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PROCEEDINGS OF SELECTED RESEARCH PAPER PRESENTATIONS

at the 1986 Convention of the Association for Educational Communications and Technology and sponsored by the Research and Theory Division in

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PREFACE

For the eighth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is publishing these <u>Proceedings</u>. Papers published in this volume were presented at the national AECT Convention in Las Vegas, NV. A limited quantity of this volume were printed and sold. It is also available on microfiche through the Educational Resources Information Clearinghouse (ERIC) system.

REFEREEING PROCESS: All Research and Theory Division research papers selected for presentation at the AECT Convention and included in this <u>Proceedings</u> were subjected to a rigorous blind reviewing process. Proposals were submitted to Dr. Melvin Bowie of the University of Arkansas, who coordinated the review process. All references to author were removed from proposals before they were submitted to referees for review. Approximately sixty percent of the manuscripts submitted for consideration were selected for presentation at the Convention and for publication in these <u>Proceedings</u>. The papers contained in this document represent some of the most current thinking in educational communications and technology.

This volume contains two cumulative indexes covering the first eight volumes, 1979-1986. The first is an author index. The second is a descriptor index. The two indexes will be updated in future editions of this Proceedings.

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TITLE: EFFECTIVENESS OF INTERACTIVE VIDEO IN TEACHING BASIC PHOTOGRAPHY SKILLS

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AUTHOR: ARNIE ABRAMS

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EFFECTIVENESS OF INTERACTIVE VIDEO IN TEACHING BASIC PHOTOGRAPHY SKILLS

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PRESENTED AT THE ANNUAL CONFERENCE OF THE ASSOCIATION OF EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY LAS VEGAS, NV. JANUARY 21, 1986

EFFECTIVENESS OF INTERACTIVE VIDEO IN TEACHING BASIC PHOTOGRAPHY SKILLS

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PRESENTED AT THE ANNUAL CONFERENCE OF AECT LAS VEGAS, NV. JANUARY 21, 1986

Introduction

The introduction of a new instructional technology has historically been followed by immoderate claims about the impact and effectiveness of that technology. This has occurred with motion pictures, television and computer-assisted instruction. The latest extravagant claims are for interactive video; a medium that combines the processing power of a microcomputer with the visual and auditory strength of videotape or videodisc (Grabowski, 1984; Leveridge, 1979; Waldrop, 1983). As with other media, the early years of implementation are filled with extreme claims, inappropriate applications, and enormous promise.

Bold predictions about interactive video have been made, but few studies have actually been conducted to validate or refute these claims. A preponderance of the literature is based on anecdotal accounts and is often written from a stance of advocacy (Bosco, 1984). This study addressed the need for systematic research to measure the effectiveness of interactive video as an instructional tool.

Purpose of the Study

The major purpose of this study was to assess the effectiveness of interactive video in the teaching/learning process. More specifically, a comparison was made of the relative effectiveness of interactive video and linear video as delivery modes in the acquisition of basic photography skills in an independent learning environment at a college level.

A second impetus for the study stemmed from the wide diversity of photography skills and experience typically possessed by the students in the population. For many students who have no prior photographic experience, traditional group instruction proceeds too rapidly: for others with considerable experience, the instruction will often be repetitive. This diversity suggested the need for an alternative mode of delivery. The investigator postulated that a self-instructional, self-paced approach would be beneficial for both novices and experienced photographers.

Research Objectives

The primary objectives of this study were :

 To determine if there is a significant difference (p.<.05) in achievement between students who receive instruction using an interactive video mode and those using a linear video mode.

- To determine if there are significant differences (p.<.05) in attitudes about the instruction between students using an interactive video mode and those using a linear video mode.
- To analyze the factors which contribute to the difference in achievement between the groups.
- To analyze factors contributing to the differences in attitudes between the groups.

Procedures

In this study, students enrolled in a teacher education program received instruction in basic photography skills in one of two methoc The control group (N=64) received instruction in an independent learning environment via a linear videotape (LV). The experimental group (N=64) also received instruction in an independent learning environment but via interactive video (IV). Interactive video refers to computer-controlled video which allows branching of the program fc remediation or enrichment (Floyd, 1980; Levenson, 1983; Troutner, 1982 The tapes were produced by the investigator and the content of both tapes was nearly identical.

Using a random number table (Borg and Gall, 1983), students were assigned to experimental and control groups. Participants then completed a 25-item written multiple-choice test (pre-test) covering key concepts incorporated in the videotapes. Subjects waited five to seven weeks before watching the appropriate videotape. Students were given an alternative form of the same test (post-test) immediately following the treatment. Analysis of covariance was used to compare achievement of the control group with that of the experimental group. The pretest was used as a covariate in order to adjust for initial differences between groups, reduce sampling error, and to give a more precise estimate of post instructional performance (postcest).

Participants also completed an attitude survey. This form offer insights into students' perceptions concerning the instruction. The written reaction form was measured on a five-point Likert scale, and related to such items as rate of instruction, frustration level, technical problems, and motivation. Significance of between group differences on individual items was tested using the Mann--Whitney U test, and ordinal consensus was measured using a Leik scale.

Results

Achievement

Results indicated that the IV group recorded significantly and consistently larger achievement gains than did the LV group. There w a difference in means between pretest and posttest scores of 29.70 (from 49.80 to 79.50) points for the linear group as compared to 35.8 (48.94 to 84.75) for the IV group (Table 1). The average difference 6.11 points in favor of the IV group, is significant at the .001 leve (F=10.48). The ANCOVA table (Table 2) shows a highly significant F (.001), which indicates a low probability that these differences were due to chance. de. 5) in de. e in

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Table 1

Comparison of Pretest, Posttest, and Adjusted Posttest Means

Group	Pretest Mean	Posttest Mean	Adjusted Post Mean	N	Gain	Gain Diff.
IV	48.94	84.75	84.95	64	35.81	
LV	49.80	79.50	79.30	64	29.70	0.11

Table 2

Analysis of Covariance - Treatment Effect

Source of variation	Adjusted Df	Adjusted SS	Adjusted MS	Computed F	Tabular F
Between Groups	1	1017.33	1017.33	10.48	3.90
Within (Error)	125	12131.62	97.05		
Total	126	13148.95			

Significance 0.0019

Summary of Attitude Results

As some researchers have noted, interactive video may prove to make more of a difference in attitude than achievement (Bosco, 1984; . Yeany et al., 1980). Findings from this study support this contention.

Although the attitude survey cannot accurately produce an overall measure, it is possible to get a comparative profile of student's perceptions of each method by tallying survey responses. Of 28 items on the survey concerning the perceived effectiveness, dependability, and motivation of each method, 16 were found to have significant differences in Mann-Whitney U levels (p. < .05). Items with the largest significance levels generally also had the greatest differences in means; in fact the first nine ranks were identical for both ranking methods (Table 4). Twenty-three group means were higher for the IV

group, compared to 5 for the LV. On agreement levels, 21 levels were higher for the IV group compared to seven for the LV.

Examining the levels of significance and between group difference may be informative. Of the 28 items, 16 items were significant at the .05 level, and 11 of those items had a difference greater than .4 of a category, all except one of these means were higher for the IV group. These need to be considered with some caution. Five of those items involved questions which were substantially different for each group. These data would indicate that student perception was higher for the interactive video method than for the linear video method.

Of the 28 items, between group levels of agreement showed differences above .15 on six items, five favored IV and one the LV group. Of these six items, five also had a between group disparity in means above .4. Of the seven testing related items, two were above .1 in agreement differences, and both favored LV. Of 21 items which involved student's reaction to the same question, only two had differences in agreement levels above .15 (.19 and .15). This indicates great similarity in item agreement levels between groups.

Table 3

Sample of Attitude Question Data Treatment

5. While	watching	this progra	am I feit c	hallenged t	o do my be	st.
s	trongly isagree	Disagree	Uncertain	Agree	Strongly agree	N/A
<u>1V</u>						
Freq	0	1	5	51	7	
7.	0	1.5	7.8	79.6	10.9	
Cum. %	0	1.5	9.3	89	100	
Likert Mean	4			Agreement	.89	
LV						
Freq	2	9	11	38	4	
7.	3.1	14 .	17.1	59.3	6.2	
Cum. %	3.1	17.1	34.3	93.7	100	
Likert Mean	3.5	1		Agreement	.695	
Between Gro	up Differ	ences				
Likert Mean	.4	9		Agreement	.195	
z score	2.9	0		Significan	ce .CO2	

Discussion The difference in between group means on this item was considerable (.49) and highly significant (.002). It would appear that students felt more challenged, more consistently (agreement difference .195) to do their best with the IV treatment...

Table 4

Key Attitude Differences Ranked by Degree of Significance

icant at th than .4 of e IV group. ose items Diff Diff Sig. Same Item Content each group. Rank # Q. ar for the swed .0001 N 15 computer questions helpful/ review 1.70 1 a the LV questions would have been helpful iisparity p ire above 14 method of feedback monotonous/ liked 1.54 2 .0001 N which a discussion after instruction had his 19 could have learned just as well without 3 N 1.5 .0001 groups. computer features/ would be better with review questions or simulation 12 usefulness of simulation/ examples of 27 1.2 .0001 N 4 different pictures best. dreaded missing review question/ would .0001 Ν 16 1.13 5 be helpful to review sections ly N/A .0001 13 enough control over rate and sequence Y .93 6 of instruction .0002 Y 18 more interesting than traditional methods . 54 7 .001 Y 28 how long could work effectivly with method .52 8 .002 Y 5 challenged to my best .49 9 .003 Y 2 mechanical malfunctions -.25 17 .005 Y 20 prefer method to tradtional instruction .48 10 .007 Y 17 felt someone was engaged in conversacion .43 11 with me .01 Y 27 like to learn other subjects with method 13 .31 .02 Y 10 too much material presented .37 12 .03 Y 11 "Gallery" sequence useful .30 15 .03 Y 25 best approach to use for learning photo .28 16

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Key attitude differences concerned level of learner control, lev of interaction, and preference over traditional methods of instructio IV students indicated a substantial degree of agreement (high consent level) on several factors including the following items:

- * For learning about photography I would prefer IV to traditional instruction.
- * IV made it possible for me to learn more quickly than traditional methods.
- * In view of the time and effort I put into it, I was satisfied with what I learned via this method.
- * I felt I had enough control over the rate and sequence of the material.
- * The computer-related features (review questions and a picture takisimulation) were important in helping me learn.

Time efficiency was not increased with interactive video. The U group all took 30 minutes to watch the tape, the IV group's time range from 34 minutes to 70 minutes with an average of 49 minutes.

Possible Reasons for Achievement Differences

Practice and Repetition: Many researchers have noted that practice and repetition facilitate learning. The interactive video method offered these attributes through the use of review questions, remediation of material, and options to review sections. One could argue that in large part the increased effectiveness of the IV system is due to the student getting an opportunity to first be quizzed on to material (questions in the IV program were different than those on the achievement test). Additionally, the picture-taking simulation offer synthesis of the information and an opportunity to apply the information.

Attentiveness: With linear video the viewer can "tune out" the program or become easily distracted. The interactive video program used in this study required mastery learning; if the viewer did not pl attention and kept missing review questions it would take longer to proceed through the instruction. It would appear that interactive video could help increase concentration for viewers with low motivation, however this may come at the price of increased anxiety at stress. Subjects in this study, for the most part, did not indicate that they dreaded missing a review question, in fact several students commented that they enjoyed the challenge, and the chance to review their understanding of the material before being tested.

High Level of Interaction: Many researchers have noted that participatory experiences aid learning. Anandam and Kelly (1981) not that interactive video "changes the student from passive observer to active participant" (p. 3). However, Bosco (1984) cautions that just because interactive video requires the student to utilize a keyboard, equating motor response with active participation trivializes the notion of what is active and what is passive in learning situations. In some cases existing programs have become "interactive" by simply ntrol, lev, instruction gh consens

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that (1981) not server to that just keyboard, is the tuations. / simply adding menus or review questions. In this study, the program was specifically designed to incorporate a high level of interaction, including a simulation of taking a picture.

High Quality of Software: Ultimately the effectiveness of any medium will be determined by the quality of software utilized. This has been evident in the inability of educational films, television, and possibly CAI to reach their full potential. From student responses, it is apparent that there was a high level of satisfaction with the programs used in this study. By careful design both programs were nearly identical in approach and content. However, the interactive videotape utilized the attributes of computer-related features.

Possible Reasons for Attitude Difference

There were 16 significant attitude differences. For purposes of explanation these can be grouped into five main areas:

Level of Learner Control: Quite evidently one factor in the difference between groups was that the linear video group effectively had no control over rate or sequence of instruction, while the computer-related features of the interactive video system afforded that group some degree of learner control. Several IV subjects indicated that they would prefer greater control over program pacing, however 78 per cent of them either agreed or strongly agreed that they felt enough control. The issue of amount of control to offer the learner remains a controversial and important issue for designers and would make an excellent topic for further study.

Opportunity for Review Questions, Feedback, and Review Sections: The LV group indicated a high desire for opportunities for review and practice. This was the most commonly cited shortcoming of the linear video method. The IV group exhibited a high level of agreement that the review questions and review sections were helpful to them, and that interaction with the IV system was positive and reinforcing.

Preference over Traditional Instruction: The difference in preference of the method used over traditional methods (illustrated lecture) favored the IV group by .434 and was significant at the .003 level. This can be due to several factors. Certainly one factor is novelty; the concept of using a videotape recorder connected to a microcomputer was enticing to many learners. However, the Hawthorne effect may not be germane because data indicated that learning via videotape was also novel to most participants. Students in the population typically had more exposure to computers than instructional television. A more important factor might have been the interaction afforded by the computer. Research on CAI has shown that the holding power of computers is in large part due to the interactive nature of the technology. In this study, the IV group had a higher perception that someone was involved in a conversation with them while receiving instruction than did the LV group (difference .437, significance .007). It may be interpreted that the computer-assisted video instruction was

perceived as being more humanizing, individualized, and personal that did the linear system.

Challenge to do Best: The IV group felt more challenged to do the best while watching the program than did the LV group (difference .4) significance .002). It is believed that this can be directly attributed to the IV students needing to correctly answer review questions to proceed with instruction. As mentioned above, whether this is a trade off for increased anxiety is a concept worthy of further study.

Time Able to Effectively use the Method: It is interesting to not that each group felt they could work effectively with the method approximately the amount of time that it actually took to watch the program. For the LV group this was thirty minutes, and for the IV group the average time on instruction was about fifty minutes. It may be that students had the perception of being able to effectively long work with the IV system because of being an active learner. In education it is a maxim that "involvement precedes interest", and this may have been the case in this study. It may be discovered that instruction may take longer with interactive video, but because learners are active and not passive, they can work longer effectively.

Implications for Further study

Retention: Achievement measures in this study measured only immediate recall of information. Testing took place immediately following treatment. A larger question would be the comparative effectiveness of methods in retention testing.

Cost-benefit, Time Effectiveness: Although this study demonstrate that interactive video can increase instructional effectiveness, it d not explore the issues of cost or time effectiveness. Interactive video is more complicated to produce than almost any other medium of instruction, and development and production costs are proportionally higher, typically as much as four times greater than CAI or linear video. However, the high development costs can be offset by repeated use of the materials and the automation of some instruction. Therefore, interactive video may be attractive to trainers who need to provide the same instruction to large number of persons at many different cites.

Increased station cost is also a drawback of interactive video. An interactive video system costs more than twice as much as a linear video system. This high station cost may make interactive video inappropriate for training or instructional situations where numerous stations are needed and funds are limited.

This study found an increase in instructional effectiveness of I of about 17 per cent over LV. This increase may not be large enough many situations to justify the added expense. Time on instruction waalso higher for the IV group than the LV group, about 50 per cent higher. In many instances this may not be an acceptable trade off.

Attitude vs Achievement:

Research in computer-assisted instruction

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has indicated that CAI may make a larger difference in learner attitude than in achievement. This may also prove to be true for interactive video. This study did not compare the level of significance between the two different research questions. It may be that interactive video's largest benefit is not its instructional effectiveness, cost effectiveness, or time efficacy, but in its ability to motivate and involve students.

Factor Analysis: This study addressed the question of how interactive video compares to linear video in instructional effectiveness and student perceptions. A more focused question is why was interactive video more effective than linear video. This chapter has offered some insights into probable causes for differences in results between the two methods. These projections are based on: data from the attitude surveys, student comments, personal experience, and intuitive judgment. Research should be conducted to provide a formal factor analysis to assess the reasons behind the performance of interactive video. This could be accomplished by altering the design of interactive videotapes and testing single attributes of interactive video. Below are several aspects which could be varied to test for their individual effect.

Varying Learner Control: Throughout this paper the point has been reiterated that the amount of learner control to give students is a key issue for designers of interactive video materials. It would be beneficial to determine if there is a direct relationship between level of learner control and student achievement. This would have implications far beyond just interactive video instruction. With interactive video this level could be modified by offering students varying levels of control over program pacing, sequence, and feedback. Students could be offered more control over what method of instruction to use or whether review sections would be optional or automatic.

Varying Level of Interactivity: Another interesting question would be if there is a direct relationship between level of interactivity and achievement. By comparing programs with varying levels of interactivity the effect of learner interaction on achievement could possibly be isolated. Variable factors could involve comparing the use of review questions to the use of simulations, or the use of multiple-choice questions versus inquiry questions.

Group Instruction: This study examined only individualized instruction, yet interactive video may have some important implications for group instruction also. Field testing the materials utilized in this study involved comparing IV individualized instruction to IV used in a class environment. In the group instruction answers to questions were derived from a consensus of the group. A short amount of time was allowed for questions and discussion with the instructor. Although adequate controls were not maintained, this experiment did find that the mean for the IV group treatment was only four points lower than that for the IV individualized method. Given the cost and complexity of delivering individualized instruction it would be beneficial to compare these two different forms of delivery. Mechanical Dependability: In this study nearly twenty per cent of IV students experienced at least some mechanical malfunction. For z training situations this would be an unacceptably large figure. Be: large scale implementation of interactive video instruction is conducted it would be beneficial to determine the mechanical reliability of different systems.

Brevity of Instruction: Barbara Fowler (1980) in her doctoral dissertation noted that due to the brevity of instruction generalizations are limited to instruction of similar length. In her case, as well as this study, instructional sequences occurred over a to 50 minute time span. Further research should be conducted utilization instruction given under other time conditions.

Replicability: Research in the social sciences has often been criticized for its lack of replication. Interactive video has been especially susceptible to this. At the time of this writing only eigh other dissertations on interactive video had been written. Interactive video offers a relatively facile way to replicate a study because the same materials can be reemployed. It would also be worthy of investigation to administer the same materials to different populations.

Different Populations and Subject Matter: Interpretation and generalization of results from this study is limited to data obtained from students enrolled in a teacher education program instructed in basic photography skills. Other studies should be conducted to determine the relative effectiveness of interactive video with different populations and with different subjects of instruction. It may be discovered that a particular medium is good at teaching some concepts to some learners and not good at others. This is an area of research that CAI research is just beginning to focus on.

Applications of Interactive Video: Determining the proper application of interactive video may be as important as investigating the relative effectiveness of the medium. As the research in CAI and instructional television has shown, proper design of software and wise application of the medium can be the decisive factor in determining till effectiveness of a technology. A relevant question is "Should we be using interactive video based instruction or interactive video assist instruction?". Research on CAI has shown that computer-assisted instruction has been more effective than computer-based instruction. Indeed in this study, in which instruction was IV based, many students indicated the desire for discussion, hands-on experience, and live question-and-answer sessions. The attribute-treatment interaction could be studied to determine what kind of student learns best from interactive video. Additionally, the level of use needs to be explored. There are at least three distinct utilization levels: class level, unit level, and lesson level. Bosco feels that ultimately interactive video will be more beneficial utilized as learning modules rather than replacing entire courses of study.

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Use in Conjunction with Other Media: In reality, most educators and trainers draw on a variety of methods and media. Studying an instructional technology in isolation is to some degree an academic exercise. Research should be conducted to determine the effectiveness of interactive video when used in concert with other media. Although it is difficult to conduct multi-variate research, it is essential that it be done because actual learning and teaching will ultimately be delivered in the real world of multi-sensory environments. Only then will interactive video be able to come out of the research lab and into the real world of training and education.

Conclusion

In this study interactive video was shown to be more effective than linear

video in teaching basic photography skills to students enrolled in a teacher education program. Significant improvements were measured in both achievement and attitude. This study demonstrated that interactive video can be a very powerful and effective training method, These considerations are essential given certain considerations. issues in the effective use of the medium. Interactive video materials must be designed and produced to address the unique characteristics and strengths of the medium; it must be utilized effectively, converging the capabilities of the technology with the nature of the educational task; and it must be used in conjunction with other media and methods, taking into consideration the total learning environment and learner characteristics. Ultimately, it is the instructional methods that interactive video facilitate that will be the strength of the medium. In concluding, it is worth reiterating J.J. Bosco's advice to potential designers, producers, and users of interactive video:

In order for the technology to be used effectively, we need to get beyond the statements of the first generation of advocates to more careful considerations. If interactive video is to become a useful tool in education, and not a mere toy or plaything, we need reasoned analysis as much as enthusiasm.

Hopefully this study will serve as a pioneering effort in the reasoned analysis of interactive video, and will aid in the transformation of the medium from technological plaything to educational tool.

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	TITLE:	EFFECT OF PICTURES ON RECALL OF WRITTEN PROSE: How durable are picture effects?
	AUTHOR:	GARY J. ANGLIN
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Effect of Pictures on Recall of Written Prose: How Durable are Picture Effects?

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Running head: DURABILITY OF PICTURE EFFECTS

Abstract

There is now substantial evidence that pictures can be used to facilitate the recall of information presented in prose passages. There is also evidence that the presence of pictures in prose passages does not hinder the recall of information that is not pictured. Are the picture effects durable over longer periods (55 days) of time? Do pictures included in prose passages help or hinder subjects recall of information that is not picture? Results of this study provide evidence that picture effects are durable. In addition, the inclusion of pictures in prose passages did not interfere with the recall of information presented only in the prose passage.

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Effects of Pictures on Recall of Written Prose:

How Durable are Picture Effects?

Results from prose learning studies examining the contribution of pictures to the recall of prose materials provide considerable empirical evidence that pictures can be used to facilitate the recall of information presented in prose passages (Alesandrini, 1984; Levie & Lentz, 1982; Levin, 1981; Levin & Lesgold, 1978). In an integrative review of research on the effects of text illustrations, Levie and Lentz (1982) report that "the results of 46 comparisons of learning illustrated text information from passages with and without pictures reveal an overwhelming advantage for the inclusion of pictures" (p. 203).

Levin (1981) has provided a theoretical framework which distinguishes between seven functions that prose-relevant-pictures may serve. The seven functions identified by Levin include: decoration, remuneration, motivation, reiteration, representation, organization, interpretation, and transformation. According to Levin (1981), "Two of these functions (the representation function and the transformation function) have proved useful in differentiating between the magnitude and

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consistency of picture effects that can be anticipated from one prose-learning study to the next" (pp. 225-226). The function of a representational picture would be to make the information in the prose passage more concrete. Levin (1981) suggests that the contribution of representational pictures to improved prose learning would be moderate. Pictures serving a transformation function would make the information in the prose passages more memorable. The predicted prose learning improvement using pictures serving a transformation function would be substantial (Levin, 1981).

This study investigated the possible contribution of pictures serving a representation function to the recall and retention of information presented in written prose passages. The primary variable considered in this study was the durability of picture effects. Peng and Levin (1979) pointed out that "in order to prove implications for classroom-learning situations, it must be demonstrated that gains attributable to pictures are not short-lived" (p. 39). Kerst and Levin (1973) have demonstrated the durability of picture effects using a paired-associate learning tasks with children as

subjects. Using a more ecologically valid story-recall task, Peng and Levin (1979) reported that picture effects found with second graders were durable over a 3-day period. Levin and Berry (1980) also found picture effects to be durable over a 3-day period. Using representational pictures, Anglin (in press) reported significant picture effects which were durable over 14 and 26 days. Based on the results of studies by Peng and Levin (1979), Levin and Berry (1980), and Anglin (in press), it was hypothesized for the current study that representational picture effects would be durable over a 55-day delay. It was also predicted that the magnitude of the picture effects would be moderate based on Levin's (1981) theoretical discussion of potential picture functions.

A secondary variable considered in this study concerned the potential effect the presence of pictures had on the recall of information that was <u>not</u> pictured. Based on the results of 10 studies, Levie and Lentz (1982) concluded that "illustrations have no effect on learning non-illustrated text information" (p. 203). A closer examination of the 10 studies reveals that subjects for 7 of the 10 studies were children in grades

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K-6. The three studies including older learners used cartoons as the illustrations. Can the lack of picture facilitation or interference found with young children be extended to older learners (college students) if the illustrations are text-redundant pictures instead of cartoon embellishments? It was hypothesized that the presence of pictures would neither facilitate or hinder subjects recall of information which was presented <u>only</u> in the passage and not pictured.

This study investigated the limits of durability for significant picture effects. The durability of picture effects was examined over a 55 day period. In addition, the effects of pictures on the recall of information presented in the text <u>only</u> was examined.

Method

Subjects and Design

Subjects were 30 graduate students from a southeastern university. The participants were randomly assigned to one of two groups--prose-plus-picture (16 subjects) and prose-only (14 subjects). In the prose-plus-picture group, subjects read the prose passage and viewed a representational picture (line

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drawing). In the prose-only group the participants read the prose passage without the relevant picture.

Materials

The three prose passages used by Anglin (in press) were also used in the current study. The passages were human interest stories which varied in length from one-half to three quarters of a page, typed, and double-spaced. The passages were selected from <u>Time</u>, a weekly news magazine. Topics discussed in each of the three passages concerned skateboarding, Santa Claus and Christmas, and an individuals attempt to set up residence on a traffic island on Manhattan.

The same line drawings used by Anglin (in press) were used in the current study (one drawing per passage). The drawings were designed to function as representational pictures, i.e. pictures whose function is that of making the prose passage more concrete (Levin, 1981). An example of the picture used for the traffic island passage is presented in Figure 1.

Insert Figure 1 about here

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The 15 paraphrase questions (5 per passage) used by Anglin (in press) were also used in this study. The 15 questions tested recall of information (text-redundant) that was presented in the prose passage and represented in the picture. An example of one of the Text-redundant Test items for the traffic island passage follows:

On what object or structure did the man set up residence?

Five additional short-answer paraphrase questions were constructed for each of the three passages (5 items per passage). The 15 new items were designed to test the recall of information which was presented in the prose passage that was <u>not</u> represented in the accompanying picture. An example of one the the Text-only Test items for the traffic island passage follows:

Where was the man finally taken?

It was previously demonstrated that subjects could not correctly answer the 15 questions which tested the recall of information which was presented in the passage and represented in the picture without reading the prose passage and/or viewing the picture (Anglin, in press). Prior to the administration of the current experiment,

the 15 new paraphrase questions designed to test for recall of information presented in the text but <u>not</u> represented in the pictures were administered to a group of 12 graduate students to verify that these new questions could not be correctly answered by individuals who had <u>not</u> previously received any treatment. Average recall for the 12 graduate students was 2%.

Procedure

Subjects were tested in a group format. In both the prose-plus-picture and prose-only groups, subjects were instructed to read the prose passage once. In the prose-plus-picture condition, subjects were also instructed to view the accompanying picture. The passage orders were counter-balanced across subjects. When a subject completed reading one passage the 10 item test for that passage was administered. The same procedure was used for passages two and three. Fifty-five days later, the subjects were tested in the same manner using the same 30-item test (10 items per passage) used in the immediate condition. In the delayed testing condition subjects did not re-read the stimulus materials.

Results

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The analyses were performed in two stages. The first analysis examined the possible effect that Treatment and Time of Test had on prose recall scores for the dependent variable Text-Redundant Test score. The second analysis also examined the effect that Treatment and Time of test had on prose recall for the dependent variable Text-only Test score

The first analysis was a 2 (Treatment) x 2 (Time of Test) repeated measures analysis of variance (ANOVA) using each subjects' prose recall score for the <u>Text-redundant Test</u> as the dependent variable. Treatment (prose-plus-picture, prose-only) was the between-subjects factor, while Time of Test was the within-subjects factor. Cell means and standard deviations from this analysis are presented in Table 1. The ANOVA yielded significant main effects for: Treatment, $\underline{F}(1, 28) = 9.36$, $\underline{P} < .01$; Time of Test, $\underline{F}(1, 28) = 98.92$, $\underline{P} < .001$. The two-way interaction: Treatment by Time of Test was not significant, $\underline{F}(1, 28) = .22$, $\underline{P} > .05$

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Insert Table 1 about here

The marginal means for Treatment indicated that subjects' average recall was greater in the prose-plus-picture condition (M = 10.38) than in the prose-only condition (M = 8.45). Marginal means for the within-subjects factor Time of Test indicated that subjects average recall was greater in the immediate (M = 12.30) than in the delayed (M = 6.40) testing condition. Given the hypothesis of durable picture effects, tests of simple main effects (Dixon, 1983) were performed to directly compare the prose-plus-picture group with the prose-only group for the immediate and delayed testing conditions. Average recall for prose-plus picture subjects (M = 13.18) was significantly higher (p < .05) than average recall for prose-only subjects (M = 11.53) in the immediate testing condition. In the 55-day delayed testing condition, the average recall of prose-plus-picture subjects (M = 7.57) was also significantly higher than that of prose-only subjects (M = 5.38) with p < .05.

The second analysis was a 2 (Treatment) x 2 (Time of Test) repeated measures analysis of variance using each subjects' prose recall score for the Text-only Test as the dependent variable. The 15 items in the Text-only Test were designed to measure the recall of information presented in the text but not represented in the pictures. Treatment (prose-plus-picture, prose-only) was the between subjects factor; Time of Test was the within-subjects factor. Cell means and standard deviations from the second analysis are presented in Table 1. The ANOVA yielded a significant main effect for Time of Test, F(1,28) = 241.69, p < .001. The main effect Treatment was not significant, F(1,28) = .32, p > .05. The two-way interaction: Treatment by Time of Test was not significant, F(1,28) = 1.30, p > .05. The marginal means for the within-subjects factor Time of Test indicated that subjects average recall was greater in the immediate (M = 11.90) than in the delayed (M = 4.52) testing condition.

Discussion

The two variables considered in this study were: a) durability of picture effects, and b) the potential

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effect the presence of pictures had on recall of information that was <u>not</u> pictured. The discussion concerning the durability of picture effects is based on the first analysis which included <u>Text-redundant Test</u> score as the dependent variable. The discussion of whether the presence of pictures facilitate or hinder subjects' recall of prose information that is not pictured is based on the second analysis. <u>Text-only</u> <u>Test</u> score was the dependent variable for the second analysis.

With respect to the first and primary variable of the study (text-redundant information), the analysis indicated that picture effects were present and durable over time (55 days). Subjects who were in the prose-plus-picture condition remembered significantly more information that was presented in the passages and represented in the pictures than those subjects who received the prose-only treatment in both the immediate and delayed (55 days) testing conditions (Text-redundant Test). Both treatment groups' average recall was significantly lower in the delayed testing condition. The results of the analysis provide evidence that

picture effects are durable over at least a 55-day delay.

A theoretical explanation of higher recall scores ed on in prose-plus-picture (representational pictures) conditions has been suggested by Levin (1981). Levin argues that representational pictures produce a memory trace which is more robust than that associated with a verbal representation of the text. The more robust trace would have benefits during initial storage of the information in the passage as well as later retrieval of the passage information. Representational pictures make the information in the prose passages more specific and provide a second mode for the information to be represented in the brain (Levin, 1981).

> Subjects' average recall in the prose-plus-picture condition was 11% - 15% higher than that of subjects in the prose only-condition. The magnitude of the picture effects in both the immediate and delayed (55 days) testing conditions are similar to those identified by Anglin (in press). Using younger children as subjects, Levin and Berry (1980) and Peng and Levin (1979) also identified similar average picture facilitation which

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ranged from 13% - 20% higher for prose-plus-picture groups than prose-only groups.

The second variable considered in this study was the potential effect the presence of pictures had on the recall of information presented in prose passages which was not represented in pictures. The presence of pictures facilitated moderately the recall (Text-only Test) of information which was presented only in the prose passage for the immediate testing condition. However, this facilitation was not significantly greater for the prose-plus-picture condition. The second analysis indicated that the presence of pictures did not significantly facilitate or hinder recall of information which was presented only in the prose passage. The average recall of information for subjects in the prose-plus-picture condition did not differ significantly with that of subjects in the prose-only condition. However, subjects' average recall was significantly lower for both treatment groups on the delayed testing condition.

In summary, the limits of the durability of picture effects was extended from 26 days to 55 days. Results of this study also support the claim that the presence

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of representational pictures in prose passages does not significantly facilitate or hinder the recall of information in prose passages that is <u>not</u> pictured. Further extension of the limits of the durability of picture effects is justified. Are picture effects durable across types of prose passages (narratives, human interest, etc.)? Will the magnitude of picture effects be similar across passage types? Will pictures facilitate the recall of information presented in prose passages for adult learners? Results of this study and knowledge of the effects of passage type and audience would provide practical information for individuals concerned with the design of instruction.

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Table 1

Means and Standard Deviations of Subjects' Prose Recall Scores by Treatment, Time of Test and Information

Tested.

	Treatment	Imme	diate	De	layed	Marg	ina
		M	SD	<u>M</u>	SD	. <u>м</u>	-
	Prose-plus-						
Text-redundant	picture	13.18	1.75	7.57	3.51	10.38	3.
Test	Prose-only	11.53	2.02	5.38	1.82	8.45	3.
	Marginals	12.30	2.05	6.40	2.91		
	Prose-plus-						
Text-only	picture	12.39	1.08	4.43	3.09	8.41	4.
Test	Prose-only	11.47	2.13	4.59	2.26	8.03	4.1
	Marginals	11.90	1.76	4.52	2.63		

Note: Prose Recall scores can range from 0 to 15 for both the test measuring text-redundant information and the test measuring information presented in the text only.

ts 19 Durability of Picture Effects 20 Figure 1. Picture Accompanying One of the Prose Passages in Experimental Condition. Marginal M 100 10.38 3.9 8.45 3.6 8.41 4.6 8.03 4.1 th the test

TITLE: THE DISPLAY OF COLOR GRAPHICS ON MONOCHROME MONITORS: A CONCERN FOR DESIGNERS AND AN OPPORTUNITY FOR RESEARCHERS

AUTHORS: PATTI R. BAKER JOHN C. BELLAND MARJORIE A. CAMBRE THE DISPLAY OF COLOR GRAPHICS ON MONOCHROME MONITORS: A CONCERN FOR DESIGNERS AND AN OPPORTUNITY FOR RESEARCHERS

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ABSTRACT

This paper presents the problem of displaying color graphics on monochrome monitors, design rules for such graphic displays, and current and proposed research to examine the perceptual and cognitive effects of pictures displayed via monochrome monitors. In order to empirically test the usefulness of the proposed design principles, a study was conducted to examine whether children could recognize computer generated pictures on monochrome monitors. Subjects were 64 second, third, and fourth graders who were randomly assigned to one of two conditions. Children in the first treatment were asked to identify, on a monochrome monitor, a figure that was initially presented in its original form and then as a redesigned, more distinguishable figure. The redesigned figure had greater figure/ground contrast because color substitutions were made that utilized pixel patterns to provide contrast in the monochromatic display. The order of picture presentation was reversed for the children in the second treatment. Results indicated that regardless of grade or FI/FD characteristics, children in this study were unable to discern critical features of a color graphic displayed on a monochromatic monitor unless it was designed to enhance figure/ground separation (p<.0001). Implications for further research, as suggested by the results of the study, are discussed.

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THE DISFLAY OF COLOR GRAPHICS ON MONOCHROME MONITORS: A CONCERN FOR DESIGNERS AND AN OPPORTUNITY FOR RESEARCHERS

The proliferation of microcomputer generated graphics in instructional software forces new attention upon the issues involved picture comprehension. Visual learning via computer encompasses several elements: the learner's perceptual system, the design of the visual message, and the medium's manner of conveying that message. While designers and producers can feel confident that pictures will usually enhance their messages, they have less information to assist them in determining the characteristics of pictures that make them mo or less appropriate for specific audiences. Furthermore, in the case of computer generated pictures, the designer does not have any control over the hardware used for display.

A critical design issue emerges when graphics intended for color display are presented on monochrome monitors or TV receivers. Color graphics that were designed to be appealing and useful to instruction are found to be less than helpful as monochromatic pictures; figure/ground separation that is aided by color differences is lost is monochrome pictures. Shapes are indiscernible and figures blend into the background.

A SOLUTION FOR THE DESIGN OF PICTURES FOR COLOR AND MONOCHROME DISPLE

By following design rules developed by Baker (1983), it is possible to design computer graphics that are perceptually salient for both monochrome and color display. These rules, developed for Apple I graphics, are outlined in Table I. The rules suggest which colors can be juxtaposed in order to allow for good figure/ground separation. Because of the way monitors translate the display signal to the screet Apple II colors are presented on a monochromatic monitor in patterns (pixels (lighted dots). By consulting Table I, the designer can choos which colors can be juxtaposed. The designer can utilize the differi pixel patterns to provide contrast and to avoid similar patterns that weaken figure/ground separation.

Insert Table 1 about here

Although these rules apply specifically to Apple II low resoluti colors, the principles generally apply to the design of pictures for other computers also. The computer may not translate display signal into pixel patterns, but colors may appear as shades of gray (or whatever the color of display is.) The designer then applies the general rule: in order to make the picture interpretable in either mode, be sure that juxtapositioned colors exhibit contrasting shades gray in monochrome. Regardless of the computer or the display hardware, the designer is asked to be sensitive to the range of possible display hardware for color graphics in computer courseware. CONCERN FOR

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THE STUDY

The design rules eminated from the practical notion of making color graphics in computer courseware suitable for the many monochrome monitors in use in schools. Yet there was little empirical evidence that following such design rules would result in pictures that were more intelligible to the children who were the intended users of the courseware. Related research was investigated, and a study was designed to empirically test the design rules that were intuitively needed and purposely formulated. This study is reported in detail by Baker, Belland, and Cambre (1985).

Review of Related Research

Several theoretical and applied areas provide insights into the variables affecting picture comprehension. These include perceptual and developmental psychology, message design, and individual differences within cognitive psychology.

Developmentalists and perceptual psychologists identify experience and maturation as important components of visual perception. A number of researchers have found that age interacts with children's ability to extract relevant information from pictures. Children do not interpret pictures in the same manner as adults nor do they obtain as much information (Campbell, 1981). For instance, young children are unable to ignore irrelevant information and are easily distracted from essential cues by peripheral details (Collins, 1970; Dwyer, 1978; Fleming & Levie, 1978). Younger children have been shown to prefer simpler pictures and to be able to extract more relevant information from them than from more complex pictures (Travers & Alvarado, 1970).

Gardner, Wolf & Smith (1975) further observed that young children's diffuse scanning patterns and numerous small eye movements affect their ability to examine a picture holistically. Travers'& Alvarado (1970) suggest that children tend to perceive parts before they perceive wholes. Children in the lower elementary grades are therefore likely to have difficulty perceiving and interrelating the various elements of a picture. Older children are better able to perceive and describe an entire scene.

Gibson (1969:77) posits that experience provides essential practice in detection, discrimination, recognition, and identification; "...as perception develops the organism comes to detect properties of stimulation not previously detected even though they may have been present. With growth and continued exposure to the world of stimulation, perception becomes better differentiated and more precise."

In addition to the issues of developmental visual perception, critical features of pictures such as figure/ground are also important to picture comprehension. Figure/ground is so basic a concern in message design that it is usually taken as the starting point of form comprehension. A German researcher named Rubin is credited with the

first studies of the features of figure/ground organization in 1921 Haber & Hershenson, 1973:184). He observed that the figure has fors shape, with recognizable "thinglike" qualities, whereas ground is either formless or having weaker or less definite form characterist; When figure/ground relationships break down, the result is camouflage or lack of meaning.

Contour is a critical element that separates figure from ground although the contour usually seems to belong to the figure. Information or uncertainty is concentrated along contours or edges. Thus, if the contours are not perceived as edges of the figures, the figures are difficult to see. Hochberg (1962:39) recommends the addition of cues to enhance figure/ground separation and make the ed more discernable; among them are making the figure more realistic or iconic, using pigment or other drawing to simulate shade and shadows using depth or perspective techniques.

The need for discernible edges of objects is as important in animated pictures as in still pictures. In a discussion of perceptu precepts of animations intended to facilitate learning for children, Caldwell (1978:23) suggests that children 4-8 years old will more readily perceive drawn objects if they are "outlined with obvious, unbroken boundaries than when the boundaries are broken or otherwise indistinct." She further suggests that bright or well-illuminated objects will be discriminated as the figure first.

Dwyer (1978) found that individual differences such as intelligence, reading comprehension, and entry behavior are critical variables in students' ability to learn from different types of pictures. Cognitive style might also be a differentiating variable is children's ability to extract information from pictures. Field independent persons evidence the ability to experience items as discrete from their background and to overcome embeddedness (Ausburn Ausburn, 1978). Furthermore, the field independent person is likely seek differentiating information with well distinguished parts, while the field dependent person is more likely to have "fused" experiences and be unable to separate items of information from their contexts (Guilford, 1980). For the field independent person, sufficient figure/ground separation in a picture becomes even more important.

The Current Study

Perceptual development, message design, and individual differences provided the framework for the present study. A computer generated picture of a unicorn which was provided as a reward picture in a commercially-developed courseware package was extracted so that could be displayed independently. In this original version, a critic attribute of unicorns, the singular horn, was barely distinguishable from the the background when displayed on a monochromatic monitor. Another picture was constructed with precisely the same form and content but following Baker's rules. Consulting the table revealed that substitution of two colors was required. The redesigned picture portrayed a unicorn which looked the same as the original picture on 5

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ed so that : in, a critica nguishable monitor. rn and revealed ned picture picture on : color monitor but had an easily distinguishable horn on a monochromatic monitor. These pictures were displayed on monochromatic monitors to subjects who were asked to describe the content of the pictures. Previous to administering the treatments, the luminescence of the screens was measured and adjusted equally on the monitors so contrast and brightness would not affect results.

Hypotheses

The following hypotheses guided the design and interpretation of the study:

H: Subjects will name the main figure in the picture correctly after they experience the redesigned picture. That is, subjects in the first treatment condition will respond correctly on the second trial and subjects in the second treatment condition will respond correctly on the first trial.

Ho: Subjects who experienced the second treatment will be able to name the main figure correctly on both trials.

H₃: Subjects who are field independent will name the main figure correctly more frequently under either treatment condition.

Ha: Subjects from higher grades will name the main figure correctly more frequently under either treatment condition.

Design

Subjects were drawn from the second, third and fourth grade classes of an urban elementary school. Within each grade level, subjects were randomly assigned to one of two treatments. In the first treatment, subjects were shown first the original reward picture on a green-screen (monochrome) monitor and asked to name what they saw. After each subject had made a response, he/she was asked what else was seen. Then the subject was shown the redesigned picture and asked the same questions. In the second treatment, subjects were shown the pictures in the reverse order; the redesigned picture was shown first and the original picture shown second. It was assumed that the identification of the unicorn in least one of the versions indicated that the subject was familiar with the concept "unicorn." Only four of the subjects did not recognize the unicorn in either version.

In another data-gathering session approximately a week later, subjects were administered the Children's Embedded Figures Test (CEFT) in order to assess field independence. There was a total of 64 subjects that were arrayed in the design as shown in Table 2.

Insert Table 2 about here

Results

The data analysis consisted of an multifactor ANOVA using a least squares solution to account for unequal n's. The dependent variable, Recognition, was scored in the following manner: 0 = No recognition of either figure, 1 = Recognition of the redesigned figure, 2 = Recognition of the original figure, and 3 = Recognition of both figures.

The analysis of variance showed a significant main effect for to treatment variable F(1,11)=40.27, p<.0001. Subjects in Treatment II (x=2.59) recognized the figure more frequently than in Treatment I (x=1.23).

There were no significant differences for variables Grade and FI/FD cognitive styles, nor was there any interaction between or amog variables.

Insert Table 3 about here

Discussion

As was expected, subjects were able to correctly name the main figure in the picture more often when presented the redesigned form a when presentation of the original picture followed the redesigned for as in the second trial. These results reiterate the need cited by Hochberg (1962:39) to enhance the edges of a figure so it is distinguishable. While figure enhancement has been determined to be important in traditional media, this study shows such figure enhancement to be at least as important with computer generated graphics. Furthermore, the nearly unanimous recognition of the original unicorn after experiencing the redesigned picture supports previous findings that experience and practice increase the ability t extract visual information (Gibson, 1969:77).

The lack of effect from field independence/field dependence may explained by the notion that this particular type of cognitive style does not take precedence over perceptual development. Cognitive sty remain relatively stable over time and tasks (Ausburn & Ausburn, 197 On the other hand, the ability to extract visual information improve with experience and maturation. The lack of effect from grade level would seem to negate developmental influence upon picture comprehension. However, a frequency count of the number of times th original unicorn was recognized in Treatment I showed a steadily increasing, yet statistically insignificant, pattern of recognition. Such results encourage a replication of the study with a larger same that includes higher grade levels in addition to grades two, three, four.

The data from this study have meaningful application to the deposition of instructional software that incorporates microcomputer generated graphics. The use of a picture as either a reward or as an exemplar futile if the student cannot see what was intended to be seen. An earlier pilot study using the same pictures revealed that the redesigned unicorn had more appeal than the "horse", the label give the original unicorn by the majority of the subjects. Additionally critical attributes are embedded in the picture, then that picture serves as a poor example. The student could possibly assimilate

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The producers of microcomputer generated graphics for computer courseware and educators who purchase the software have some evidence via this study that: 1) microcomputer generated graphics intended for color presentation but displayed on monochromatic monitors may not have sufficient figure/ground contrast, 2) insufficient figure/ground contrast may adversely affect picture comprehension, and 3) younger children, at least through fourth grade, seem to lack the necessary perceptual maturity to overcome the effects of poorly discernible figures on a monochromatic green screen. Since producers have no control over the display devices used with software, attention to the solutions for generating graphics for both color and monochrome display would lead to more intelligible pictures for children regardless of the type of monitor used.

Several elements of the study warrant further investigation. If the sample were larger and expanded to include kindergarten through sixth grade, would the very young children not recognize the original unicorn even after they had seen the redesigned picture and would the older children be able to recognize the unicorn more often even when presented with the original picture? In other words, the practice provided by the redesigned unicorn may not be enough cue for the young children to prompt recognition, and the older children's perceptual maturity may be advanced enough that they would not need the exposure of the redesigned picture to recognize the original one. Another question involves the lack of interaction between recognition and cognitive style. Is the inability of field independent subjects to overcome embeddedness a matter of perceptual immaturity as previously discussed or is it perhaps a function of the characteristics of the pictures used? A larger sample may again provide additional clues as would trying different pictures.

Other questions are prompted by the results of the study and deserve consideration by researchers who want to examine the properties of visual perception via computer generated graphics. Some of these questions include:

(1) What are the unique attributes of computer graphics display?

(2) How do these attributes compare to those of traditional media in terms of viewer perception and cognition?

(3) Do the results of the color/black and white studies hold true for computer generated pictures?

The purpose of this study was to investigate the comprehensibility of microcomputer generated color graphics that are displayed on monochromatic monitors. Such comprehensibility appears to be enhanced by attending to the arrangement of elements in the pictures so that figure/ground separation is apparent in either color or monochrome. Regardless of display hardware, pictures included in courseware can be designed to be comprehensible by users, especially young children.

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TABLE 2

Distribution of Subjects

		I	II.
	FI	2	4
Grade 2	FD	6	6
	FI	8	5
Grade 3	FD	4	8
Grade 4	FI	5	5
	FD	7	4

n=32 n=32

Order of graphic presentation

I = Original, redesigned

II = Redesigned, original

Note: From "Recognition of Computer-Generated Pictures on Monochron: Monitors" by P. Baker, J. Belland, and M. Cambre, 1985, Journal of & Based Instruction, 12(4), p. 105. Copyright 1985 by ADCIS.

	Source	dſ	SS	F	
1	Treatment	1	27.5625	40.27*	
	Grade	2	0.1289	0.09	
	FI/FD	1	0.4017	0.59	
	T*G	2	0.4156	0.30	
	T*FI/FD	1	0.1436	0.21	
	G*FI/FD	2	0.6505	0.48	
	T*G*FI/FD	2	0.8601	0.63	
	Total:	11			0759

TABLE 3

ANOVA of Figure Recognition by Treatment, Grade, and FI/FD Assessment

*p<.0001

<u>Note</u>: From "Recognition of Computer-Generated Pictures on Monochromatic Monitors" by P. Baker, J. Belland, and M. Cambre, 1985, <u>Journal of Computer-</u> <u>Based Instruction</u>, <u>12</u>(4), p. 106. Copyright 1985 by ADCIS.

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TITLE: INSTRUCTIONAL FILM RESEARCH AND THE LEARNER AUTHOR: MELVIN MCKINNEY BOWIE

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INSTRUCTIONAL FILM RESEARCH AND THE LEARNER

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INSTRUCTIONAL FILM RESEARCH AND THE LEARNER

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Research into the value and effectiveness of motion pictures in education has spanned more than six decades. Most of the work was done prior to 1970, with the middle 1950's representing the peak of activity. Hoban and van Ormer (1970) reviewed the research conducted between 1918 and 1950. Since that time there appears to be no indepth search which focuses entirely on the instructional film. This was due largely to the new interest in instructional television. Of the nearly three hundred and thirty-five studies analyzed by Reid and MacLennan (1967), only thirty percent of them dealt with instructional films, while the other two-thirds were concerned with the effectiveness of instructional television. Other writers such as Allen (1960), Lumsdaine (1963), Twyford (1969), Simonson (1980), and Seibert and Ullmer (1982) compiled definitive findings from the research on communication media in general. Their writings did not focus on work with instructional film in particular.

If one were to look closely at the research on instructional film, three distinct phases in the research become apparent. The first phase emphasizes the capacity and capabilities of film as a medium for teaching groups of learners effectively. These studies, which spanned roughly from the late 1910's to the early 1950's, focused on the film itself and what it could or could not accomplish as an instructional tool. These studies primarily analyzed the capacity of film to teach basic facts and concepts when compared to conventional teaching. A few studies of that period even compared film teaching to teaching with other types of media such as filmstrips and still photographs. Later, research efforts shifted to the manipulation of certain film qualities in an attempt to achieve a given learning outcome. In these studies, conducted primarily during the 1940's and 1950's, researchers experimented with the presence or absence of color, sound effects, music, animation, and narrative structure.

Then, around 1960 the research slowly began to focus on the learner. The research question now became, "Who learns from films?" rather than, "Can films teach?" or "How do films teach?" The two latter questions imply a sort of overt action on the part of the teacher in which something is done to the learner. The first question is more covert in nature. Here, the burden for action is placed on the learner. The first question analyzes what the learner brings to a learning situation, while the other two look at what the teacher brings to an instructional situation. Focus on the learner thus presented researchers with a number of new variables for study. Intelligence, aptitude, learning style, personality variables, maturation, ethnic background, sex, and other individual traits came under study as these traits interacted with the attributes of motion pictures.

Figure 1 depicts the three phases of instructional film research conducted in this country over the past sixty-five years as gleaned from the literature. The illustration should in no way imply distinct breaks in the research efforts, but should be viewed as a continuous and dynamic search, with much overlapping between juxtaposed phases.

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The present paper concentrates on experimental studies which are representative of the third phase. These studies focus on the the question, "Who learns from film?" They were conducted primarily between 1960 and 1985 as this was the period in which the research interests appear to have shifted from the film to the student. The paper does not, however, focus on all individual differences that were studied, but deals mainly with the development of higher level cognitive skills through the use of films, the effects of film viewing on individual learning styles and other learner differences, and the effects of film viewing on the self-concepts of students. It was reasoned that these findings might be of the most value to teachers as they seek solutions to some of the most challenging problems confronting them in practically every classroom.

Purposes

This paper has four (4) main purposes. (1) It seeks to report the findings from instructional film research which focus on the use of films in helping students to master higher cognitive learning, particularly among the talented and gifted. Higher cognitive learning is concerned with mastery of problem-solving and inquiry skills which include hypothesis generation, the generation of appropriate questions, the development of observation skills, and hypothesis testing and evaluation.

(2) The paper will summarize the available research on the interaction between film viewing and learning styles. While these studies are few in number, they represent a promising approach to a difficult question---"What works for what type of learner?"

(3) The paper seeks to summarize the research findings on the use of films in enhancing the self-concepts of school-age children. The problem of low self-esteem, particularly among minority inner-city students, has long been regarded as an obstacle to academic achievement. Self-concept has also been found to be an important differential in teaching females in science and mathematics classes.

(4) The paper will then discuss implications of the research findings and make recommendations for their applications in a normal classroom. This section emphasizes the fact that the use of films in teaching and learning did not represent a panacea for all of the ills in the classroom, but they did bring a fresh approach and need variety to the scene.

The Effects of Films on Higher-Cognitive Learning

It has generally been accepted that film viewing is an effective and efficient method for helping students to increase their store of basic facts and concepts. It is not enough, however, to simply teach facts in the classroom. Teachers must also help students in learning broad general principles, and in mastering inquiry and problem-solving skills that are so needed in order to function in a complex society. A few experimental studies have attempted to determine the effectiveness of films in helping students to master these types of skills.

The effects of informational-expository and historical-dramatic types of films on student abilities to master the scientific method were studied by Kazem (1960). Four groups of high school students were

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matched on pre-test knowledge, intelligence, reading ability, sex, and school location. One group saw two informational-expository fills A second group saw two historical-dramatic films, and a third group one of each type. The control group did not view films. Film group significantly out-scored the control group on the application of knowledge tests. The group viewing a combination of films made more gains that did the group viewing historical-dramatic films, but the differences were not statistically significant. High ability studer made consistently higher scores, but students of average intelligend made the most gains. Test scores between the sexes did not differ.

At the University of Illinois, Suchman (1961) believed that when children reach the operational stage of development, they can be train the mastery of inquiry skills. Exposing children to a systematic process of discovery is the key to such training. Drawing on the writings of Jerome Bruner and others, Suchman summarized the benefit the training (p.151): (a) exploration, manipulation, and mastery are intrinsically motivating; (b) a reinforcing sense of power and self-confidence comes from successful autonomous discovery; and (c) to strategy of data intake and processing has an important effect on the productivity and depth of discovery. The author then described the results of an experimental program called Inquiry Training designed students in the intermediate grades.

Fifty students of high ability were exposed to science problems using filmed demonstrations. Students were asked to identify object the demonstrations, verify conditions and changes in the objects dur the demonstrations, and cite variables responsible for the changes. Student responses were recorded on the blackboard. They were then to identify conditions that could affect the outcome of the demonstration, such as, "What would happen if ... ?" Students then had seek verification as to why the condition would affect the outcome. author explained the importance of this method (p.162): "He learns every episode contains objects, that the state of an object at a give time can be described by a set of attendant conditions, and that an change in a condition is an event... The child learns to identify fil all objects and systems, and then to determine their conditions both the beginning of the episode and immediately following each independ The films used in the study were organized and presented U event." expand on previous learning. Each film involved a new concept or a variation of a previous one. Suchman felt that structuring the fill this manner was important in giving students a sense of progress.

Results of the study were cited in terms of individual progress. Students were observed in the number and types of questions they as in problem-solving situations after Inquiry Training. Suchman, acknowledging the wide range in individual differences, concluded th this type of training had definite benefits in helping youngsters increase inquiry skills. The method proved particularly helpful wit gifted students.

Allender (1968) described three studies using inquiry training students in grades three through seven. The studies used specially developed films and other materials. As a test of inquiry skills, students were required to role-play a small city mayor. Increases i the desired behaviors directly correlated with increases in grade lebut no interactions were found with sex, intelligence, or reading ability.

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y training wi d specially ry skills, Increases in in grade lev r reading Two studies conducted by Salomon and Sieber (1970) described a method for influencing the number of relevant questions and hypotheses generated based on the structure of the stimulus. In the first experiment, two films were used, one with structured sequences, the other with unstructured sequences. Students in one group were asked to write down the number of details observed in the structured film and to generate as many hypotheses as possible about the plot of the unstructured film. It was predicted that the unstructured film would solicit more questions but fewer hypotheses. In the second experiment, subjects were asked to memorize as many details as possible in the film scenes or to generate hypotheses. The dependent measure was the number of times subjects asked to review the film sequences. It was predicted that the number of details and hypotheses reported was directly related to the structure or lack of structure in the stimulus.

Results of the first experiment supported the hypothesis. Unstructured films produced more questions and generated more hypotheses than did structured sequences. The second experiment also produced significant differences between the two types of sequences in favor of the unstructured film. The authors concluded that uncertainty and information searching are maximized when a stimulus suggests many different responses.

A study which continued the efforts of Suchman (1961) and Salomon and Sieber (1970) was done by Wright (1978). The same films used by Suchman were used in this study. Students were assigned-to three treatment groups during Phase I of the study. At this time, subjects were shown a film depicting a problem situation and were asked to list as many details and generate as many hypotheses for solutions as possible. Maximums were 75 for the former and 5 for the latter task. Fourteen months later subjects used a new set of films to test long-term retention of the previous training. The study found that students were significantly more successful in demonstrating the types of inquiry skills in which they had receive intensive training. For example, students who had been trained in attending cues to generate details about a problem were able to list a significantly higher number of details in a new problem situation than were students who had not had the training. An important conclusion of the study was that it "presents a model for investigating means of improving basic inquiry skills" (Wright, 1978, p.213). It was also assumed that the development of such skills could conceivably be carried out in the average classroom.

Another study of this type was conducted by Pearson (1972). Here, films were used as verbal mediators with nursing students to help sharpen their observation skills. The author designed the study in order to determine the feasibility of increasing the number of real observations reported by students in a patient-nurse contact and to minimize the number of inferences being reported as real observations. It was hypothesized that students receiving filmed instruction would report more observations and fewer inferences than would students not receiving the films. The study divided 129 students into three treatment groups. Two groups viewed special observation technique films, a preparatory film, and the test film. A third group saw only the preparatory film before the final test film. With the test film, students were asked to: "Please list below all the observation of fact or occurrence that you noticed about the patient in the filmed sequence you just viewed" (p.288). A jury then classified responses as reported observation or inference. Using ANOVA techniques, the researcher that there were significantly fewer inferences reported as observe by the nurses who had learned observing skills with instructional as compared to nurses who did not see the films.

The studies dealing with the development of higher cognitive a have been few in number, but represent important work in the effecuse of instructional films. Research findings indicate that it is possible through training to increase the ability of students to a to details, pose relevant questions, and generate hypotheses in a problem situation. These processes are vital to inquiry, problem-solving, and discovery learning. The research indicates to higher cognitive skills can be developed with the use of films in very young as well as in adults. At least one study (Allender, 19 found maturation as a differential in learning hypothesis generation The research literature, however, presented no studies in which fil were used to improve student abilities to test hypotheses, draw conclusions, and evaluate conclusions.

Effects of Films on Learning Styles

A great deal of attention in the instructional film research a 1960 focused on the general aptitude and intelligence levels of st as they interact with filmed materials. Little work, however, has done with films and learning styles. Hoban and van Ormer (1970) discussed findings from the 1930's and 1940's which suggested that films facilitated learning in auditory type learners. May (1965) discussed the relationship between sensory dominance and learning media. However, three studies (Thomas, 1972; Smith, 1973; Simons et.al., 1985) looked specifically at cognitive styles and film lear while one study (Snow, Tiffin and Seibert, 1965) tested a broader concept of individual differences and the amount of learning from film. Two other studies (Salomon, 1972; Clark, 1973) which invest the effects of aptitude on film learning are included here because their unique contributions to an understanding of how learners les with films.

The nature of a film's content on the behavior of young childred found to interact with the cognitive styles of the learners (Thomas 1972). One hundred and forty-three boys, ages 5 years to 8 years is divided into three groups. One group watched an aggressive film, is a second group saw a nonaggressive film. A control group did not is films. A agression measure after the viewing found that age and cognitive styles were differential in the amount of aggressive behavior observed in the subjects. Younger boys were more aggressive than boys. Cognitive styles became more differentiated with age.

Don Smith (1973) measured 400 college sociology students for cognitive style using the Rokeach dogmatism scale-Form E. Two gro 200 each took identical final examinations after one group had bee taught with lecture and the other with films. Results of the stud indicated no differences in test scores on patterns of cognitive s GPA, sex, or major field of study. The author pointed out that th study used group effects rather than individual effects in an atter replicate group problems usually confronted by the average teacher inses as real researcher f l as observat tructional f

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Five studies at Iowa State University looked at "learner aptitude interaction with media type when attitude change is the goal of instruction" (Simonson, et.al., 1985, p.4). The studies specifically investigated the characteristics of field dependence (FD), field independence (FI), and hemisphericity as they interacted with mediated messages. Cognitive styles of the participating students were measured using the Embedded Figures Test for FD/FI and the Conjugate Lateral Eye Movement Test for hemisphericity. The studies focused on developing desired student attitudes toward soil conservation, smoking, or disabled persons.

Results of two of the studies indicated an interaction between treatment and cognitive style. Students who had viewed the film on soil conservation and who were field independent had higher attitude scores that did the other treatment groups. Also, students who were field independent and viewed the film on disabled persons were found the have more positive attitudes toward the subject. Left brain dominant students were found to have more positive attitudes toward soil conservation than did right brain dominant students. The authors concluded that motion pictures tended to work generally best for all learners and for field independent learners in particular.

A broader concept of individual differences and learning from film was studied by Snow, Tiffin and Seibert (1965) at Purdue.University. Four hundred and thirty-seven college physics students were divided into film group and control group. Students were assessed for the personal variables of ascendancy, responsibility, emotional stability, attitude toward physics, attitude toward film, numerical and verbal aptitude, and prior knowledge of physics. Results of the study indicated that students who were active, self-assured, and independent performed better with film than with face-to-face instruction: On the other hand, students who were low in responsibility and tended to be unwilling to take on independent learning activities preferred conventional teaching. On the intellectual variables, students low in aptitude performed better with the film treatment. The authors speculated that viewing the film allowed low aptitude students an opportunity for needed clarification of physics concepts.

In a discussion of the findings the authors concluded that instructional method can inhibit learning in some students while facilitating learning in others. It was hoped that the study would provide grounds for decisions concerning the assignment of students to alternative instructional treatments.

An explanation for the interaction between aptitude and film viewing that was found in the study above could lie in the findings by Salomon (1972). This researcher found that 8th and 9th ground students internalized and imitated visual codes from motion pictures according to their levels of mathematical and verbal aptitudes. It was hypothesized that students low in aptitude would use visual cues for modeling and internalizing visual information, and that students high in aptitude would already have a useful internalization code and would only need visuals to activate it. Both hypotheses were partially supported. Students high in aptitude tended to notice fewer visual cues in a film which depicted a solid object being unfolded into space. On the visualization test these students were unable to reconstruct the object as well as low aptitude students. It was suggested that low aptistudents did not already have a schematic code to be supplanted a the high aptitude students, hence the greater attention to visual

Further support for the explanation might also be found in a by Clark (1973). College students in a psychology class were div into film and control groups after their scores on the Hidden Figpart of the French Aptitude Test had been obtained. Using ANOVA techniques, the researchers found that low aptitude students persignificantly better with the film than with the teacher.

The film research on learning styles and other learner characteristics suggests that films are more effective with studer are field independent, left brain dominant, high in responsibility self-assured, and who are low in mathematical and verbal aptitude. Face-to-face instruction tends to work best with passive, irrespon and high aptitude students.

The Use of Films in Changing Self-Concepts

It is generally accepted that students will not learn well if bring to the learning situation negative or low concepts of thense Much work in educational research has been undertaken in the last years to help improve student self-esteem. The influence of fila viewing on the changing self-concepts of children, particularly an black children who come from low socio-economic homes, has been su by a number of researchers (Weisgerber and Danoff, 1969; Teaham, 1 Dimas, 1970; Morin, 1973, 1976). At least one study (Paroly, 190 looked at the stereotyping of female social roles in films designed elementary school children.

The study by Weisgerber and Danoff (1969) used a mixed group of black and white students to test changes in attitudes toward a black hero (Frederick Douglass). It also sought to discover if the file any effect on the self-image of the black students. Two experiment groups viewed the film, while two control groups did not. Eight self-concept instruments were administered prior to the film and to days following the film. Responses were analyzed according to race sex, and socio-economic status. The results showed that both contro and treatment groups identified equally with the hero. One has to speculate about the researchers' choice of a film hero since Freder Douglass is so well-known and accepted by most school-age youngster Surprisingly, the study did find differences on the variable of se Black females possessed more self-esteem than black males, while we males possessed more self-esteem than did white females.

In that same year, Teaham (1969) conducted further research de with the impact of film on the self-concepts of minority children. Teaham hypothesized that the viewing of films about successful biad professionals would improve the self-concepts of black youth and we raise their levels of aspiration. Students in the study came from inner city schools in a large midwestern city. One experimental 9 saw six films about black professionals and six films showing white professionals. A second experimental group saw six films, all show black professionals. A control group saw no films. Attitude instruments were given one month prior to the film showings and one month after the films. ow aptitud anted as visual c id in a revere divide iden Figure ; ANOVA its perfor

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earch deal hildren. sful black th and woul ame from f mental grow ing white all showit ude s and one Students who saw the films changed significantly in their attitudes toward their own race and toward themselves. Students who only saw films with black professionals made the most significant changes. The latter finding was particularly true for black males from low socio-economic homes. Students in the control group moved in the opposite direction, showing less racial and self-pride over time. The study also found that black girls tended to have lower goal aspirations than did the boys.

A similar study by Dimas (1970) divided fourth and sixth grade black students into two groups. One group viewed films about black heroes such as Jackie Robinson and Martin Luther King, Jr. They also saw film segments of a black middle class family. A second group saw similar films, but these films portrayed white models. The study found that students who viewed the films with black role models later expressed more positive aspects of self-concept than did students who viewed films with white role models.

The findings in the Teahan and Dimas studies were not replicated by Morin (1973, 1976). This study sought to measure attitude changes of black students when exposed to a film with either black or white actors. It was assumed that the race of the communicator in a film would affect the attitudes of black students toward that film differently, particularly when the students were stratified by socio-economic status. It was believed that students from high socio-economic homes would identify more readily with white actors and that the opposite would be true for students from low socio-economic homes. The hypothesis was rejected. There were no changes in attitudes among either group toward the films. Morin concluded that black children were not overly preoccupied with the race of the film communicator, therefore the race of the film actor does not significantly affect the attitudes of minority children.

Paroly (1983) wondered about the effects of educational films on the self-concepts of female children. Analyzing the degree of female stereotyping in 32 films produced for elementary school children between 1975 and 1980, the investigator found that male and female roles were not equal in portraying occupational or vocational behaviors. Males were more often portrayed in achievement or leadership roles, while females were more often portrayed in nurturing or submissive roles. The Paroly study suggests that because young children tend to accept the "authority" of films in a learning situation, the use of certain films may work adversely in efforts to form positive self-concepts among children.

While one study found no interaction between the self-concepts of minority children and film role models, most of the evidence supports the presence of such an interaction. Films have been found to foster racial pride among minority students and to postively influence the way these students think of themselves. Other evidence suggests the presence of sex biases in many instructional films which are currently being used in elementary schools. Teachers are subsequently urged to become aware of these films and their potential negative effects on the self-concepts of female children.

Conclusions and Implications

Instructional film research which focused more closely on the learner has provided the classroom practitioner with important cludifferences in learner characteristics and how these differences a learning under various conditions. While the number of studies of type has been disappointing, the work that has been done is of tremendous value to teachers as they seek effective methods of instruction for all types of students. The popular acceptance of as a teaching and learning tool coupled with the fact that most so have ready access to some kind of film collection, increases the n of the film research literature as a source of possible answers to difficult questions.

The following conclusions and implications are drawn from the research literature:

- Films are effective in teaching students the skills of inquiry learning, discovery, and problem-solving. Teach who work with gifted and talented students should consi the frequent use of appropriately-designed films.
- Unstructured films have been found to generate more requestions and more hypotheses in problem-solving activitian structured films. When these higher-cognitive activities are a goal of instruction, teachers should a out and use unstructured films.
- Films have been found to be particularly effective in teaching observation skills and in training students to attend to important details. Teachers should consider to use of films for needed training prior to assigning tas which will require the use of these skills.
- 4. Students who are high in mathematical and verbal aptimized to benefit less from visual cues in films, while students with low aptitudes tend to imitate and intermisuch cues. Teachers should, therefore provide students are poor in mathematical and verbal ability with frequency opportunities to take advantage of film viewing.
- 5. Films tend to be more effective with students who are influenced by internal forces (field independent), are logical and analytical (left brain dominant), are independent, active, and are high in personal responsibility. Teachers are thus cautioned against the consistent use of films with students who are passive, irresponsible, and who tend to be more influenced by external forces (field dependent).

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- 6. Films have been found to positively influence student self-concepts. Teachers should consider the frequent use of films depicting appropriate role models for deprived minority youngsters when working with this type of student.
- At least one study found the stereotyping of sex roles in films for young children. Teachers should, therefore, become aware of such biases and should closely preview all films before using, particularly with very young children.

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TITLE: EXTERNAL PACING AS AN INSTUCTIONAL STRATEGY FOR THE DESIGN OF MICRO-COMPUTER BASED INSTRUCTIONAL PROGRAMS TO IMPROVE PERFORMANCE ON HIGHER LEVEL INSTRUCTIONAL DEJECTIVES

JOHN SUMMES CAMELOS PHILI BHKER WILLIAM TAYLOR JOHN BELLAND FRANCIS DWYER EXTERNAL PACING AS AN INSTRUCTIONAL STRATEGY FOR THE DESIGN OF MICRO-COMPUTER BASED INSTRUCTIONAL PROGRAMS TO IMPROVE PERFORMANCE ON HIGHER LEVEL INSTRUCTIONAL OBJECTIVES

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December 10, 1985

Rationale

At the 1985 AECT Convention in Anaheim, CA, the authors presented a research study titled, "Varied Self-Paced Micro-Computer Based Instructional Programs for Addressing Individual Differences When Acquiring Different Levels of Instructional Objectives". A refined version of this study was later accepted for publication in a special issue of ECTJ dealing with micro-computer based instruction and individual learning differences. The "1985 AECT RTD paper presented some unique results regarding the design of micro-computer instructional programs. These results tend to be in opposition to past instructional systems designed to address the problem of individual learning differences by the use of a self-paced instructional method. However, the 1985 AECT RTD paper results were consistent with current cognitive psychology principles, indicating that attending and motivation are strong predictors of successful learning when dealing with improving information processing. In other words, what Wittrock (1978) and others (Yerkes-Dodson Law in Travers, 1972; Zeigarnick Effect and Ovsiankina Effect in DeCecco, 1963) have indicated is that by increasing motivation and attention, learning or information processing may also be increased. On the other hand, what self-paced instructional systems (i.e., Skinner's programmed learning; Glaser's IPI-system; and Postlethwait's Audio-Tutorial System; in Cross 1976) tend to do is put the locus of control for pacing in the learner's hands. This would tend to decrease external control, not only for pacing, but also decrease control over the manipulation of the student's attending behavior and motivating the student. A similar position has been expressed by Carrier (1984) and Reiser (1984), both noting that learner's may not be the best judges of what instruction they need, how much instruction, when to seek instruction, and what to attend to in an instructional segment.

The results of the 1985 AECT RTD paper clearly indicated that a micro-computer based instructional program, that is moderately externally paced, allowed for more information to be acquired, and for better performance on higher level objectives, than both self-paced and a more aggressive externally-paced condition. Our results fit the cognitive psychology literature quite well, but were in opposition to the research on self-paced instruction. However, little

PP. 146-163 of the 1985 AECT RTD Proceedings, Authors Dwyer, F., Taylor, W., Canelos, J., Belland, J., Baker, P.

TEGY D MANCE ES research has been done to date on the issue of self-p instruction and micro-computers, probably because of widely held erroneous assumption that self pacing is best way to design micro-computer based instructional programs.

As can be seen in the results of our 1985 AECT apaper, summarized in the table of means, Table 6, the external paced plus cognitive processing time conditions was superior to both the self-paced and the external paced, no cognitive processing time conditions. These results are particularly significant when considering that the subject's performance in the external paced cognitive processing time condition held constant, ext though intellectual task difficulty increased significantly going down the table. Table 7 provides summary of the analysis of variance results of the 19 AECT RTD study.

Given the unique results of the 1985 AECT RTD st and their significance in predicting how to design micro-computer based instruction, the authors have decided to conduct a series of studies to further investigate these results. Since the external control pacing had such a significant effect on learning, by manipulating attention and motivation, it is likely t further external controls can have an effect upon learning or information processing. These external controls should be designed to control attending beha and motivation when interacting with visual and verba information from the micro-computer based instruction program. Looking at the table of means in Table 6 indicates two distinct effects occurring. First the spatial problem free-recall scores are quite low when compared to the other test scores. This even occurrs the Externally Paced plus Cognitive Processing Time Condition. This low score probably occurred because subjects were attending to mostly verbal information not the spatial or visual information required to so the spatial free recall problem. As indicated in the AECT RTD paper, the instructional sequence presented subject with a visual and a set of verbal information Each instructional question then required the subject respond with verbal information. However, visual/spa information was a part of this to-be-acquired information, but the learner was not directly forced attend to this information. To externally control 🕬 attending to visual information, the instructional program was changed to include a 5 second time delay after the visual was presented, but prior to any ver information being presented. The presence of visual spatial information, and the absence of verbal information should presumably direct the learner's attention to the visual information. To further cont

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the learning of spatial information, every 5 to 7 instructional displays the learner was given a cue to try to form a mental image of the visual/spatial information seen so far. This was done by including a special instructional display that formed an outline of the heart, with verbal directions that asked the learner to try to fill in the parts he or she had already seen by forming a mental image. The second effect noted in Table 6 is the wide range of scores across the test types in the Self-Paced and External Paced No Cognitive Processing It was felt that the 5 second visual delay Condition. variable would tend to level off these scores by forcing subjects to more carefully attend to information presented. While these external manipulations of a 5 second visual delay and a cue to image, seem like a small amount of external control, recall that a 7 second delay caused the differences in scores between the Ep + Cp, Sp and Ep - Cp conditions the 1985 study. As indicated in the 1985 AECT RTD paper, cognitive style variables should be examined in terms of effects upon learning when different micro-computer based instructional conditions are used. The cognitive style variable examined in this study was reflectivity and impulsivity. A final variable examined was the effect upon learning of a simple imagery strategy to further control information processing. The four theoretical hypothesis examined in this study were:

- The external control of a 5 second visual delay will improve overall learning from the instructional programs and particularly the processing of visual and spatial information, for use on spatial learning tasks.
- A cue to form an image will improve learning on spatial tasks when compared to those subjects without imaging cues.
- 3) Reflectives will tend to respond more favorably to micro-computer instructional programs than impulsive cognitive styles who probably require more external control than CAI can afford.
- Imaging training will improve visual learning overall if given prior to working with CAI.

Experimental Design

The present study is a research in progress and was completed on November 8 and 9, 1985, at Ohio State University. The data analysis completed to date appears in Tables 1 thru 5, and Figure 1. This analysis can be compared to the results of the 1985 AECT RTD study found in Tables 6 and 7. Further analysis will be done with the resulting data, and the reflectivity-impulsivity will be added to this further analysis in addition more comprehensive literature review on this cognitivariable. Further, a complete description of the instructional programs and test types/intellectual will be not included in this review but can be found the 1985 AECT RTD paper, pp. 146-163. However, modifications in those micro-computer based instruct programs will be considered.

The experimental design appears in Figure 2, a a (4 x 5 x 2 x 2) design. There are 4 basic instructional conditions, as indicated earlier, a s second visual delay was added to each instructional condition to improve attending to visual information The instructional programs are the same used in the AECT RTD study. However, the external paced no coord processing time condition is not used in this study. programs are micro-computer instructional programs designed to teach the names of the parts of the hear the heart phases and operations. There are 57 instructional frames in each instructional program, these are identical to the 1985 AECT RTD study program The only overall change in each instructional condition was the addition of the 5 second visual delay, this occurs in the following manner. Each instructional display consists of a visual of the heart and releva heart parts and verbal labels, then under the visual segment of verbal information appears describing the visual and verbal labels. This information is then removed from the CRT screen, a study question appear and the learner types in the appropriate answer. To force the learner to attend more carefully to the vi information, a 5 second visual delay occurs after the heart visual and part labels appear on the screen, p to any verbal instruction appearing under the visual this point, the learner is forced to attend to the " information. After several frames the learner seems realize that this visual information must be important Two of the instructional conditions provided an image cue, that helped the learner recall prior visual information during the instructional sequence. This imaging cue occurred every 5 to 7 instructional dispin the sequence of 57 displays. The image cues consisted of an outline visual of the heart appearing the screen, then a verbal segment told the learner to to fill in the outline drawing with heart parts he of had already seen by forming an image in the mind. learner had as much time as needed to think about the image. The 4 basic instructional programs were the:

> Self-Paced Instruction - 5 sec. delay - no imaging cue

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- (2) Self-Paced Instruction 5 sec. delay imaging cue
- (3) External-Paced Instruction 5 sec. delay no imaging cue
- (4) External-Paced Instruction 5 sec. delay imaging cue

There were 5 types of tests or intellectual tasks. These tests were identical to those given in the 1985 AECT RTD study and are described in detail in that study. The tests represent specific intellectual tasks, and were designed to range in difficulty from a simple task to a difficult task and were called:

List learning test Less Difficult
 Spatial learning test, cued recall
 Simple concept learning test
 Complex concept learning test
 Spatial problem test, free recall
 More Difficult

The cognitive variable was the reflectivity versus impulsivity variable. As the name implies, the reflective cognitive style tends to take more time with information based decisions, while the impulsive cognitive style tends to have as the main goal; "getting things done quickly." reflectivity-impulsivity was determined using Barratt's test, (Barratt and Patton, 1983). The test was given on-line to subjects prior to beginning the instructional programs, and scores were recorded for each subject. While the reflectivityimpulsivity variable data has been collected, the data has not yet been added to the currently analyzed data. It was assumed that reflectives may be more adept at using micro-computer based instruction than impulsives, indicating that the impulsive cognitive style may need more external control in the learning environment than typical methods of CAI can provide.

The last variable examined was the imagery training variable. It is likely that training subjects to form images would help them acquire visual information better, than no such prior training. The image training group had a brief workshop on how to form mental images by hearing an explanation of the value of imagery in learning, and practicing forming images of objects. The workshop consisted of a video-taped demonstration and explanation of an imagery strategy.

Subjects participating in the study were 200 freshmen from Ohio State University. Subjects received points toward their final grade in freshmen psychology for participation. Subjects were randomly assigned to the 4 instructional conditions, and from there randomly assigned to the imagery training and no training gro Subjects were run through the study conditions over period of two days. Data was calculated on 168 subj who completed the study, yielding an equal 42 subject each of the 4 instructional conditions.

Preliminary Analysis and Results

The analysis was conducted using a 4 x 5 x 2 analysis of variance with repeated measures. A complete analysis using the reflectivity-impulsivity variable be conducted at a later time, and this will yield the complete 4 x 5 x 2 x 2 experimental design found in Figure 2. A table of means for the overall experimendesign can be found in Table 1.

The analysis of variance is summerized in Table Table 4 indicates that the significant differences to last year (see Table 7) on the instructional type condition have been eliminated. Looking at the patt of means found in Table 2 indicates that the different across test conditions have been leveled off to enoug an extent to eliminate a significant difference on the instructional conditions. In other words, in a gener sense, the Self-Paced and External-Paced instruction conditions provided for similar test performance. should be noted that the External-Paced condition in present study is the External-Paced plus Cognitive Processing Condition from the 1985 study, the Extern Paced No Cognitive Processing condition was not used. is likely that this overall improvement in test performance over last years study was a result of add the 5 second visual delay to each of the instruction conditions. This visual delay forced the subject to concentrate on the visual display of the heart and labels, thus improving overall information processing Comparing Table 6 and Table 2, emphasizes this overal performance difference between the 1985 AECT RTD stu and the present study. Looking at Table 6 and Table also reveals the significant increase in scores on L Spatial Learning Problem test in the present study. that the average score on this test in the present 5 was 9.71 points, compared to 6.55 points in the 1985 AECT RTD study. It is likely that the 5 second visu delay caused the learner to attend more carefully to visual/spatial information, thus improving scores on Spatial Learning Problem Test.

Significant differences are found between test types, or intellectual tasks (Table 4). These differences are further analyzed in Table 5, and the results indicate that the tests do range in difficult making the spatial learning problem free recall, the difficult task. ing gro is over a .68 subje ! subject

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of particular interest is the interaction found in Table 4 between test type and instructional condition. This interaction is displayed in Figure 1, and the means involved in this interaction are presented in Table 2. Α Tukey method has been conducted on the means involved in this significant interaction. The complete analysis of these means will not be presented here, however, the source of the interaction was the different pattern of means occurring in the External-Paced Image Cue condition. The scores in this condition tended to be higher than the other three conditions, particularly the score on the Spatial Problem Free Recall (see Figure 1). Similarly, the Self-Paced Image Cue condition yielded a higher score on the Spatial Problem Free Recall Test, contributing to this interaction. Further analysis of this interaction is planned in a future presentation of the results of this study.

Conclusions

The preliminary results of this study indicate that external control of instructional conditions, in micro-computer based instruction, can improve information processing. These results further support the notion that putting the learner in complete control of instruction, via a self-paced condition, may not be the best teaching method for CAI. Specifically, these preliminary results supported our first hypothesis, indicating that a 5 second delay after visual information is presented on the CRT can improve learning of visual and spatial information. This 5 second delay probably caused the learner to attend more carefully to visual information and therefore process more visual information. While a 5 second delay seems slight, it did improve scores on the Spatial Problem free recall test over the 1985 AECT RTD study, and tended to improve test scores in general. Additionally, support was found for the second hypothesis, indicating that a cue to form images, as a form of external control, improved performance on the Spatial Learning Problem. Students may need this type of cueing to help them process information and tell them what is important and needs to be acquired in the instructional sequence. The imagery training probably did not have a noticeable effect because of the beneficial effects of the 5 second delay and image cueing.

Overall, the External-Paced condition plus cognitive processing time (from the 1985 AECT RTD study) with an imaging cue, was the better of the three micro-computer based instructional conditions. Furthe analysis is planned by adding the reflectivityimpulsivity variable, and further analysis of the instruction by test interaction will be carried out a future study presenting this data.

	<u>Self-Paced</u> 5 sec Delay (No Image Cue)		f-PacedSelf-Pacedsec5 sec.elayDelayImage(ImageCue)Cue)		External-Paced 5 sec. Delay (No Image Cue)		External-Paced 5 sec. Delay (Image Cue)		⊼ 1-5
•	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trained	
List Learning Test	11.81	10.67	13.10	14.48	11.86	13.67	15.0	12.86	12.93
Spatial Learning Test	13.38	12.86	12.10	14.48	12.71	14.67	14.14	14.33	13.69
Simple Concept	11.91	11.81	11.29	12.33	11.52	12.86	11.67	13.33	12.09
Complex Concept Test	11.91	11.14	10.86	11.67	11.86	11.91	11.76	12.48	11.70
Spatial Problem Free Recall	9.19	8.10	10.29	10.52	9.43	9.67	10.71	9.76	9.71
XIT/NIT	11.64	10.91	11.70	12.70	11.48	12.55	12.66	12.55	
XSP/EP	11	.28	12	.20	12	.01	12.	.61	
	Image 1	Training	x =	11.87	No Image	e Trainin	g x=	12.18	

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Table 1: Overall Table of Means

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In C	struction ondition earning Task	Self-Paced No-Image Cue	Self-Paced Image Cue	External-Paced No-Image Cue	External-Paced Image Cue
1)	List Learn	11.24	13.79	12.76	13.93
2)	Spatial Cued	13.12	13.71	13.69	14.24
3)	Simple Concept	11.86	11.81	12.19	12.50
4)	Complex Concept	11.52	11.26	11.88	. 12.11
5)	Spatial Free	8.64	10.41	9.55	10.24

Table 2: Instructional Condition X Test-Learning Task Interaction Means

	Image Training	No Image Training
List Learn	12.94	12.91
Spatial Cued	13.30	14.08
Simple Concept	11.60	12.58
Complex Concept	11.60	11.80
Spatial Free	9.91	9.51

Instruction

Self-Paced No-Image

Self-Paced Image

External-Paced No-Image

External-Paced Image Table 3: Learning Task X Image Type "Almost Interaction" Means

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Source (BG)	Mean Sq.	Df	F-Ratio	Probability
Instruction Type (A)	64.814	3	1.092	.35
Image Type (B)	20.430	1	0.344	.56
(A) x (B)	40.321	3	0.679	.57
Error	59.372	160		
Test Type (C)	380.909	4	63.258	.0001
(A) x (C)	11.503	12	1.910	.03
(B) x (C)	13.683	4	2.272	.06
(A) x (B) x (C)	7.417	12	1.232	.26
Error	6.022	640		

Table 4: Analysis of Variance Results; 2 x 4 x 5 Design

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(4) Comples Concept Learning Test <u>11.07</u> (5) Spatial Learning Problem Test <u>9.71</u> (5) Spatial Learning Problem Test <u>9.71</u> (5) Spatial Learning Problem Test <u>9.71</u> (2.09 - 9.71 = <u>1.02</u> 12.09 - 9.71 = <u>2.38</u> * 11.07 - 9.71 = <u>1.36</u> (*Significant at .05 alph <u>Table 5</u> : Mean Differences, Test Type or Learning Task, Using T-Method	Source (BG) Instruction Type (A)	 (1) List Learning Test <u>12.93</u> (2) Spatial Learning Cued Test <u>13.69</u> (3) Simple Concept Learning Test <u>12.09</u> 	$12.93 - 13.69 = \underline{.76}$ $12.93 - 12.09 = \underline{.84}$ $12.93 - 11.07 = \underline{1.86}$ $12.93 - 9.71 = \underline{3.22}^{*}$ $13.69 - 12.09 = \underline{1.6}$
(*Significant at .05 alph <u>Table 5</u> : Mean Differences, Test Type or Learning Task, Using T-Method Probability	Mean Sq.	 (4) Comples Concept Learning Test <u>11.07</u> (5) Spatial Learning Problem Test <u>9.71</u> 	$13.69 - 11.07 = 2.62^{*}$ $13.69 - 9.71 = 3.98^{*}$ $12.09 - 11.07 = 1.02$ $12.09 - 9.71 = 2.38^{*}$ $11.07 - 9.71 = 1.36$
Probability	Df F-Ratio	Table 5: Mean Dis or Learning Task	(*Significant at .05 alpha) fferences, Test Type c, Using T-Method
	Probability		

	Self- Paced	External Pace, Norm Reading Speed + Cp	External Pace No Cp	Control	WG, X Control In
List Learning	12.36	12.48	11.84	1.92	9.65
Spatial Learning Cued	12.32	13.60	10.64	5.68	10.56
Simple Concept Test	11.00	12.80	8.88	7.12	9.95
Complex Concept Test	10.40	13.64	9.48	6.56	10.02
Spatial Problem Free-Recall	6.76	8.60	4.28	.88	5.13
BG, X.,,	10.67	12,22	9,02	4.43	
Avg. Time Overall	50.36 ,min.	44.64 min.	45.04 min.	n/a	

Table 6: Resulting Test Means and Overall Time for Each Instructional Program, 1985 AECT - RTD Study

Mean Sq.	Df	f-ratio	Probability
			1.2
1404.359	3	45.875	.001
30.613	96		
,			
493.917	4	99.785	.001
51.901	12	10.485	.001
	Mean Sq. 1404.359 30.613 493.917 51.901	Mean Sq. Df 1404.359 3 30.613 96 ' 493.917 4 51.901 12	Mean Sq. Df f-ratio 1404.359 3 45.875 30.613 96 ' 493.917 4 99.785 51.901 12 10.485

Table 7: Resulting Lindquist I, 4 x 5 Analysis of Variance Data, 1985 AECT - RTD Study

Self- Paced	External Pace, Norm Reading Speed + Cp	External Pace No Cp	Control	WG, X Control In



	Self- Instru 5 sec. No In Cu	Paced ction Delay mage e	Self <u>Instr</u> 5 sec. Im C	-Paced uction Delay age ue	Externa <u>Instr</u> 5 sec. No I Cu	l-Paced uction Delay mage e	Externa <u>Instr</u> 5 sec. Ima Cu	l-Paced uction Delay ge e
	Image Trained	Not Trained	Image Trained	Not Trained	Image Trained	Not Trainęd	Image Trained	Not Trained
List	Ref*	R	R	R	R	R	R	R
Learning Test	mp*	I	I	I	I	I	. I	I
Spatial Learning Test				•				
Simple Concept Test			· · · ·					
Complex Concept Test								
Spatial Problem Free Recall								

*Cognitive Variable - Reflectivity vs. Impulsivity not yet analyzed for this write-up

 $\frac{Figure 2}{2 \times 2} \times 4 \times 5 \text{ Analysis of Variance}$

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TITLE: AN ASSESSMENT OF NURSING ATTITUDES TOWARD COMPUTERS IN HEALTH CARE

RUTHORS: DAUID L. CARL RACHEL R. CARL SHERRY GREATHOUSE

AN ASSESSMENT OF NURSING ATTITUDES TOWARD

COMPUTERS IN HEALTH CARE

by

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AN ASSESSMENT OF NURSING ATTITUDES TOWARD COMPUTERS IN HEALTH CARE

PURPOSE OF STUDY

Computer technology is rapidly becoming a part of health care, and one of the primary groups to be affected by computer automation is nursing. Many opinions have been expressed in the literature--some authors suggest ways to facilitate nurses' acceptance of this innovation, while others speculate that the "human oriented" profession will not accept the idea of computer technology. Most of these points of view have not been supported by empirical data. The primary focus of this study is to assess the attitudes of practicing nurses, nursing faculty and nursing students toward the use of computers in the health care setting.

REVIEW OF LITERATURE

Nursing professionals have been writing about computer technology since the early sixties, with a significant number of articles written on the subject beginning in the mid-seventies. Even today, however, nursing journals do not publish a great deal on the subject -- some journals dedicate only two articles per year to the topic of computers in nursing and health care (Grobe, 1985). The majority of the literature deals with five main areas of computer usage in relation to nursing and health care: 1) client data gathering functions, 2) educational applications, 3) administrative/management uses, 4) clinical practice applications, and 5) research functions. (See the bibliography for citations concerning each of these areas). These are, of course, important topics of study; however, few nursing research studies deal with questions regarding the potential implications for users of automation in health care--the human factors.

Schwartz (1984) identifies human factors, which are perceptual and attitudinal in nature, that can be categorized as follows: 1) apprehension/confidence level, 2) perception of usefulness of technology, and 3) user motivation. Throughout the nursing literature may be found "opinion articles" that discuss these human factors in terms of how nursing should approach the introduction of computer technology into health care, or that offer predictions of how nurses will respond to the computerization process. These articles approach the subject from an experiential basis--the opinions are rarely based upon empirical data. The following examples are typical of most "human factors" literature in nursing (Anderson, 1984; Zielstroff, 1976; Tate, 1975; Waterstradt, 1981):

 a) Careful planning is essential when implementing change; ownership of the computerization plan will facilite acceptance.

RD

b) Open lines of communications must be maintained.

c) A sense of urgency and commitment must be conveyed facilitate automation by maintaining a forward momentum.

 d) Group work is essential in developing a sense of ownership regarding the adoption of automation.

 e) A formalized orientation program must be planned and offered for all nursing staff members and for new employees.

Another area of the literature concentrates on more abstract and theoretical aspects, such as conflict that occuwith change of any kind and strategies that aid in coping with these changes. Tate (1975) cites three types of conflict the can occur with computer automation -- those that: 1) sten from differing goals and incompatible perceptions/values/beliefs, reflect struggles regarding the allocation of resources such funding, equipment, power, status, and 3) relate to perceive threats to one's identity as part of a group. Tate's suggest strategies for coping with changes related to computerization are useful for both the individual staff nurse and the nurse administrator. The recommended strategy includes collecting facts, understanding the nature and dynamics of the system, developing assertiveness skills and strategies, confronting i issue, compromising and negotiating resolution, and finally, "refreezing"--dealing with relationships that have been strain in the process.

Mixed predictions and reviews are found regarding the responses of nurses to computer automation. Frank (1964) spec of depersonalization and other dangers that the "technotronic age can bring, while reassuring the reader that nurses need be fearful of being replaced by computers. Another author de with "computer cowardice" among nurses and offers educational solutions to miminize the effect (Grobe, 1984). Two of the empirical studies on nursing attitudes toward computerizator health care present a very different point of view. Norwood, Hawkins and Gall (1976) found that 94% of their respondents indicated a favorable view regarding the use of computers in health care. Krampf and Robinson (1984) reported the following attitudes of nurses toward computers: 79.5% feel that they gain satisfaction from learning to use a computer, 90.4% belu that if nursing informaton is automated nursing productivity effectiveness will be increased, and 87.7% indicated a willingness to attend staff development programs on computers

A review of the literature regarding how nurses will respond to computerization or how nursing leaders should introduce the computer automation process in health care settings shows a wealth of personal opinions and personal experiences, but a dearth of quantifiable data. Little empirical information is available that compares perceptions¹ attitudes toward computerization; that which does exist evaluates primarily the practicing nurse and does not address the attitudes of nursing students and faculty. One primary S conveyed

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more that occur coping with aflict the stem fro /beliefs, rces such perceive 's suggest terization the nurse pllecting system, ronting to finally,

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will are onal le eptions ist address rimary 8 of the present study is to assess the attitudes and perceptions of practicing nurses, student nurses, and nurse educators toward computerization of health care in general, and its impact on the profession of nursing in particular. The following research questions were formulated:

- What is the perceived value of computers in health care?
- What is the perceived effect of computer automation on nursing practice?
- 3) What are nurses' attitudes toward learning about computers?
- 4) What factors are perceived as enhancing or inhibiting the process of computerization in health care?

DEFINITION OF TERMS

Attitude--an individual's feeling, position, orientation, or opinion toward a topic, subject or event.

Nurse educators -- facuty members currently teaching in a nursing education program (all faculty must be licensed and have completed masters or doctoral degree preparation).

Nursing students -- first and second year students enrolled in two year nursing education programs.

Perception -- an individual's thought, understanding, or cognition relevant to a topic, subject or event.

Practicing nurses--registered nurses (diploma, A.D., B.S., and M.S. prepared) employed in general hospital settings.

METHODOLOGY

Questionnaires were sent to nursing personnel at two general hospitals, nursing educators at three associate degree schools of nursing, and student nurses at two associate degree nursing programs. Agencies participating in the study did not have hospital information systems or computer assisted instruction programs in operation at that time. Each participant was asked to respond to a series of twenty questions. Demographic information included age, sex, level of education, previous experience in health care delivery, and previous use of computers in the health care setting. Additional questions assessed the participants' views regarding the usefulness of the computer and the effect it may have on nursing and health care. Anonymity was maintained throughout the study--the identities of individuals who participated were not revealed and only group data were analyzed. The sample size

was 83 first year nursing students, 84 second year nursing students, 52 practicing nurses, and 26 nursing faculty. percent of the respondents were male; this reflects the nat exp demographic trend of male representaton in the profession. all participants responded to all of the questions; for this ·reason, the actual number of data vary from question to question. The questionnaire response rate was 66%. Statistical analyses were performed using Chi square, cross tabulations and frequencies.

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RESULTS

The results of the study fall into four general categor These categories are: perceived value of computers in health care, perceived effect of computers on nursing practice, attitude toward learning about computers in health care, and perceived factors which facilitate or hinder the implementation of computers.

Value of Computers in Health Care Α.

The first category deals with some basic attitudes that Pr professional and pre-professional nurses have toward computer nu in the health care system. Specific questions assess previou experience with computers, and the perceived effect of this Nu technology on health care. fa

Table 1. OUESTION: HAVE YOU HAD PREVIOUS EXPERIENCE W COMPUTERS IN A HEALTH CARE FACILITY?

	Previous experience (%)					
	No exp	erience	Experience	TOTAL		
Students	7	0.1	29.9	100		
Practicing nurses	6	4.2	35.8	100		
Nursing faculty	3	0.8	69.2	100		

Chi-square = 15.2** p < .0005

ursing				
ty. Ten	The data i	ndicate that most of	the respondents	have not ha
the nati	avperience with	computers in a heal	th care facility	. However,
ssion.	it appears that	nursing faculty hav	ve had this backg	round as par
to to	of their profes	sional experience. ked with computers a	Just under 70% o is compared to an	r the nursin proximately
	faculty had not	nfaculty personnel.	to compared to up	proximater)
, cross	Curre		5	
- 3	Table 2.	QUESTION: DO YOU TH	INK THAT COMPUTE	RS WILL
	AFFECT HEALTH C	ARE?		
categor				
in health	-		1.5.5 (A.S.)	
ice,		Potential ef	fect (%)	
ire, and				
.ementati		Will affect	No affect	Total
- 3				
	Students	97.0	3.0	100
es that	Practicing			
computer	nurses	94.3	5.7	100
previou				
I CHIS	Faculty	100	0	100
	Lacurey	100		100
	Chi-square = 1.	87		
TENCE UN	n < 0.39			
IENCE WI	p < 0.39			
IENCE WI	p < 0.39			12.00
IENCE WI	p < 0.39 The respon	se to this question	is an overwhelmi	ng, "Yes,
IENCE WI	p < 0.39 The respon computers will participants di	se to this question affect health care i sagree with this con	is an overwhelmi In the future." Incept. There is	ng, "Yes, Few of the no
IENCE WI	p < 0.39 The respon computers will participants di significant dif	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
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IENCE WI	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
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IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
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IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the
IENCE WI TOTAL 100 100	<pre>p < 0.39 The respon computers will participants di significant dif three groups.</pre>	se to this question affect health care i sagree with this con ference in responses	is an overwhelmi in the future." icept. There is among the membe	ng, "Yes, Few of the no rs of the

Table 3. QUESTION: IF COMPUTER TECHNOLOGY DOES AFFEC HEALTH CARE, DO YOU BELIEVE THAT ITS INFLUENCE WILL BE POSE OR NEGATIVE?

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	Positive/negative influence (%)					
	Positive	Negative	Total			
First year students	100	0	100			
Second year students	97.6	2.4	100			
Practicing nurses	94.1	5.9	100			
Nursing faculty	100	0	100			

Chi-square = 6.00p < .11

Once again, the participants agree. The influence of computers will be positive. While a few responses were negative, it is clear that the great majority of nurses and nursing students feel that computers have something positive add to health care.

B. Effect of Computers on Nursing Practice

The next category of questions deals with the general impact of computerization on nursing, and the specific areas nursing which would be affected by the introduction of computechnology into the health care setting.

DOES AFFEC	Table 4. Q YOU PERFORM YOUR	NURSING DUTIES	MORE EFFECTIVELY?	NO COULD NE.
	A AND A A A A A A A A A A A A A A A A A	Eff	ectiveness (%)	
e (Z)		More effective	Less effective	Total
Total	First year students	93.7	6.3	100
100	Second year students	89.0	11	100
100	Practicing nurses	86.5	13.5	100
100	Nursing faculty	96.2	3.8	100
100	Chi-square = 3.1 p < .38	1 .		
nce of were rses and positive	Members of specifically aid duties. This pe a few of the res affect other com will nursing.	each group stron nursing personn rception of the pondents seem to ponents of healt	gly agree that comp el in performing th use of computers in believe that compu h care more positiv	outers would heir nursing hdicates tha iters will vely than it
eneral ic areas of comput				
- 1			E.	
- 1				

Table 4. QUESTION: DO YOU THINK THAT COMPUTERS COULD HELP

Table 5. QUESTION: WHICH NURSING SPECIALTY DO YOU BE WOULD BE MOST DIRECTLY AFFECTED BY THE INTRODUCTION OF COMP TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Specially		
•	Frequency	Percent
ICU/CCU	78	34.2
Medical/surgical	51	22.4
Emergency/outpatient	46	20.2
Other specialty	- 23	10.1
Community health	15	6.6
Rehabilitation/extended	care 12	5.2
Obstetrics/gynecology	2	. 9
Psychiatric/mental heal	.ch 1	. 4
Pediatrics	0	0.0

Table 6. QUESTION: WHICH NURSING SPECIALTY DO YOU BEU WOULD BE LEAST DIRECTLY AFFECTED BY THE INTRODUCTION OF COM TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Specialty			
17 (188)	Frequency		Percent
Psychiatric/mental health	53		23.6
Community health	48		21.3
Rehabilitation	46		20.4
Emergency/outpatient	26	7.3	11.6
Obstetrics/gynecology	18		8.0
Other specialty	16		7.1
Pediatrics	7		3.1
ICU/CCU	6		2.7
Medical/surgical	5		2.2

The specialty which nurses believe would be most affect is the highly technologically oriented ICU/CCU. Conversely, nurses believe that the psychiatric/mental health specialty would be least affected. The trends displayed in tables 5 st suggest that nurses think specialties such as ICU/CCU and medical/surgical nursing, which currently use a large amount technology, will continue to be affected by new technologies and that the less technological specialities such as mental O YOU BEL OF COMPO health, community health, and rehabilitation will not be affected quite as strongly. The attitude reflected in these responses seems to be that those specialities currently using technology will increasingly be expected to work with computers and those specialities not currently involved will not be as dramatically affected.

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Table 7. QUESTION: WHICH NURSING ROLE DO YOU BELIEVE WOULD BE MOST AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

	Frequency	Percent
Staff nurse	91	38.2
Nurse researcher	56	23.5
Director of nursing/		
supervisor	23	9.7
Head nurse	23	9.7
office nurse	17	7.1
Nurse educator	8	3.4
Nurse practitioner	7	2.9
Clinical nurse specialist	7	2.9
Other role	6	2.5

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t affect versely, ecialty bles 5 and U and e amount nologies, mental Table 8. QUESTION: WHICH NURSING ROLE DO YOU BELIEVE WOULD BE LEAST AFFECTED BY THE INTRODUCTION OF COMPUTER TECHNOLOGY INTO THE HEALTH CARE SYSTEM?

Role		
	Frequency	Percent
Office nurse	74	31.9
Nurse educator	38	16.4
Staff nurse	37	16.0
Director of nursing/		
supervisor	27	11.6
Nurse practitioner	19	8.2
Other role	15	6.5
Nurse researcher	9	3.9
Clinical nurse specialist	7	3.0
Head nurse	6	2.6

These data indicate that the two nursing roles which apperceived as being most affected by the computer are those the staff nurse and the nurse researcher. When asked which nursing roles would be least affected, the respondents place office nurses and nurse educators at the top of the list.

C. Learning About Computers in Health Care

The third category of responses deals with perceptions, the survey participants regarding computer courses, and the respondents' willingness to take computer courses either as of formal nursing education or as an inservice activity.

Table 9. QUESTION: DO YOU THINK THAT TO USE A COMPUTE EFFECTIVELY YOU NEED A STRONG MATH BACKGROUND?

	Math background (%)		
	Necessary	Not necessary	Total
First year	80.53	8.52	
students	18.3	81.7	100
Concord wood			
students	13.3	86.7	100
Practicing			-
nurses	5.7	94.2	100
Nursing			
faculty	0.0	100.0	100

Chi-square = 8.83 * p < .03

This question indicates a difference in attitude among four groups. While the great majority of participants do not believe that a strong math background is necessary, the data indicate that the student responses differ significantly from those of the nursing faculty and practicing nurses. More students hold the belief that math is important in using computers in a nursing setting, while none of the faculty are only a few practicing nurses agree.

d which					
ts place lișt.	- the second sec	Students	Practicing	Faculty	Total
- 1	Confident	39.5	54.7	40.0	42.9
	Comfortable	37.7	32.1	48.0	37.6
and the	Neutral	13.8	5.7	4.0	11.0
ther as ity.	Somewhat Uncomfortable	4.8	3.8	4.0	4.5
COMPUTE	Apprehensive	4.2	3.8	4.0	4.1
	NSD df=8				
Total	Table 11. QUE (USE OF COMPUTERS) STUDENTS?	STION: ^E SHO IN HEALTH CA	DULD A COURSE ARE) BE REQUI	IN COMPUT RED FOR NU	ER LITER RSING
100		NO	YES		
1	Students	47.9	52.1		
100	Practicing Nurses	24.5	75.5		
100	Faculty	38.5	61.5		
100	** p < .01 df=2	, ,			
- 1		:			
amone		ć			
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Table 12. QUESTION: SHOULD A COURSE IN COMPUTER LITER BE OFFERED AS AN ELECTIVE FOR NURSING STUDENTS?

			_
	NO	YES	
Students	11.0	89.0	
Practicing Nurses	32.6	67.4	
Faculty	16.7	83.3	
TOTAL	15.8	84.2	
			_

** p < .01 df=2

Table 13. QUESTION: IF A COLLEGE COURSE OR CONTINUING EDUCATION OFFERING IN COMPUTER LITERACY WERE AVAILABLE, WOUL YOU ENROLL IN IT?

(*)	NO	YES	
Students	11.7	88.3	
Practicing Nurses	9.6	90.4	
Faculty .	12.5	87.5	
TOTAL AVERAGE	11.3	88.7	

NSD df=2

Tables 10 - 13 present some interesting data. Most num are not afraid to enroll in a course in computer literacy. fact, 80.5% of the respondents indicate that they would feel comfortable or even confident about taking such a course; on 4.1% express a feeling of apprehension. When asked if a coin computer literacy should be required for all nursing students, practicing nurses, nurse educators, and students nurses disagree significantly. The students are about even divided in their opinions; however, three of every four practicing nurses believe that a course should be required. Nurse educators support the idea at a ratio of two to one. Table 12 presents a seemingly contradictory situation. While MPUTER LITE students and faculty groups support the idea of having a computer course as an elective, the response rate of the computer course falls from 75.5% (required) to only 67.4% practicing nurses falls from 75.5% (required) to only 67.4% (elective). Apparently, practicing nurses feel that knowledge of the use of computers in health care is sufficiently important that a computer literacy course should not be an optional that a computer. Table 13 indicates that all three groups of respondents would be interested in enrolling in a college or continuing education course in computer literacy. Appoximately 89% of the sample say that they will enroll if given the opportunity.

D. Factors Affecting Implementation of Computers

The final category of items deals with factors which facilitate or inhibit the introduction of computer technology into the health care setting.

CONTINUING LABLE, WOUL Table 14. QUESTION: WHAT DO YOU BELIEVE WOULD BE THE MAJOR FACTOR IN BLOCKING THE IMPLEMENTATION OF COMPUTERS IN HEALTH CARE?

ractor	Frequency	Percent
Financial considerations	137	56.2
Nursing staff attitudes	48	19.7
Administration attitudes	33	13.5
Medical staff attitudes	20	8.2
Other factor	6	2.5

Table 15. QUESTION : WHAT DO YOU BELIEVE WOULD BE THE MAJOR FACTOR IN FACILITATING THE IMPLEMENTATION OF COMPUTERS IN HEALTH CARE?

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Factor	S	1
	Frequency	Percent
Administration attitudes	110	46.0
Financial considerations	57	23.9
Nursing staff attitudes	36	15.0
Medical staff attitudes	27	11.3
Other factors	9	3.8
Nurses identify the major obstacle to the implementation computers in health care as the lack of money. This factor followed by the attitudes of nursing staff. They also belie the major factor which could facilitate the implementation is computer technology to be a positive administrative attitude and to a lesser degree an adequate supply of money.

DISCUSSION AND IMPLICATIONS

The results of this study are categorized into four gen groups. The first of these categories is the perceived val computers in the health care system. Although few of the respondents to the questionnaire have had previous experienwith computers, they believe that this technology will have profound effect on health care and that this effect will enthe quality of health care. The second category examines he respondents perceive the effect of computerization on nursipractice. The opinion of the nurses is that they expect the more technologically oriented specialities to be most affect Specialities such as ICU/CCU, medical surgical, and emergence outpatient nursing are expected to be most dramatically affer while the traditionally "human oriented" specialities like psychiatric/mental health nursing and community health nursing will be least affected. Two nursing roles are expected to most affected by computers. Staff nurses and nurse research are at the top of the "most affected" list. This result is particularly surprising since these two roles are now using computers in a number of hospital and university settings. However, the three roles believed to be least affected are office nurse, nurse educator, and once again staff nurse. fact that the role of staff nurse is mentioned toward the to each list indicates that some disagreement exists regarding full impact on this particular nursing role. The third cate of responses deals with the nurses' attitudes toward learning more about computers. Apparently the majority nurses do not suffer from a pronounced sense of cyberphobia. Most of the respondents indicate that they are not afraid of this emergin technology, and express a strong desire for learning more and the subject; they also strongly encourage nursing education ! include a course on computer literacy in the nursing curricul These data suggest that leaders in the process of computer automation need not spend as much time as previously thought "preparing nursing personnel to accept the computer." Rather time should be devoted to designing courses and implementing plans to effectively teach the nursing staff to use computed The final category of responses deal with those factors which nurses believe will enhance or hinder the implementation of computers. As might be expected, financial considerations if identified as the number one factor to block the implementat of computers. Money is always a major consideration when introducing costly innovations. When asked which factors wo most facilitate the implementation of computers, nurses indiplementati nis factor also belin mentation c /e attitude /.

to four get :eived value a of the s experience will have tt will enha examines ho 1 on nurside expect the iost affect id emergence ically affer :ies like salth nursi sected to te ie research result is now using settings. scted are f nurse. ward the top regarding : third cate ard learning :ses do not ost of the this emergin ing more abi education ing curricul computer ily thought sc." Rathe splementing ie computef ictors which itation of lerations 1 .mplementat .on when factors vol urses ind!

that a positive administrative attitude is most important. This implies that strong central administration support of computerization can have a significant, positive influence in the automation of a health care unit.

Replication of this study is recommended to validate the findings recorded here. Further study could also include data from respondents grouped according to formal nursing preparation (e.g. diploma, associate degree, baccalaureate, masters, and doctorate), to determine how formal education influences nurses' perceptions of computer automation in health care. An examination of attitudes and perceptions of various age groups regarding computer automation might also yield interesting and useful results. Reviewing data from these varied respondents could guide the nurse educator or nurse administrator who is planning for computerization and is considering the needs of the professionals or pre-professionals who will be affected by this process. Data comparing pre-computerization and post-computerization perceptions and attitudes of nurses could be useful in evaluating the impact of changes undergone, and the effectiveness of plans and strategies implemented. Such results may assist nurse administrators and educators when planning for the future technological advancements that are inevitable.

CONCLUSION

Throughout the literature may be found references discussing how nurses should approach the introduction of computer technology into the health care setting, and how nurses will respond to computer automation. Unfortunately, few hard data are available to support these claims. This study provides an empirical background. Among the findings of this study are the following: nurses are accepting, not opposing computer technology in the health care setting; nurses perceive the influence of computers on nursing and health care to be positive; nursing curricula should provide educational preparation in computer technology; continuing education offerings will be well-received by nursing; and nurses identify a strongly positive orientation by adminstrators as facilitating the computerization process in health care. Finally, these empirical data indicate a willingness among nurses to enter the information age with a progressive, positive orientation and with preparedness.

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TITLE: RESEARCH ON TELETRAINING: STUDENT ACCEPTANCE, LEARNING EFFECTIVENESS AND COST BENEFITS IN THE CORPORATE ENVIRONMENT

AUTHOR: ALAN G. CHUTE

RESEARCH ON TELETRAINING:

STUDENT ACCEPTANCE, LEARNING EFFECTIVENESS AND COST BENEFITS IN THE CORPORATE ENVIRONMENT

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RESEARCH ON TELETRAINING: STUDENT ACCEPTANCE, LEARNING EFFECTIVENESS AND COST BENEFITS IN THE CORPORATE ENVIRONMENT

INTRODUCTION

Previous research on teletraining has indicated that teletraining is a viable alternative delivery medium for short duration programs. Since 1981, AT&T has studied teletraining effectiveness for short continuing education programs and for multi-day courses. This paper highlights the 1984 research results and the benefits associated with using teletraining to deliver training to a mationwide audience.

BACKGROUND

The AT&T Communications National Teletraining Network was established to meet the needs of professional sales personnel located throughout the United States. Because of high costs associated with travel and travel time and the need to keep professional sales people up-to-date on the latest service information and technological developments, the National Teletraining Network was Implemented.

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In 1981, AT&T Communications began to offer professional sales courses to field locations via teletraining. These courses had duration which range from 2 days to 2 weeks. In October of 1983, the Sales and Marketing Educ Division began to offer weekly one hour information updates to the field personnel throughout the United States. The program developed for telet, ing delivery were topics that field sales managers had identified as high interest topics which were required to keep current in a competitive tele 1984 munications environment.

In October of 1983, weekly programs were delivered to five cities, one fra each AT&T Communications region. In November of 1983, five additional site prev were added because of requests from field managers to include their cities is n the National Teletraining Network. Since then the network grew steadily are network of over 135 locations at the end of 1984.

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The network today delivers weekly one hour programs and regularly schedule atte teletrained courses which are periodically evaluated using a reaction leve The evaluation survey, course debriefings and cognitive pre and post tests. In perinumber of programs and courses offered and the number of total participants grow who have attended National Teletraining Network programs grew steadily size test the initiation of the project to over 21,000 by the end of 1984. Research face studies were conducted to track effectiveness and trial new delivery techniques.

TELETRAINED RESEARCH

courses to

keting Educa the field a for teletral impact of teletraining on learning, on student acceptance of courses and instructors, and on student willingness to take additional teletrained proied as high titive teleca 1984.

Student Learning

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ditional sit: Previous research conducted by Sales and Marketing Education has shown there their cities: is no significant difference between the amount students learn in classes that w steadily t: are teletrained and the amount learned in face-to-face classes. To continue with our ongoing research, comparative studies of test results are periodical-

ly conducted. The most recent study compared the test scores for students rly schedule: attending teletrained and face-to-face classes of the Telemarketing I course. eaction leve. The results for two classes are presented in Figure 1. The teletrained group st tests. In performed slightly higher on the pre-test, but the difference between the two participants groups was not significant at the .05 level (t=1.73, df=20). On the poststeadily sime test, the teletrained group's performance was significantly higher than the 4. Research face-to-face group (t=6.24, df=20).

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Student Acceptance of Courses and Instructors

All students attending courses at the AT&T Communications training center those complete a student reaction survey at the end of each class. The survey two categories: course relevance and design, and quality of instruction. Accept last item in each category is used as a general index of student satisfact. The items are: "Overall, I feel the course was effective." and "Overall A shor feel the instructor was effective." These two items were used to compare teletr student acceptance of the face-to-face and teletrained courses.

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During 1984, courses in the sales training curriculum were converted to te scale trained delivery. As the transition was being made to a teletrained delivering mode, the courses continued to be taught face-to-face. Modifications were programade in the design of the courses to adapt to the medium of teletraining; ration however, the course objectives and the instructors were the same for both in the face-to-face and teletrained versions of the courses. During the study period, a total 329 students attended 45 face-to-face classes, and 590 students attended 32 teletrained classes.

Significance tests for large-sample means were used to compare the data for all face-to-face classes with the teletrained scores for the second half of 1984. The teletrained classes from July through December were used becaus the courses were progressively being converted to teletrained delivery dur the first half of the year. The results of these analyses are shown in Figures 2 and 3. No significant differences at the .05 level of significat were found between the face-to-face and the teletrained classes on either course relevance and design or the quality of instruction categories. Th¹³

research supports the conclusion that students do not perceive a difference in effectiveness between courses delivered in a teletrained delivery mode and .ning center: those delivered in more traditional face-to-face classes.

The survey b

nstruction. Acceptance of National Teletraining Network Programs

nd "Overall: A short questionnaire was used to evaluate the effectiveness of the one-hour to compare teletraining programs offered to the sales force via the National Teletraining . Network. The most important item on the questionnaire was: "I would partici-

pate in future teletraining courses." This item was measured on a five-point verted to telescale and was used as an indicator of student acceptance of these programs. ained delive Figure 4 shows the results on this item for the first three quarters of NTN eations were programming. The percent agreement with the statement, as indicated by a letraining; rating of 4 or 5, was 88.7% in the fourth quarter of 1983, and rose to 91.6% in the second quarter of 1984. Similarly, the percent unwilling to particihe study and 590 results were uniformly positive across the 5,530 students who participated in the programs, the use of the form was discontinued in the third quarter of 1984 to reduce administrative costs.

the data for cond half of used because elivery duri shown in f significant Student acceptance of the one-hour teletrained programs began high and increased with time. Today, these short programs are an integral part of the training delivery system. The teletraining seminars are a primary vehicle for introducing new applications and for keeping the field sales people up-to-date on important issues and services.

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The research done at Sales and Marketing Education during 1984 focused demonstrating that teletraining is an effective training medium as measu student learning and acceptance. The results of the studies presented y strongly support the conclusion that teletraining is a viable instruction delivery mode.

COST BENEFITS OF TELETRAINING

The National Teletraining Network produced significant cost benefits for Communications in 1984. Major savings were realized for both the multipl courses and the one-hour seminar programs delivered via the NTN. The sav resulted from travel costs and productivity-related costs that were avoid using the teletraining medium. The information presented here substantia the fact that teletraining is a cost-effective alternative to face-to-fac delivery of training.

Savings from Teletrained Courses

In computing the cost benefits for the courses delivered via teletraining assumption was made that students would have had to travel to Sales and M keting Education in Cincinnati to received this training if teletraining w not an alternative. During 1984, 590 students attended teletrained session of courses in the sales training curriculum. An average round-trip airfar \$400 and a per diem of \$90 per day for lodging and daily expenses resulted a total cost avoidance per student of \$670 per course. The average course length was 2.6 days. The total savings for 590 students was \$395,300.

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34 focused on the cost avoidance from not traveling is offset somewhat by the line and bridge charges associated with teletraining. A typical teletrained course at presented to sales and Marketing Education had one "home site" and two remote sites. This instruction configuration incurred charges for six lines (one audio and one audiographic for each location), and six ports on the bridge (two for each location). Bridging costs were based on the AT&T Communication's ALLIANCE* Teleconferencing Services. Equipment and other capital investments were not considered in these calculations since existing equipment was used; only operating expenses enefits for a ware included. Using these assumptions, the total network charges for the 57 the multiply teletrained sessions was \$197,448. Subtracting these network teletraining N. The save charges from the cost avoidance figure produced a net savings of \$197,852, or were avoide \$335 per student.

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face-to-face Travel cost avoidance was only part of the actual savings realized from teletraining. Employee productivity savings needed to be factored into the computations: that is, the reemployment of non-productive time spend traveling, waiting in airports, and catching up once back at the home location. Assuming the average non-productive time was six hours per student, then the total lost-time expense for 590 students was \$84,960, or \$144 per student. Adding eletraining. this savings to the earlier travel cost figure of \$335 per student produced a ales and Man total net cost avoidance of \$479 per student. .etraining w

This data supports the assertion that teletraining is clearly a cost-effective trip airfant way to deliver courses. The benefits included both direct travel expense es resulted. avoidance, and increased productivity resulting from reduced no productive rage course time. 95,300.

*A service mark of AT&T.

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Savings from Programs

Similar calculations were performed to determine the cost avoidance for the programs presented via the Network. The following two assumptions were may doing these calculations. First, students from the 130 field locations were not travel to the Sales and Marketing Education Center in Cincinnati to per cipate in a 60-minute training session; therefore, each presenter would he to travel to approximately 25 major sites to deliver the training. Second students would utilize ground transportation from local or remote location we attend a training session in one of the 25 locations.

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If each presenter had traveled to 25 locations costs incurred would have si \$90 for local expenses and \$400 for airfare; the travel cost for each pres ter would have been \$12,250. For the 44 programs presented in 1984, the s cost avoided was \$539,000.

The cost benefit analysis for the seminar programs also accounts for the seminar programs of the long distance calls placed to Cincinnati by each of the remote loss 1 tions was \$83,028. These programs did not use any interactive graphic devices; therefore, only one telephone circuit was required for each rescue location. Since a meet-me premises bridge located at Sales and Marketing 1 Education was used, no additional bridging charges were incurred. The expenses incurred for the reproduction of visuals used for the programs di 1984 was \$38,754. The total cost avoidance for the 1984 National Teletral Network programs was \$417,218, a net savings of \$9,482 per program.

The cost-benefit calculations indicate that the National Teletraining Network is a cost effective method for providing update training for AT&T Communications. Benefits of the NTN in addition to cost-effectiveness include: the ability of this medium to reach remote, low density locations which are too difficult and time consuming to reach through conventional travel arrangebocations we ments; the ability to add multiple locations to a training session when nnati to proveded; the flexibility to increase the number of students who can be reached er would have at one time; the ability to quickly disseminate information to an entire sales ng. Second force; and the ability to share limited instructor resources. Without the te location with, much of the current update training would not be attempted due to various

constraints. Perhaps the chief benefit of the National Teletraining Network's programs is that it provides training to field sales people, where they need ould have b it and when they need it to remain current in a competitive environment. r each pres

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CONCLUSION

The National Teletraining Network has had a positive impact on the field sales s for the c force within AT&T Communications in three major areas. First, sales profesork. The c sionals have had an opportunity to keep current and to increase their knowremote loci ledge base of products and services in a very timely manner. Studies conductgraphic ed within AT&T Communications have shown that teletraining is a viable means each remote of learning technical information and sales skills. Second, student accep-Marketing tance of the National Teletraining Network's programs and the teletrained d. The courses has been outstanding. Students indicate that teletraining is a viable programs dr medium for delivering content which addresses sales skills and technical information. Third, the National Teletraining Network's weekly programs and teletrained courses have been proven as very cost-effective alternatives to traditional delivery channels for professional sales and marketing education.





FIGURE 2

STUDENT ACCEPTANCE OF COURSES

	Teletrained'	Face-to-Face"
Sessions	32	45
Mean	4.03	4.18
Standard Deviation	.42	.42
No significant difference (z=1.52, df=75, p=.06)		

e July - December 1984

= = All of 1984

FIGURE 3

STUDENT ACCEPTANCE OF

	Teletrained'	Face-to-Face"
Sessions	32	45
Mean	4.54	4.57
Standard Deviation	.27	.31
No significant difference (22,45, df275, p2,33)		

July - December, 1984 # # All of 1984

FIGURE 4





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TITLE: A COMPARISON OF THE EFFECTS OF LOGO USE AND TEACHER-DIRECTED PROBLEM-SOLVING INSTRUCTION ON THE PROBLEM-SOLVING SKILLS, ACHIEVEMENT, AND ATTITUDES OF LOW, AVERAGE, AND HIGH ACHIEVING JUNIOR HIGH SCHOOL LEARNERS

AUTHOR: DAVID W. DALTON

A Comparison of the Effects of LOGO Use and Teacher-Directed Problem-Solving Instruction on the Problem-Solving Skills, Achievement, and Attitudes of Low, Average, and High Achieving Junior High School Learners

by

David W. Dalton Instructional Systems Technology School of Education Indiana University Bloomington, Indiana

Running head: The Efficacy of LOGO

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Abstract

With the advent of basic skills curricula throughout the United States, many educators have become increasingly concerned with an apparent lack of emphasis on higher-level thinking skills, specifically, problem-solving skills.

To address this concern, many school districts and individual teachers have adopted the use of the LOGO programming language to teach problem-solving skills. The many assertions regarding the efficacy of LOGO in improving learner achievement, attitude, and problem-solving skills made by the proponents of LOGO have made LOGO seem ideally suited for classroom application. Unfortunately, many of these assertions have yet to be tested empirically.

In this study, the effects of LOGO use were compared with a program that provides instruction in problem-solving strategies, as well as with a control group, using six dependent measures, two on each of the following constructs: achievement, attitude, and problem-solving skills.

The results of the study indicate that neither LOGO nor the Problem-Solving treatments produced significant improvement in basic skills proficiency or general attitudes. However, both LOGO and the Problem-Solving group were successful in improving learner attitudes related to mathematics.

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In addition, the Problem-Solving group scored significantly higher on both measures of problem-solving skills than did the LOGO group, demonstrating that the benefits of LOGO may not transfer beyond the LOGO environment.

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A Comparison of the Effects of LOGO Use and Teacher-Directed Problem-Solving Instruction on the Problem-Solving Skills, Achievement, and Attitudes of Low, Average, and High Achieving Junior High School Learners

There is considerable evidence to suggest that computer-assisted instruction (CAI) is a highly effective mode of delivery for instruction in a wide variety of instructional settings (Kulik, 1983).

Yet, Papert (1980), the creator of the LOGO programming language and author of the controversial text <u>Mindstorms</u>, argues that CAI is not an appropriate use of the microcomputer. Papert argues that CAI does not allow the learner to control the learning, so the learning content becomes separated from the child's reality, and hence, insignificant.

Papert believes that LOGO's turtle geometry is an ideal vehicle for teaching problem-solving skills. It is Papert's contention that children are able to "relate to the turtle," and that learning becomes more concrete and hence, easier and more relevant. Because the learning is more relevant, Papert and other proponents of LOGO (Lawler, 1980; Watt, 1982) believe that LOGO use leads to improved

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learner attitudes. In addition, because the learner is able to articulate his/her thinking, they assert that LOGO has meta-cognitive benefits that enable the learners to improve their performance with basic skills and transfer newly acquired problem-solving skills to new learning situations.

On the other hand, other authors have noted what they feel is a lack of applicability of the LOGO language in the framework of the traditional public school curriculum (Steffin, 1983).

Although it has been used and tested extensively at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology since the late 1960s, LOGO is relatively new in the public school system, appearing in microcomputer form around 1980. Because of this late start, little research has been conducted on the efficacy of the LOGO language. Much of the writings concerning LOGO to date are very "soft" in nature, typically describing an author's experience in integrating LOGO into his/her classroom.

Until recently, the only empirical data available on LOGO had come only from the M.I.T. researchers themselves. Although these studies are objective in nature, many serious questions as to their external validity exist, especially considering much of this research has been conducted on large, main frame computers, rather than the microcomputers in use in the schools. Hence, to date, many of the propositions surrounding the use of LOGO and its benefits are

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Clearly, many questions concerning the efficacy of LOGO remain unanswered and more research is required. This study compared he effects of LOGO use with teacher-directed problem-solving instruction and conventional mathematics instruction on the problem-solving ability, basic skills achievement, and attitudes of junior high level learners.

Methods

Subjects

The subjects chosen for this study were 97 seventh grade learners, selected from five sections of a seventh grade mathematics course. Few of the learners in this sample had previous experience with LOGO and none of the learners had been exposed to the problem-solving strategies employed in the problem-solving treatment.

There was an approximately equal distribution of males and females in the group. The sample was composed primarily of Anglo students (n = 85) with only s small amount of minority students (n = 12).

Materials

Three instructional treatments were employed: a problemsolving strategies instructional treatment, a structured LOGO treatment, and a control.

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<u>Problem-Solving</u>. This treatment consisted of approximately 20 hours of instruction in problem-solving strategies. The lessons in this treatment consisted of self-contained, print-based worksheets, designed to function entirely as stand-alone instruction. The learners were given the appropriate worksheets and directed to work independently.

The lessons of this treatment focused on six problem-solving strategies: "Guess and Check," "Make a Table," "Patterns," "Make a Model," "Elimination," and "Simplify." Materials for all of the six strategies were adapted from <u>Teaching Problem-Solving Skills</u> (Dolan & Williamson, 1983).

LOGO. In this treatment, the learners were provided with approximately 20 hours of computer time in which to explore the turtle graphics capabilities of the Terrapin LOGO language on the Apple II microcomputer system. Each learner was provided with a lesson which contained a list of new commands and exercises which guided exploration of these commands. Each learner worked independently to complete the lesson. Each lesson also contained a difficult, culminating activity on which the learner focused after completion of the preliminary activities of the lesson.

Prior to the beginning of the study, all teachers involved were given a briefing on the type of intervention that should occur so that the types of suggestions given to the learners would be consistent

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across all groups.

<u>Control</u>, Learners in this group were given additional time for completing any school assignments and/or recreational reading. <u>Dependent Measures</u>

In addition to the three treatments described, the learners were assessed on their achievement, attitudes, and higher-level thinking skills.

Achievement Measures. There were two measures of achievement used in this study. The first of these measures was the district administered <u>Program Criterion Reference Test</u> (PCRT). This test is a measure of the student's mastery of the grade level objectives. The test contained 80 multiple choice items, four for each of the 20 objectives. Using data obtained from this study yielded a split-half reliability coefficient of 0.78.

The second achievement measure used in this study was mathematics subtests of the <u>Comprehensive Test of Basic Skills</u>. The split-half reliability coefficient for the combined scales was found to be 0.90, using data from this study.

Attitude Measures. Student attitude was also evaluated with two measures. The first of these two measures was the <u>Revised Math</u> <u>Attitude Scale</u>, a Likert-type questionnaire. Learners were asked to respond to 20 statements on a five part scale, ranging from "Strongly Agree" to "Strongly Disagree." The split-half reliability coefficient

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of the survey was found to be 0.93.

The second attitude scale used in this study was the <u>School</u> <u>Attitude Measure</u> (SAM). The SAM is also a Likert-type survey that contains 85 questions pertaining to attitudes toward school, teachers, and attitudes towards education in general. Data collected in this study indicated that the split-half reliability coefficient of the SAM was 0.78.

Prior to administering the attitude scales, the learners were assured that their responses would be judged "blindly," and that their annonymity would be protected. They were then encouraged to respond honestly to the scales' items.

<u>Problem-Solving Skills Measures</u>. Two measures of problemsolving skills were used in this study: the <u>Test of Cognitive Skills</u> (TCS) and the <u>Test of Non-Routine Problem-Solving Skills</u> (TNRPSS).

The TCS consists of four sections: "Memory," "Analogies," "Sequences," and "Verbal Reasoning." Data from this study yielded a split-half reliability coefficient of 0.88 for the TCS.

The <u>Test of Non-Routine Problem Solving Skills</u> was developed by this author in consultation with teachers familiar with teaching and assessing problem-solving skills. This scale consists of 20 items that measure non-routine problem solving skills. These problems are open-ended in nature with several possible solutions. The learner was able to select the solution strategy he/she wished to

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The final version of the TNRPSS was obtained by analyzing test-item data from an original pool of 85 items. The split-half reliability coefficient of the final version of the TNRPSS was found to be 0.76.

Procedure

Students in five seventh grade mathematics classes were systematically assigned to the three treatments previously described from the five class rosters.

Students were then designated as high, average, or low in prior achievement based on sixth grade CTBS scores.

Prior to the beginning of the study, the learners were informed that the treatment groups would be rotated after the initial assignments had been completed.

Each of the learners was then subjected to their respective treatments for two instructional periods, approximately 45 minutes each, per week over a period of two months, 20 sessions in all.

At the end of the experimental period, each learner was posttested on the dependent measures. The experimental data were analyzed as follows.

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Experimental Design and Data Analysis

Data from this study was analyzed through a fixed-effects ANOVA for each of the dependent measures. The design of the experiment was a 3 x 3, two-factor design, featuring three levels each of treatment group, LOGO, Problem-Solving, and Control, and prior achievement, High, Average, and Low.

Dependent measures included two measures of posttest achievement (the mathematics subtests of the <u>Comprehensive Test o</u> <u>Basic Skills</u> and the seventh grade <u>Program Criterion Referenced</u> <u>Test</u>), two measures of student attitude (the <u>School Attitude Measure</u> and the <u>Revised Math Attitude Scale</u>), and two measures of problem-solving skills (the <u>Test of Cognitive Skills</u> and the <u>Test of</u> <u>Non-Routine Problem-Solving Skills</u>).

Results

Test of Cognitive Skills

The cell means for the TCS are shown in Table 1. Both achievement level means and treatment group means were significantly different (p = .001) as shown in Table 2, the ANOVA for this result.

The Problem-Solving Group differed significantly from the Control, but not from the LOGO group, while the High group differed significantly from the Low group, but not the Average Group.

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Insert Tables 1 and 2 about here.

Test of Non-Routine Problem-Solving Skills

The cell means for the TNRPSS are listed in Table 3 and the ANOVA is found in Table 4. These means did not differ significantly (p = .05). However, the mean of the Problem-Solving group was significantly larger (p = .001) than the means of the Control and the LOGO groups, although the means of the LOGO and Control groups themselves did not differ significantly (p = .05).

Insert Tables 3 and 4 about here.

Comprehensive Test of Basic Skills

The cell means for the mathematics CTBS are given in Table 5. There was no signifificant treatment main effect (p = .05), as shown in the analysis of variance table, Table 6. However, the achievement means were significantly different (p = .001). Specifically, the High group scored significantly higher than either the Average or Low group. However, the means of the Average and Low groups were not significantly different (p = .05).

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Insert Tables 5 and 6 about here.

Program Criterion Referenced Test

The means for the achievement level groups were all significantly different for the PCRT (p = .001). However, there were no significant differences among the treatment group means (p = .05).

Insert Tables 7 and 8 about here.

Revised Math Attitude Scale

The cell means for the RMAS are given in Table 9 and the ANOVA is shown in Table 10. The means for the treatment groups were significantly different (p = .001). Both the LOGO and Problem-Solving group means were significantly greater than that of the Control group. However, the means of the Problem-Solving and LOGO groups themselves were not statistically different (p = .05).

In addition, the mean for the Low group differed significantly from the mean of the High group (p = .05). However, the means of the Low and Average groups did not differ significantly, nor did the means of the Average and High groups (p = .05).

In addition to these main effects, there was also a significant (p = .001) interaction between treatment and achievement. This

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interaction is plotted in Figure 1.

Insert Tables 9 and 10 and Figure 1 about here.

School Attitude Measure

Cell means for the SAM are given in Table 11. Neither treatment group means nor the achievement group means differed significantly (p = .05), as shown in Table 12, the ANOVA table for this measure.

Insert Tables 11 and 12 about here.

Discussion

There are three main results from this study that warrant further discussion and analysis. First, neither treatment group, LOGO or The Problem-Solving strategies group, demonstrated any improvement in basic skills achievement as the result of the experimental intervention.

Much of the research on mastery based instructional programs has supported the notion that the learner must actively become immersed in the knowledge or skill that is being learned for mastery to become a reality. In this study, no such intensive basic skills learning took place. Although this type of basic skills instruction is

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not the aim of LOGO there have been many assertions made as to the efficacy of LOGO in improving the basic skills achievement of learners. The results of this experiment indicate that neither LOGO, nor more conventional problem-solving instruction, produce improved learner achievement., principally due to the lack of focus on these skills.

Second, the Problem-Solving group scored significantly higher than did the Control or LOGO groupon both measures of problemsolving skills. In this case, learners given specific instruction in problem-solving strategies were able to apply this new knowledge to a variety of new problems, whereas learners subjected to a more general learning experience such as LOGO were not able to respond appropriately to new situations. This result again supports the body of conventional research that asserts that specific, well-designed instructional interventions can have positive impacts on learning outcomes. In addition, this result suggests that LOGO's "top-down" thinking model may not transfer to problems outside of the LOGO context.

Finally, although there were no significant results on the <u>School Attitude Measure</u>, there were highly significant differences on the <u>Revised Math Attitude Scale</u>. The SAM measures a variety of general attitudes towards school, teachers, and learning. These attitudes are influenced by years of development, as well as a variety

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of factors outside of the school itself. It may therefore be logical to conclude that a much more dramatic treatment must be employed over a longer time frame in order to produce significant changes in this type of evolved attitude trait.

However, learners in the LOGO and Problem-Solving groups scored significantly higher than their counterparts in the Control group on the <u>Revised Math Attitude Scale</u>. Yet, neither treatment, LOGO nor Problem-Solving, scored significantly better than the other. Both of these treatments represented something different from the normal classroom routine of these students. Therefore, it is likely that these improved attitudes are, in some part, attributable to a novelty effect.

Finally, the significant Achievement by Treatment interaction present with the RMAS indicates that Low learners in the LOGO and Problem-Solving groups scored far higher than High or Average level learners, while Average-level learners seemed to prefer the Problem-Solving treatment overall, while High learners responded favorably only to the LOGO treatment.

These results, coupled with observations made during data collection indicate that the novelty effect earlier mentioned is most pronounced for the Low learners, who have generally been unsuccessful with conventional classroom instructional practices. It Is this type of student that Papert (1980) suggests is benefited most

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greatly by LOGO. However, the results from this study indicate that virtually <u>any</u> new intervention, especially one in which success comes quickly and easily, is likely to produce substantial improvements in the attitudes of low learners.

The favorable attitudes of Average-ability students toward the material in the Problem-Solving treatment may result from the fact that these materials were designed specifically for "average" learners. In addition, many of these learners have had a variety of computer experiences in previous math classes and in other content areas. Therefore, the novelty effect may have been less strong for these learners.

High learners also responded favorably to LOGO, but less favorably to the Problem-Solving treatment. This result is likely due to the materials of the Problem-Solving treatment were somewhat simplistic for their ability level. Observations indicated that high level learners often developed their own problems to solve in the LOGO environment. Solving this type of personal problem was undoubtedly more challenging and rewarding to these students.

In summary, the results of this study suggest that the problem-solving skills fostered through LOGO use may not transfer outside the context of LOGO, since LOGO apparently provides only a single algorithm which may not apply to many types of non-routine problems. In contrast, the problem-solving strategies taught as part

of the Problem-Solving treatment were highly effective in improving the problem-solving skills of these learners. Both the LOGO group and the Problem-Solving group demonstrated an improvement in attitudes related to mathematics instruction. This improvement was, in part, attributed to a novelty effect.

Neither treatment group demonstrated an improvement in more general attitudes or basic skills achievement. This lack of improvement was attributed to the lack of a specific focus on these two constructs. by the materials in these treatments. The results of this study suggest that specific, well designed interventions targeted at specific types of learning can be effective in producing improvements in these learnings. However, non-specific interventions such as LOGO may not be nearly as effective.

It should be noted that the LOGO treatment used in this study was only one of many possible applications of LOGO and it is possible that other applications of LOGO, over longer periods of time, would produce different results and more research with these applications should be conducted. However, based on the results of this study, LOGO does not produce the effects often suggested by its proponents.

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Table 1. Mean percent scores for the Test of Cognitive Skills (TCS).

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		Control	PS	LOGO	TOTAL
ethnic ucation		43.05	59.03	52.50	51.49
CREATING.	Low	(N=9)	(n=9)	(n=8)	(n=26)
solving	T	60.18	76.81	67.19	69.38
r-based	Average	(n=7)	(n=11)	(n=8)	(n=26)
iligence		74.75	78.58	75.62	76.04
tute of	High	(n=10)	(n=7)	(n=12)	(n=29)
owerful		59.85	71.34	66.61	66.01
A	TOTAL	(n=26)	(n=27)	(n=28)	(n=81)
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Table 2.	Fixed-effects	analysis	of	variance	for	the	Test of
	Cognitive Skill	s (TCS).					

SV	SS	df	MS	F
Treatment (T)	1217.21	2	608.60	7.22ª
Achievement (A)	5409.43	2	2704.72	32.08 ^b
ТА	305.77	4	76.44	0.91
s:TA	6070.32	72	84.31	

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^b p < .001

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Table 3. Mean percent scores for the Test of Non-Routine Problem-Solving Skills (TNRPSS).

10		Control	PS	LOGO	TOTAL
228	Townson	25.00	50.56	21.25	32.69
080	Low	(n=9)	(N=ð)	(n=8)	(n=26)
91		21.43	47.27	27.50	34.23
-18	Average	(n=7)	(n=11)	(n=8)	(n=26)
	GRAN ST	33.00	54.29	29.58	36.72
	High	(n=10)	(n=7)	(n=12)	(n=29)
		27.12	50.19	26.61	34.63
	TOTAL	(n=26)	(n=27)	(n=28)	(n=81)

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Table 4.	Fixed-effects	analysis	of	variance	for	the	Test of
	Non-Routine Pr	oblem-So	lvin	Skills (Th	RPS	5).	

SV	SS	df	MS	F
Treatment (T)	10388.95	2	5194.47	20.31ª
Achievement (A)	825.27	2	412.64	1.61
ТА	331.24	4	82.81	0.32
s:TA	18417.96	72	255.81	

a p < .001

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 Table 5.
 Mean percent scores for the mathematics Comprehensive

 Test of Basic Skills (CTBS).

	Control	PS	LOGO	TOTAL
	58.39	58.04	62.35	59.41
Low	(n=8)	(n=9)	(n=7)	(n=24)
	68.24	74.01	80.15	74.59
Average	(n=6)	(n=11)	(n=8)	(n=25)
	87.69	91.47	88.24	88.85
High	(n=13)	(n=8)	(n=10)	(n=31)
	74.68	73.87	78.40	75.55
TOTAL	(n=27)	(n=28)	(n=25)	(n=80)

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SV	SS	df	MS	F
Treatment (T)	266.07	2	133.03	0.71
Achievement (A)	8376.86	2	4188.43	22.43ª
ТА	270.26	4	67.57	0.36
s:TA	13256.39	- 71	212.09	

Table 6. Fixed-effects analysis of variance for the mathematics Comprehensive Test of Basic Skills (CTBS). .

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Table 7. Mean percent scores for the Program Criterion Referenced Test (PCRT).

	Control	PS	LOGO	TOTAL
	49.63	49.33	53.00	50.50
Low	(n=8)	(n=9)	(n=7)	(n=24)
	58.00	62.91	68.13	63.40
Average	(n=6)	(n=11)	(n=8)	(n=25)
	74.54	77.75	75.00	75.52
High	(n=13)	(n=8)	(n=10)	(n=31)
	63.48	62.79	66.64	71.01
TOTAL	(n=27)	(n=28)	(n=25)	(n=80)

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Table 8. Fixed-effects analysis of variance for the Program Tak Criterion Referenced Test (PCRT).

SV	SS	df	MS	F
Treatment (T)	665.87	2	332.94	1.91
Achievement (A)	16253.54	2	8126.77	46.73ª
ТА	1242.17	4	310.54	1.79
s:TA	12347.31	71	173.91	

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Mean percent scores for the Revised Math Attitude Scale Table 9. (RMAS).

F		Control	PS	LOGO	TOTAL
1.91	-	57.50	73.00	74.00	67.97
46.73a	Low	(n=10)	(n=10)	(n=9)	(n=29)
1.79	and the second	62.90	69.15	67.44	66.72
	Average	(n=10)	(n=13)	(n=9)	(n=32)
		62.08	61.22	68.69	64.31
	High	(n=13)	(n=9)	(n=13)	(n=35)
		60.94	68.13	69.87	69.22
	TOTAL	(n=33)	(n=32)	(n=31)	(n=96)
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Table 10. Fixed-effects analysis of variance for the <u>Revised Math</u> <u>Attitude Scale</u> (RMAS).

SV	SS	df	MS	F	-
Treatment (T)	1417.25	2	708.62	22.32ª	Low
Achievement (A)	208.01	2	104.00	3.28 ^b	-
TA	859.59	4	214.90	6.77 ^c	1251
s:TA	2761.64	87	31.74		Ave
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Table 11. Mean percent scores for the <u>School Attitude Measure</u> (SAM).

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	Control	PS	LOGO	TOTAL
	69.63	70.66	67.01	69.17
Low	(n=10)	(n=10)	(n=9)	(n=29)
	70.53	72.43	72.53	71.87
Average	(n=10)	(n=13)	(n=9)	(n=32)
	71.56	69.10	73.46	71.63
High	(n=13)	(n=9)	(n=13)	(n=35)
	70.66	70.94	71.32	70.97
TOTAL	(n=33)	(n=32)	(n=31)	(n=96)

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Table 12. Fixed-effects analysis of variance for the <u>School Attitude</u> <u>Measure</u> (SAM).

SV	SS	df	MS	F
Treatment (T)	30.24	2	15.12	0.02
Achievement (A)	1311.86	2	655.93	0.97
ТА	1914.78	4	478.69	0.71
s:TA	58673.83	87	674.41	9 14





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TITLE: THE EFFECTS OF UIDEO-ONLY, CAI ONLY, AND INTERACTIVE UIDEO INSTRUCTIONAL SYSTEMS ON LEARNER PERFORMANCE AND ATTITUDE: AN EXPLORATORY STUDY

AUTHORS: DAVID W. DALTON MICHAEL J. HANNAFIN

Interactive Vide

The Effects of Video-only, CAI only, and Interactive Video Instructional Systems on Learner Performance and Attitude: An Exploratory Study

by

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and

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Interactive Video

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The Effects of Video-only, CAI only, and Interactive Video Instructional Systems on Learner Performance and Attitude: An Exploratory Study

Computer-assisted instruction (CAI) has had beneficial effects on learner achievement in a wide variety of instructional settings. Research has shown that CAI not only improves learner achievement, at times by as much as 50%, but can also reduce the amount of time necessary to accomplish the same amount of learning (Kulik, 1983).

CAI has been effective with a wide variety of learners and in many different types of instructional settings (Charp, 1981). In addition, CAI has had positive effects on improving the affective outcomes of instruction, such as learner attitude and self-esteem (Dalton & Hannafin, 1985; Clement, 1981). The favorable attitudes of learners who participate in computer-assisted instructional programs have been attributed to the fact that the computer had infinite patience, never showed signs of anger or frustration, and left the learners with a general feeling of having learned "better."

Yet, despite the many instructional benefits associated with the use of CAI, there are many instructional situations in which CAI simply is not adequate (Martorella, 1983). For example, computer generated graphics are generally not capable of depicting intricate, visually-oriented instructional sequences, such as surgical

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procedures or flight training, with the realism that is required.

On the other hand, video images can present instruction with a realism that is not possible in CAI. However, although video-based instruction has been effective in many situations, the many instructional benefits of the typical CAI are lost (Russell, 1984) Since video-based instruction is generally non-interactive, the possibilities for individualized pacing, feedback, and reinforcement are greatly diminished.

Many authors note that video often becomes a passive instructional medium where learners do not actively participate a the learning and hence, simply "turn-off" to the instruction (Gendele & Gendele, 1984).

In the past decade, computer and video technologies have been merged to form a new promising media known as "interactive video." With this new technology, the learners are shown a segment of video instruction and asked questions about that segment by the computer The computer can then perform the same functions as it does in more conventional CAI: inputting and judging the learners' responses providing feedback and reinforcement, and record keeping.

The possibilities for improving CAI with video images throug interactive video instruction seem very promising. Current researd indicates that the variety of visual and auditory learning stimul present in interactive video can dramatically improve learning (Clark

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In addition, a recent study noted that the interactive nature of interactive video can not only improve short-range recall, but can also aide in retention (Schaffer & Hannafin, 1984). However, this study also demonstrated that excessive amounts of interactivity in interactive video do not appreciably effect performance or retention, but drastically impact the efficiency of the instruction presented.

Although the many assumptions made about interactive video make it seem ideally suited for many educational and training settings, there are many questions concerning the use of interactive video technology that have yet to be answered. This study compared the effects of interactive video instruction on learner performance and attitude, with conventional CAI and stand-alone video, in order to determine exactly what types of learning tasks best lend themselves to interactive video instruction

Materials_and_Methods

The 134 subjects for this study were selected from six introductory level junior high Industrial Arts Exploration classes. The basic learning consisted of a set of 27 General Shop Safety Rules. In general, each of the rules involved a visually-oriented task or behavior required of the learners. Three parallel forms of instruction were employed: Video-only, CAI only, and Interactive Video. The

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video-only lesson consisted of a 15 minute video presentation on the safe use of tools. Learners were shown a short narrated segment that depicted both an example and non-example of the correct behavior. The CAI-only lesson used the narrator's script as the basis of a tutorial lesson. The interactive video lesson combined the video segments from the video lesson with the tutorial from the CAI lesson.

Prior to the beginning of the study, the learners were designated as relatively high or low in prior achievement based on their sixth grade total <u>Comprehensive Test of Basic Skills</u> scores They were then randomly assigned to one of the three treatment groups described. At the conclusion of the lesson, the learners were given a print-based posttest, covering the rules that had been presented in the three treatments, and a survey to address their attitudes towards the instruction.

Design and Procedures

This study employed a completely crossed 3 x 2 x 2 treatment by achievement by sex factorial design, featuring 3 levels of treatment (video only, CAI only, and interactive video), and three levels of prior achievement (high, average, and low) based on CTBS scores. Dependent measures included one measure of performance and one measure of attitude toward instruction.

Posttest performance scores were analyzed with ANCOVA

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procedures, using prior achievement as the covariate. Attitude scores were analyzed with ANOVA procedures.

Findings

The means for the treatment groups on the performance measure were 64.98%, 73.54%, and 70.48% for the Video, CAI, and Interactive Video treatments, respectively. The means of all three groups were significantly different at the alpha = .05 level.

In order, the attitude scale means of the Video, CAI, and Interactive Video treatment groups were 75.07%, 74.26%, and 82.87%. The mean of the Interactive Video group was significantly higher than both the CAI and Video only groups at the alpha = .005 level. However, the means of the Video group and the CAI group were not statistically different.

In addition to the treatment main effect on the attitude scale, there was also a significant Achievement by Treatment Interaction.

Implications of the Study

There are three major findings from this study that warrant discussion: a) CAI alone tends to the the most effective instructional delivery system for the type of learning task chosen for this study, b) interactive video instruction produced significant improvements in learner attitudes when compared with CAI and Video alone, and c) the attitude effects observed in this study were not constant across prior achievement level.

It might be assumed that the interactive video treatment, by virtue of its video enhancements <u>and</u> individualization, would be the most effective in producing high levels of performance. However, this assumption was not supported by this study for two principal reasons. First, the interactive video equipment was very new to these students. Observations made during the lessons indicate that these learners were somewhat distracted by the various noises and indicator lights produced by the videotape players in this treatment. Second, the delays caused by long tape access times may have given the learners the opportunity to drift and not actively participate in the instruction. On the other hand, these learners were familiar with CAI lessons, so this media provided no such distractions and its more direct nature seemed to keep these learners more "on task."

Although the learners using the CAI lesson performed best, the interactive video lesson was successful in improving learner attitudes towards the instruction. This improvement in learner attitude may be the result of the more motivating nature of the "natural" video images or the immediate reinforcement provided by the computer (Bejar, 1982). Unfortunately, as noted earlier, the learners involved in this study had never used this kind of delivery system before. Therefore, the differences in observed attitudes may in part, be attributable to a novelty effect.

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est, the learner learner of the ided by er, the lelivery es may, However, the most important finding of this study is that the attitude differences observed varied across prior achievement level. Specifically, low ability students scored dispropotionately lower on the CAI lesson than low learners in the other treatment groups. What, then, could account for this strongly negative reaction to the CAI treatment by low ability learners?

In the school chosen to participate in this study, CAI has been used for approximately four years, primarily for remediating the basic skills deficiencies of low-ability learners. Perhaps CAI, when used only in a remedial capacity, can have the same stigmatizing effects often observed with low ability learners are placed in conventional "special" programs. The results of this study support the notion that a great deal of care is warranted in the use of CAI, and remedial programs in general, if these detrimetal effect are to be avoided.

In summary, the results of this study indicate that CAI can be a highly effective mode of instruction where the additional capabilities provided by interactive video are not required. In addition, both interactive video and CAI are more effective in producing high levels of performance than video only, substantially due to their ability to keep learners more actively participating in the learning. Finally, although CAI can be used to effectively improve learner attitude, like other types of instructional media, CAI can have deliterious effects

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on learner attitude if used in a manner where low ability learners feel demeaned or isolated because of their additional needs.

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Author notes

This manuscript is based in part on an article appearing in an upcoming issue of <u>Educational Technology</u> magazine.

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TITLE: WORD PROCESSING AND THE WRITING PROCESS: ENHANCEMENT OR DISTRACTION

AUTHORS: DAVID W. DALTON JAMES F. WATSON

WORD PROCESSING AND THE WRITING PROCESS: ENHANCEMENT OR DISTRACTION?

by

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RUNNING HEAD: Word processing

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Abstract

Although highly-designed, outcome-based computer-based instructional interventions have been successful in inproving the basic skills of learners in a wide variety of educational settings, little research has been conducted on more open-ended computer learning activities, such as word processing.

The present study examined the effects of a year-long word processing program on learners' hollistic writing skills. Learners were in the treatment group used a word processor three times per week to complete their writing assignments, while students in the control used conventional print-based writing techniques.

Results from this study suggest that word processing is especially effective for low ability students. However, there were several logistical problems related to access to the computers encountered during the study that may have prevented more dramatic results.

WORD PROCESSING AND THE WRITING PROCESS: ENHANCEMENT OR DISTRACTION?

Introduction

Highly-designed, outcome-based computer-assisted instruction (CAI) has been effective in a wide variety of instructional settings (Kulik, 1983). Yet, it has been suggested that the great potential benefits of instructional applications of computer-based technologies lie in more open-ended computer activities such as word processing, where the computer is used more as a learning tool than as an electronic tutor (Dudley-Marling, 1985).

Traditionally, writing skills have been taught by two distinct approaches: the reductive approach and the hollistic approach (Hartwell, 1985). In the reductive approach, writing is taught by focusing on discrete, often isolated mechanical skills, including punctuation, syntactical rules, etc.

The hollistic approach concentrates attention on the process of writing and largely neglects instruction in specific mechanics, the assumption being that if learners concentrate on the meaning and the production of the text as a whole, the mechanical skills will follow With this approach, learners are taught that the writing process consists of three distinct steps: pre-writing or planning, writing, and

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most importantly, revision (see Figure 1). This approach to writing instruction is now the most popular (Moffet, 1968).

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There is evidence to support the efficacy of the hollistic approach to writing instruction. In a study comparing the two :ion approaches, no significant differences were found in the writing ngs quality between treatment groups, leading the authors to conclude tial that the reductive approach, while leading to better mechanical ies skills, does not improve the overall quality of the writing product ng, (Meckel, 1963). In addition, it has been noted that the hollistic an approach can be especially effective in improving the writing skills of low-achieving learners, since these students tend to get ict bogged-down with the form, rather than the substance of the text ch (Rose, 1983). зy

In a recent review of the literature comparing the two approaches to writing instruction, it was noted that some authors found that mechanical approaches can often have deliterious effects on the overall quality of students' writing (Hartwell, 1985).

To date, computers have been used to support writing mechanics through the use of drill and practice and tutorial CAI. The RSVP project conducted in the Miami/Dade County schools found that this type of computer instruction did improve the learners'

mechanical skills, but had no discernable impact on the overall quality of their writing products. The "Writing to Read" project sponsored by IBM (Blum & Furlong, 1983) has also supported this lack of efficacy of the reductive approach.

The potential benefits of word processing technology in assisting learners within the hollistic approach, especially in the revision portion of the process, seem somewhat obvious. Yet, very little empirical study has been conducted to date. A recent study conducted with elementary students reported that the inclusion of word processors in the writing program produced significant improvements in the attitudes of the learners (Willer, 1985) Specifically, it was noted that the learners involved in the study had favorable attitudes towards the revision process when accomplished on the microcomputer and spent more time in the revision processors have been used with primary age learners (Phenix & Hannan, 1985)

Although the potential of word processing in aiding the writing process seems great with elementary learners, many questions as to the efficacy of this technology with other populations remain.

This study examined the effects of a year-long hollistic writing program that used word processing technology to aide learners in revising their writing on learners' writing skills.
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Methods

Subjects

The subjects of this study were 80 seventh grade students, drawn from four remedial language arts courses. Learners were placed in the remedial programs based on below-average sixth grade <u>Comprehensive Test of Basic Skills</u> (CTBS) scores and through the reccommendations of their sixth grade teachers. Although below-average in language skills, many of these learners possessed average to above-average skills in other content areas, such as mathematics and science.

Materials

Two treatments were employed: a word processing treatment and a conventional writing process treatment.

Word processing treatment. Over a period of one academic year, students in the word processing group completed all of their respective writing assignments on an Apple IIe microcomputer equipped with the <u>EreeWriter</u> word processing program. The <u>EreeWriter</u> program is a moderately powerful public domain word processing program which possesses editing features including the abilities to find and replace errors, move text blocks, and format documents on screen. Each student was furnished with their own word processing and data diskettes and provided with aproximately three instructional periods of computer time per week.

The students were given two weekly writing exercises to

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complete on the word processor. This exercises included developing fictional short stories, writing letters, and expository prose. These exercises typically required the learner to produce between one and two pages of text each. In addition to the writing exercises, the students completed four major written papers. The students were given a general topic and asked to produce a final printed document of between three and five pages.

<u>Conventional writing program</u>. Students in the conventional writing program used pen-and-paper methods to complete the same types of writing activities.

Procedure

Prior to the beginning of the study, the learners were designated as relatively high or low in prior writing achievement based on results of a writing pretest.

The learners were then assigned to their relative treatment groups were they completed

At the conclusion of the study, the learners were given a standardized writing test, which was scored by three independent. "blind" examiners. The evaluations of each of the three examiners was combined to form a combined score.

These writing samples were evaluated by each examiner on the following five criteria: structure and organization, correct usage of the parts speech, punctuation, capitalization, and spelling.

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Experimental Design and Data Analysis

The design of this study was a 2 x 2 completely crossed treatment by achievement factorial design, featuring two levels of treatment (word processing and conventional writing), and two levels of prior achievement (high and low).

posttest writing sample scores were analyzed with ANOVA procedures.

Results

The percent cell means for the writing sample are given in Table 1. Overall, the mean of the relatively high achieving learners was 77.56%, while the mean of the relatively low achieveing learners was 71.06%. These means were significantly different at the p = .01level as shown in Table 2, the analysis of variance table for this result.

Insert Tables 1 and 2 about here.

The mean for the word processing group was 75.69%, while the mean of the conventional writing group was 72.94%. These means were not significantly different. However, there was a significant (p = .10) Achievement by Treatment Interaction. This interaction is depicted graphically in Figure 2.

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Discussion

There are two results from this study that warrant further discussion. First, there was a significant achievement by treatment interaction. This interaction indicates that the relatively low achieving learners scored significantly better if they used the word processing treatment than low learners in the conventional.

This result supports much of the previous research that suggests that the writing skills of low achieving learners and other special populations can be greatly benefited by word processing technology even though other types of "special" interventions have had little effect.

In addition, this result and observations made during the study support the notion that word processing can make the revision process more facile and less frustrating for these learners. Specifically, the teachers involved in this study noted that the learners using the word processor required less encouragement to revise drafts of their writing assignments and generally spent more time in thr revision process than their counterparts using pencil and paper methods.

Interviews conducted with learners in this study suggest that the word processor made the writing process more pleasant because

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correcting errors was simplified and the computer eliminated much of the physical discomfort with which many of these learners have associated the writing act.

However, it should be noted that there was no treatment main effect observed in this study. Specifically, word processing was not effective for the relatively high ability students. Observations conducted during the study and interviews conducted at the conclusion of the study indicate that this lack of efficacy was the result of two main factors.

First, many students had significant trouble in keyboarding. Learners at this age level have been exposed to little formal typing instruction. As a result, they spend an inordinately large amount of time "hunting" about the keyboard before the can "peck" a key. Many learners stated that they found this task excessively time consuming and distracting when compared with pencil and paper writing. In fact, several noted that typing problems effectively interrupted their concentration while writing.

The second major problem with the word processing treatment was the disruptive nature of the accessing the hardware necessary. In this school environment, all of the school's computers are grouped into two laboratories. Although ready access was not a problem during the period of time required for the study, each trip to the computer lab seemed to be a "mini field-trip."

Several students stated that they preferred remaining in class

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working, rather than the disruption of relocating in the computer lab In addition, other students said that they often purposefully wasted time during the required transitional periods.

Finally, several students in the word processing group noted that they often neglected the careful planning that they would have ordinarily performed prior to actually composing the draft. The attributed this neglect to their impression that the word processor simplified editing to such an extent that planning was no longer as important as it had been with conventional paper and pencil writing One student noted that the consequences of poor planning while using the word processor were not a severe since "with computer, so what if you have to start over?"

Although this study demonstrated that word processing has the potential to provide an instructional environment that can be beneficial to the writing skills of low achieving learners, several important questions remain and further research should be conducted

Future studies should investigate three issues concerning the instructional uses of word processing. First, an appropriate mode of providing basic keyboarding skills should be investigated. Perhaps an introductory module on keyboarding should be provided to all the students in a manner analguous to basic handwriting skills. Clearly, the lack of these skills is a serious impediment to developing writing skills with the word processor.

Second, varied hardware configurations should be examined in

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order to find the basing mode in which the type of distractions observed in this study might be minimized. For example, potential solutions including using a dedicated computer classroom should be investigated. In any event, the disruptive arrangements encountered during this studied should be minimized to the extent possible.

Finally, future studies should determine ways in which outlining and other pre-writing activities can be emphasized, along with the re-writing and editing phases of the writing process. There are several relatively new computer-assisted project planning programs that are available. Perhaps such a package might provide a suitable method with which planning skills might be developed.

In summary, the results of this study suggest that, with the exception of several significant logistical problems associated with the implementation of the computers themselves, word processing technology, because of its ability to greatly simplify the re-writing phase, may provide the ideal medium for the development of hollistic writing skills for many learners.

Tab

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ad project Control Word Processing TOTAL id writing x = 77.13 X = 78.00 X = 77.56 1er, 38(4), s = 10.10 s = 8.85 s = 9.35 High (n = 32) (n = 16) (n = 16) aching of X = 74.25 X = 67.88 X = 71.06 iter-based s = 7.86 s = 7.71 s = 8.32 LOW (n = 16) (n = 16) (n = 32) iterature. Chicago: X = 75.69 X = 72.94 X = 74.31 s = 9.02 s = 9.65 s = 9.37 TOTAL Inciculum. (n = 32) (n = 32) (n = 64) inade one

Table 1. Writing sample cell means in percent.

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Source	SS	df	MS	F
Achievement (A)	676	1	676	8.96 ^a
Treatment (T)	121	1	121	1.60
AxT	210.25	1	210.25	2.79 ^b
Within (error)	4527.50	60	75.46	

Table 2. Analysis of variance for the writing sample.

a.001 < p < .01

b.05 < p < .10

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Figure Captions

Figure 1. The writing process including pre-writing, writing, and re-writing.

Achievement by Treatment Interaction for the writing sample.

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8.96a

1.60

2.79b

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Figure 2





TITLE: A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

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A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

1986 AECT Annual Conference Las Vegas, Nevada Jan.17,1986

Research and Theory Division and The Division of Telecommunications

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A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Abstract

For the past 40 years television has been primarily delivered by a limiting IER EDUCATING proadcasting medium. The steady establishment of cable television nin communities, recent technological developments in cable carrying

acity, and the loosening of FCC regulations have all fostered the potential rapid cable growth and utilization. With increasing market penetration, colleges and universities have or will affiliate with local or regional is systems providing a mutually beneficial relationship for training, oranning, and public access.

The purpose of the presentation will be to report upon a selective and survey which focused upon documenting and identifying operational miens these affiliated stations are having in accomplishing their respective sions. Results from the study will help in providing an understanding of the ment range of operations and assist other colleges and universities to mine this option in television and education.

The primary areas of interest consisted of station: (1) organization; (2) get; (3) personnel; and (4) equipment.

The paper will concentrate on the most significant problems identified the four primary areas of interest. The paper will also provide remendations that may be used by higher education institutions that are midaring developing a cable facility and those existing facilities looking ways to improve. 120-1

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A COMPREHENSIVE STUDY OF THE OPERATIONAL PROBLEMS OF HIGHER EDUCAT AFFILIATED CABLE TELEVISION STATIONS

Background

contr For the past 40 years, television has been primarily a broadcasting azjer i Signals were transmitted from antennas located on towers and picked up antennas. This system limits the amount of channels that can be broadcast to overlapping and interference. Nearly one-half of the U.S. television audience cannot receive more than six broadcast channels; many receive the picture quality is inferior on many of the channels (Smith, 1979).

licipa However, cable television has the potential to end the scarcity of a iste channels. Many existing cable systems carry 20 television channels and a a cabie to 40 (Williams, 1982). Fiber optics developed at Bell Research Labs nut the fin possible a greatly increased channel capacity, numbering into the thousand channels (Bittner, 1981).

Further cable growth has been fostered by the elimination of some some regulations in 1978 by the courts (Levenson, 1980). Estimates of cable material are that 50% of about 95 million projected households in 1995 will be pure cable services. In the early 1980's, cable penetration is a little over 77 million households (Williams, 1982). rsit

Many colleges and universities have television studios and often the The . · affiliated with local cable systems. These studios have several purposes Th the most important being the instruction and training of students. However, 1015 many of these studios also provide public access for the community to the The. ty-si cable company's channels. A study is needed to determine what problems to studios are having in accomplishing their mission. Such a study would be 8 00.8 A 51 in providing an understanding of the services available and assisting other tinuin colleges to examine the option in television and education.

Purpose

508-0 This study will focus on examining college and university affiliated stion television stations and the identification of their operational problems. The The purpose of this study is to present data on problems and concerns rural a college should consider before starting a cable affiliated station. hin ti There are four research questions that will be examined by the study burbi These questions will center around four areas; organization, budget, pers foool

beta What organizational concerns can be identified in college and universal cable affiliated stations? 89151

and equipment. The four research questions to be answered are:

- 2. What budget concerns can be identified in college/university cable affiliated stations?
- з. What personnel concerns can be identified in college and university affiliated stations?
- illat What equipment concerns can be identified in college/university cable ad to affiliated stations? iliat

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Himety-two directors or chief executives of higher education affiliated stations were surveyed. A developed questionnaire consisting of over 100 initial variables, clustered under the four primary areas of interest, served controlled protocol for the 20 to 30 minutes in-depth telephone interviews. autority of the questions requested a reaction to a statement along a incontinuum scale. The protocol also provided the opportunity for adcasting rended commentary which was later synthesized given identified patterns. cked up by e broadcass The consuming method of telephone interviews proved invaluable, resulting elevision

receive les mornation not readily attainable through other research methods. The 100% ricipation, frankness, and enthusiastic support of this research effort by 1979). interviewed became rapidily apparent given the unique focus of this survey rcity of nels and som cuble systems alone. For an indepth report on the methodology and a copy h Labs nake the final questionnaire used in this study see Dudt and Lamberski, 1986. he thousand

Analyses of Demographic Information

of cable gra The survey gathered information from 87 college- and university- affiliated ill be purch. ttle over 2 10 stations across the United States. There were 23 private colleges and mersities and 64 public colleges and universities.

often they. The size of the institutions of higher education surveyed varied a great 1 purposes at. The smallest college had an undergraduate student enrollment of 780 ts. However dests and the largest university had 65,000 undergraduate students. ity to the ... The graduate enrollments of the surveyed institutions varied also. problems the morsix of the colleges/universities did not offer graduate education at all y would be a lie one university had 10,000 graduate students.

A slight majority of the colleges and universities surveyed had ongoing isting other Ringing education programs, 46 or 52.9%. However, there were 37 institutions housed cable facilities that could not answer the question. These ctors did not know if their institution provided continuing education. buring the discussion on continuing education (non-credit adult education) the directors, it was noted that only one director was using the station non-credit adult education. The 37 directors that did not answer the affiliated u

stion were totally unaware of their institutions efforts in this area. problems. The institutions were divided into three demographic areas; urban, suburban nd concerns teral. An urban institution was defined as an institution that was located ation. min the city limits of a major metropolitan center of 50,000 or more people. the study. burban institution was located within a one-hour drive of a major dget, person

ropolitan center, a rural institution was more than a one-hour drive from a metropolitan center. The majority of the institutions, 49 or 56.3%, were nd university There is a great variation in the age of the higher education affiliated. There is a great variation in the age of the higher education affiliated

evision stations; one station was founded in 1957 and the late in 1984. "" was a growth throughout the 1960's and 1970's with continual but slower wh in the 1980's.

Thirteen facility directors were unable to establish when their stations an, Several of the directors were new to their positions and some said that iversity Te had been so much staff turnover over the years that the date had been

Generally, it takes four years once a station has been founded to become sity cable iliated with a cable company. The earliest date for cable affiliation was nd to be 1966, according to the directors surveyed, with the latest filiation being January of 1985. There were only four directors that were

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unable to identify when their stations became affiliated with the cable

Programming of the vast majority (97%) of the higher education affin cable stations is part of the basic cable fee. In other words, individual within the community receiving cable do not generally have to pay extra the the college's/university's cable station. There were only six colleges/universities whose programming was not included within the basic fee.

The basic cable fee varied for \$5 to \$23 for cable service (all dolle at call figures were rounded to the nearest dollar). Twenty-five of the directory eter 28.7% did not know what the basic cable fee was in the community where the receip programming was presented to the public. It is important to note that not equil programming developed by a college/university is presented on the local to 1f there was no local cable company, often the programs were carried by a nigh company in another town or city. This helps explain why the directors were hare unfamiliar with the price system of the cable company.

There were only six surveyed facilities that had programming whose a gram were not included in the basic cable fee. Only one director Knew what is cab additional fee was for his programming. His cable company's basic fee us gram to get the pay television channel that carried the facility's programming. Ho other five directors had their programming on pay television channels but ctio not know what the consumer's fee was to obtain the programming.

The population of the communities that could potentially receive the Un surveyed facilities programming varied greatly, ranging from the smallest the to the largest at 1.5 million. There were 22 directors that did not know a accurately their community's population.

A large majority of the directors (72.4%) did not know how many house were getting cable and could receive their facility's programming. The a directors that did know generally how many households could receive their programming gave a large range from 200 households to 170,000 households.

Analyses of Station-related Problems

"What organizational concerns can be identified?"

Problems areas in instructional programming, reporting relationships from company relationships and public access were explored.

The most serious problem faced by the directors in providing instruct of programming was inadequate funding. Some of this problem was caused by the and general lack of funds in higher education, but there was also a lack of the dir and administrative support for the effort in some schools. Several direct Ma related that their administration wanted the instructional programming but lo unwilling or unable to fund the efforts at the proper level. Each direct day stated that within the colleges and universities there was a minority conf faculty members that were against televised instruction. It is interesting note that nowhere did unions provide insurmountable problems in providing at 1 televised instruction or telecourses.

Although the college/university administrators gave lip service to supporting the station's programming, they did not back this up with monthit equipment and personnel. This was a serious problem for the directors.

Almost all of the stations had a four-year period of growth and add before they became affiliated with a local cable company. This allowed from stabilization of staff and programming before cable casting was begun.

Although the stations had a variety of administrative models, there den generally few problems in day-to-day management. The chain of command and

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cable structure were not usually perceived as a problem. A few problems arose, n affil when the source of funding conflicted with the day-to-day workload. divide especially true when the station was attached to an academic department extra to the station received its funds directly from the administration instead of the department.

e basic Generally there were few problems in the higher education cable stations generally there were few problems in the higher education cable stations interesting with the cable company. Once the cable channel has been provided, interesting of the cable companies have a "hands-off" approach. There are two problems that irectors warned of: one -- do not share the channel with another programming here the rea and two -- do not rely on the cable company for upgrading or maintenance

that the equipment. local cales the sharing the channel with another programming source creates problems for local cales the sharing the channel with another programming source creates problems for ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have ad by a migher education station according to the directors and very few still have add by a might education station according to the directors and very few still have add by a might education station according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors and very few still have add by a might education according to the directors according to the directors according to the directors according

whose concerning is popular, several directors stated, then the local public asked what is cable company to provide more of the programming and less of the college's what is cable company to provide more of the programming and less of the college's fee was optiming. One college station lost its channel due to this problem. fee was optiming. Host of the higher education affiliated cable stations do no have a "amming. Host of the higher education affiliated cable stations do no have a "amming advisory board even though there is an advisory board "on paper." its but actioning advisory board even though there is an advisory board "on paper."

ive the Unless the higher education's affiliated station's programming is popular nallest, the community, the cable company will not upgrade equipment or provide any sallest, the community, the cable company will not upgrade equipment or provide any ot know the of maintenance. Most higher education directors do not have an equipment of know maintenance relationship with the cable company.

Providing public access to the community is not generally a problem for the The 24 ation. Most directors believed the benefits outweigh the problems. Public their cess affords an opportunity to provide realistic productions and programming their erience for students.

at budget concerns can be identified?"

Hany directors believed that the college/university administrations wanted e station to provide more services than they were willing or able to pay for. Using is a problem that some directors were unable to solve. The directors inships, lieved that they had a constant problem in educating the administration on the photost of television.

nstruct. Generally speaking, the cable companies have no, or relatively few, d by the bancial commitments to the station. The service that they most often provide K of familing and the transmission of the station's signal to the head end.

director Most of the higher education affiliated cable stations only cable cast on ing but plocal cable system. Only four higher education facilities had developed director stage with other cable companies.

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widing Mat personnel concerns can be identified?"

e to The largest problem that the directors faced was that they had too many h money ditional responsibilities besides the station's operations. Many directors ors. It also teaching faculty members and were given a one course teaching load d adjustification. Several directors stated that this was not enough of a reduced owed for aching load. Many directors also complained that there were not enough un. Difessional staff to oversee the work load and this created a heavy reliance on there we state. The reliance on students also caused some problems getting work done and and

Page

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in a professional and timely manner.

The heavy time demands placed on the directors also caused problem professional development. Several directors stated that they were not co in the latest developments in the television field. Care must be taken be colleges/universities to prevent this from happening.

"What equipment concerns can be identified?"

The biggest problem that the directors had was a lack of equipment, tionlarge number of students working at many of the stations created a need were equipment than the university expected. Common equipment components that needed were: remote equipment (switches, cameras, lights) and more editio geve facilities.

Important components were often missing and the quality was not at a world desired level for many directors. Often the colleges/universities bought all; equipment that they believed would minimally do the job. This equipment warch then prove incapable of providing the technical quality expected. There the c also a tendency to <u>not</u> buy new equipment soon enough and some directors we provusing equipment that was either worn out or outdated.

A lesser equipment problem that many directors faced was inadequate Purc physical plant. Little or no air conditioning, low ceilings or high noim dial levels from the studio were common problems.

Recommendations

This study provides information that may be used by higher education tion institutions that are considering developing a cable affiliated facility suctions those existing facilities looking for ways to improve. Recommendations 1- dents offer suggestions for planning and 5-10 suggest ways to developing the statements.

 A newly formed higher education facility should not immediately beca affiliated with a cable company. Most existing facilities took four year creation to cable affiliation. This time period allows the station stain develop procedures, personnel and gain production experience. This confirmer, with Zoglin (1981) who believes that a cable channel must be obtained bein higher education makes a commitment.

2. A higher education affiliated facility should have complete control me channel. This channel should carry only programs that are approved by the higher education institution. This action will ensure the station's propente does not compete with programming from other profesional sources. Higher popular commercial entertainment has caused at least two stations to low channel to higher rated programs when the general public asked the cable mens, for more entertainment.

3. Create a functional advisory board and use it to develop a clear misinton, statement. Clemens (1980) has developed clear purposes for the advisory Most existing stations do not use advisory boards for long-range planning help in solving the major problems. This involvement of the community caller, improve the public relations of the college (Clinton, 1981; Zoglin, 1981).

 Develop a close relationship with the college/university administration Many administrators do not understand the complexities of television and

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"oblem: this lack of understanding often causes a lack of support. Many "oblem: close also believed that their facility was not getting its fair share of " not close also college/university resources. This may also be due to a general taken along college/universibilities television offers (Carpenter-Huffman, Kletter 1971).

Involve other faculty members in the stations operations. This increased involve other faculty members in the stations operations. This increased palvement by higher education faculty benefits both the faculty and the solvement by higher education faculty benefits both the faculty and the solvement for public service (Clinton, 1981). The higher education station need to write by the energy and input of the faculty members. This would expand the

e editia Develop linkages with other nearby cable companies. This would expand the selence of the station and the college/university. Few of the facilities of at a veyed where programming on more than one cable system. According to Zoglin bought will, this might create tension with the cable company; however, this ipment searcher does not agree. Most cable companies do not have a large commitment There w the college cable station and its programming. This finding agrees with itors memor and Michell, (1971).

"quate Purchase the best quality equipment possible. The cable station will be on the noise dial with commercial stations and noticably poorer technical quality will the stations professional image. Audiences expect quality production noise, 1975; Turek, 1979) and the college/university must make this commitment be successful.

The college/university should hire a full-time director. Currently, the cation ation directors are forced to wear too many hats; teachers, administrators and ility a postion coordinators. This has led to staff turnover, a heavy reliance on ions 1- idents and inadequate ongoing professional staff development. Most directors the star now working on one half or one quarter release time from other duties.

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TITLE: A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

RUTHORS: KURT P. DUDT RICHARD J. LAMBERSKI

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A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

1986 AECT Annual Conference Las Vegas, Nevada Jan.21,1986

Research and Theory Division

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A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Abstract

The purpose of this paper is two fold. First, to present a developed modelogical approach for the study of cable television stations affiliated higher education institutions; and second, to present the significant engs detailing the operational problems of higher education affiliated cable evision stations.

The paper will highlight an extensive literature search and a resulting The paper will highlight an extensive literature search and a resulting restual framework utilized throughout the investigation. The literature rch helped identify over 100 variables. The conceptual framework developed atified and clustered critical issues of concern on the operations of cable resting stations. Variables were clustered under the four primary areas of rest: (1) organization; (2) budget; (3) personnel; and (4) equipment. A constructed questionnaire which addressed this conceptual framework

wided the guided protocol used during the 20 to 30 minute telephone terviews. Ninety-two directors or chief executives of higher education filiated cable stations were surveyed.

Internal and external validity of the questionnaire was controlled in part extensive pre-study screening by professional reviewers. Subsequent trument revisions allowed for a majority of questions to be presented as a tement to which a reaction along a value-continuum scale would be offered. Instrument also provided the opportunity for open-ended statements which re analyzed post-hoc given perceived patterns.

The investigators will identify strategies and techniques utilized in the elopment of the questionnaire protocol. The consuming telephone survey nod will be discussed in terms of results and impact not readily attainable rough other research methods.

Discussion of the research findings will focus upon the four major areas of terest. Data summaries will be presented concentrating on the most significant plans identified.

A METHODOLOGY IN STUDYING HIGHER EDUCATION AFFILIATED CABLE TELEVISION STATIONS

Background

For the past 40 years, television has been primarily a broadcasting. Signals were transmitted from antennas located on towers and picked up by #lectin antennas. This system limits the amount of channels that can be broadcast 1000to overlapping and interference. arned.

However, cable television has the potential to end the scarcity of refor (channels. Many existing cable systems carry 20 television channels and The atifle to 40 (Williamns, 1982). Fiber optics developed at Bell Research Labs name possible a greatly increased channel capacity, numbering into the thousand G. The channels (Bittner, 1981). Further cable growth has been fostered by the acces elimination of some FCC regulations in 1978 by the courts (Levenson, 198

26120 Many colleges and universities have television studios and often te catio affiliated with local cable systems. These studios have several purposes 121 the most important being the instruction and training of students. However ephon (many of these studios also provide public access for the community to the chano cable company's channels. A study is needed to determine what problems ticipi studios are having in accomplishing their mission. Such a study would be each (in providing an understanding of the services available and assisting one colleges to examine the option in television and education. ceduri

Purpose

This study will focus on examining college and university affiliate ontun television stations and the identification of their operational problems. the

The purpose of this study is to present data on problems and concern taine a college should consider before starting a cable affiliated station. teap

There are four research questions that will be examined by the study in c questions will center around four areas: organization; budget; personnel alway equipment. The four research questions to be answered are: eral.

- What organizational concerns can be identified in college and university 1. 4. E cable affiliated stations?
- 2. What budget concerns can be identified in college/university cable affiliated stations?
- ld ta What personnel concerns can be identified in college and university 3. concerns affiliated stations?
- 9425 4. What equipment concerns can be identified in college/university cable 2 500 affiliated stations? # sat

Me thodology

Content Analysis

The purpose of this study was to gather data on the operational prod

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and university affiliated cable television stations. Survey research stillized to gather the information as Babbie (1973) stated that survey at it useful in discovering the distribution of certain traits or A descriptive survey was used which of certain traits or march is A descriptive survey was used, which according to Isaac and Micheal (19), will collect data systematically to describe a situation or area of mest factually and accurately.

The method for data collection was telephone interviews. This method of succing data was chosen due to very poor response rate to the initial pilot padcasting But of 20 questionnaires distributed as a pilot test, only four were icked up by An alternative method of collecting data, telephone interviews, was be broadcas

refore selected. The total identifiable population was 92 directors. These facilities were

"ch Labs au matified from two sources: <u>TV Guide Almanac</u>; and the <u>Journalism Directory</u>

The following professional organizations were also contacted in an the thousand Br ed by the accessful effort to identify more facilities; Alpha Epsilon Rho; the I often they sociation of Educational Communications and Technology; the Broadcast I purposes scation Association; and the National Cable Television Association. It was also felt that the highest response rate would be obtained by its. However lightone interviews. This proved correct as 87 of the 92 directors that were ity to the problems to charge of facilities were interviewed. Thus, the response rate was 94.5%. y would be a sech director. isting other

cedures.

arcity of

Eighty-seven of the 92 directors of higher education affiliated cable ations across the United States were interviewed. Telephone interviews affiliated sortunity of immediate clarification. Station listings in <u>TV Guide Almanac</u> problems, is the Journalism Directory 1983 were useful in identifying facilities but nd concerns stained may errors when identifying the appropriate director. Some facilities ation. d temporary or revolving directors making it more difficult to identify who the study. Is in charge at the present time. The secretary that answered the telephone personnel; as always able to give accurately and quickly the director's name. Often veral telephone calls were necessary to establish an appointment to do the terview. id universit. The interviews were conducted during the months of November and December of

54. Each interview took an average of 20 minutes with a few taking as long as half hour .

' cable The interview took the following format. First, the interviewer would give me background information on the project and the purpose of the research. condly, the interviewer would explain the questionnaire and its format. This

wid take one or two minutes after which the interviewer would proceed through versity equestionnaire one question at a time until all the questions were completed. I directors were encouraged to volunteer infromation that was not covered by

* questions. Few took the opportunity to provide any additional comments as ity cable ist seemed to believe that the answer choices provided by the questionnaire re satisfactory as to scope.

strument Development

Before constructing the questionnaire, informational interviews and Kussions with various professionals associated with the cable television onal proble dustry and higher education were held. These discussions led to the

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development of a preliminary questionnaire that was validated by a team experts. The validators were each sent a draft of a questionnaire and an asked to respond to any inconsistencies or ommissions. There were also follow-up interviews with the validators that focused on criticisms of the instrument in order to more fully redefine the questionnaire.

The validations were chosen carefully in order to provide input that not only broad in scope but also specialized. All validators had a broad background in television, higher education and were able to bring unique that were neeeded to develop the questionnaire, The validations were also as a pilot test. This was helpful in perfecting the interview technique the other directors were interviewed.

Questionnaire

The survey questionnaire is divided into two parts; a copy of the conquestionnaire is provided in the Appendix. The first part helps identify demographic information about the cable station. The second part requests specific information concerning the station and related problems based up primary research questions.

Data Analysis

The data obtained from 87 completed interviews were coded and entered the SPSS (Statistical Package for the Social Sciences) program housed in Honeywell level 66 computer at the Indiana University of Pennsylvainia. The were 106 questions with 15,322 data points for this research project.

Several types of statistical data were obtained upon analysis. There frequency counts for all answers, adjusted for missing data. Occassionally there were questions that the directors were unable or unwilling to answer resulting in missing data.

Exploratory analysis of data revealed trends, identified problems, and exposed areas of further research.

Highlighted Findings

This investigation examined data obtained form telephone intervi. higher education affiliated cable television stations. The comprehences focused upon the primary areas of interest: I. Organization; II. Budget: Personnel; and, IV. Equipment.

The following outlined summary of the major findings is not presented rank order; rather, highlighted issues or statements are provided within primary areas of interest.

I. ORGANIZATIONAL PROBLEMS/STATEMENTS

a. The data indicates a consistent finding of inadequate funding brand colleges and universities. The areas of equipment and personnel were a typically cited.

b. Most local cable companies do not intervene in the day to day operations of the station.

c. Most affiliated stations do share the provided cable channel with another prgramming source. The affiliated station is the sole source bi programming for a provided channel.

d. Stations which have advisory boards perceive those boards as being

Page

2

nactive or having a low level of activity. Related to this finding, most station directors do not recognize a need for a more active board. Most station directors believe that providing or doing public access Most station benefits the overall operation of the cable station.
PROBLEMS/STATEMENTS
aducation administrators want and demand that the station
a. Higher educations than the administration is willing or able to provide
budgetary support for. b. Linkages with other cable systems, for programming acquisitions or for b. Linkages with other cable systems, for programming acquisitions or for program delivery, were not evident. Related to this finding, there appears to be a limited return on investment.
c. Dverwhelmingly, there does not seem to be a financial commitment from the cable company.
PERSONNEL PROBLEMS/STATEMENTS
a. Most station director's time is divided among other institutional responsibilities apart form direct station management. Related to this, most director's perceive that they are not given sufficient release time and station duties.
 b. Most stations are highly dependent upon student assistants. Given a predominantly student work force, programming and general studio work/tasks are not preformed in a timely or professionally consistant manner. c. There appears to be inadequate, ongoing, professional development for station directors.
EQUIPMENT PROBLEMS/STATEMENTS
a. The data revealed that there is a consistent pattern of overutilization of equipment and a general feeling of insufficient stock of equipment. This is especially evident given the numbers of students involved at most stations.
b. A consistent finding was the statement by station directors of the inadequacy of their current physical plant. This was particularly
technology.
c. Current equipment or projected patterns of equipment purchasing is
perceived to be below desired levels of quantity and particularly quality. d. There appears to be little or no strategic planning for equipment
update. In most cases equipment must be expensively maintained beyond its useful service life.

In summary, the findings indicate specific problems and issues which most sher education affiliated cable television stations must deal with. These unding by solims and issues appear consistent across different sponsoring institutions onnel were ad across station structure or size.

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A PROFILE ON CURRENT PROBLEMS OF

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New Jeru	COLLEGE AND UNIVERSITY CABLE AFFILIATED TELEVISION STATIONS
Education	of this questionnaire is to collect data on the status and problems of college and university and cable television stations.
burgh, ise	TO BE COMPLETING THIS QUESTIONNAIRE?
tional Pro	rector, coordinating to the college or university and the community.
for	THE RESTIONAIRE
ada, Jan.	The questionnaire is station. The second part requests some specific information concerning the station and num about the cable station. The second part requests some specific information concerning the station and replems. It also contains an opportunity for sharing some specifics not highlighted within this
an Diego,	It woeld be most beneficial if you answer all the questions and statements as best you can. You should
f Develop	information from you, but also to provide a common base of knowledge and sharing as you work through the
versity of	angurz.
1.1	strictPATION AND SHARING OF RESULTS
e Publicat	to receive a copy of the results (check)? Yes No
	If yrs, please print or type this identification information-
	(DrIHriHs) (First) (H.I.) (Last)
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	Address:
	Office Phone: () -
	1 - GENERAL DEMOGRAPHIC INFORMATION
	ete mame of college or university:
	e theck which is applicable about your institution: private public
	Dees your institution have continuing education (check):YesNo If yes: What is the appproximate enrollment
	<pre>ing or location characteristics of the institution. Check one- urban (within the city limits of a major metropolitian center, 50,000 people) suburban (within one hour driving distance of a major metropolitian center) rural (having no major metropolitian centers within a one hour driving distance)</pre>
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	Profile - Page 1 of 7
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5.Fill-i	n the requested information:	
	The year cable station was founded:	
	The year station became affiliated with a cable company:	
	Is your station programming part of the basic cable fee (check & answer)- YesYesNo	
	If yes, what is the total monthy fee paid by subscribers. \$	
	If no, what is the base monthy fee \$	
	and what is the additional fee for your station's programming. \$	
6.What i	s the number of cable subscribers that	
	-can receive your stations programming (potential):	
	-are receiving your stations programming (actual):	
7.Check	one of the appropriate statements on channel reception:	
	Your station is received on one of the first 12 primary channels.	
	Your station is received on a channel number greater than 13.	
8.List t	he professional organizations or associations that the television staff and or the st Please check: <u>Individ</u>	atio ual
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Profile - Page 2 of 7

	the of problem areas in instructional programming. Circle your feelings as to the signific
Des	a such your station. Add any comments for clarification of your responses
	Problems Street
Time!	ant in the
	sea serious problem
	a a 1 5 lack of or no faculty support
1	specify:
	a s 4 5 lack of or no administrative support
1	123 specify:
	a s 4 5 lack of or no community support
1	12 3 to enecify:
	a a 4 5 inability to do cable instructional programming due to unions
	123 snarify:
	and sinadequate funding for production of instructional programming
1	1234 Constity:
	- a a 4 5 Others
1	1234 J Duller
	Spectry.
1	1234 D Uners
	specity:
1	1234 5 Uthers
	specity:
	the the the reportion relationship of the station (clease sheck one).
hich be	At describes the the reporting relationship of the station opease check oner.
-	The station is dependent upon an academic unit but also has a wider.
	The station is attached to an academic unit but also has a wider
	institutional mission than classroom use alone.
	the station is an administrative unit of the institution.
1000	Other:
mets i	for clarification of your responses (optional-specify). And problem
	5=a serious problem
1	123451s it clear who assigns tasks?
	specify:
0	12345 Does the source of funding conflict with day to day workload?
	specify:
1	12345 is the chain of command clear?
100	SDeci fy:
-	12345 Other:
0	snari fv:
	12345 Other:
	Sper Levi
•	specify: 12345 Other:
• •	specify: 12345 Other:
	specify: 12345 Other:
	specify: 12345Other: specify:
	specify: 12345Other: specify:
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	specify: 12345Other:

6.Below is a list of relationship areas with the cable company. Circle your feeling as these problems given your particular station. Add any comments for clarification of your (optional-specify).

			-	1.1				
	0=	-no	i p	001	o l et			
					5	=a serious problem	1.0	
3	0	1	2	3 4	1 5	quality control of programming: specify:		
	0	1	2	3 4	1 5	upgrading of equipment specify:		1
	0	1	2	3 4	1 5	censoring of programming specify:		
	0	1	2	3 4	1 5	specification on amount of programming hours specify:		
	0	1	2	3 4	1 5	specification on times of scheduling specify:		
	0	1	2	3 4	1 5	other:specify:		 100
	0	1	2	3 (4 5	other:		100

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7. There are several issues regarding public access. By public access we mean the public ablue use the cable system to transmit programming (usually for a fee).

Do you provide public access.____Yes____No

8.Below is a list of problem areas that deal with public access. Circle your feeling as to m of these problems given your particular station. Add any comments for clarification of your (optional-specify).

	0=	'n	0	000	001	em 5=a serious problem
12	0	1	2	3	4	5 conflict of interest between the institution and cable company specify:
50	0	1	2	3	4	5 unprepared clients or users specify:
	0	1	2	3	4	5 overuse of facilities specify:
	0	1	2	3	4	5 other:specify:
	0	1	2	3	4	5 other:specify:

Section (B) - Discussion of the critical issues of the organization.

Respondent Generated:

From the above description items on organization and the issues generated by the investigation issues do you feel are significant given organizational considerations (optional).

ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

Section (A) - Description of the budget.

1.What is the station's estimated total operating budget in a given fiscal year (12 months): \$_____

Profile - Page 4 of 7

	indicate the percentage from each of the categories below, the source of these
	this total budget, marten
	Cameral College/University operating funds
3	General academic department operating funds
	y Special student fees
	2 Outside user fees including grants and or contracts
	* Endowment or alumni contributions
	X Other:
	2 Others
	100 X TOTAL
	list below, circle your opinion on those budgetary problems which are representative of your
	station. Add clarification statements if needed (optional-specify).
	amp problem
	5mg serious problem
	112345 lack of a commence of the administration
	spectry.
	specify:
-	#12345 station lacks a fair share of existing funds due to budgeting policies
	specify:
1	#12345 budget operations are dependent upon soft monies (grant & contract)
	specify:
	1 2 3 4 5 other:
	s r 2 2 4 5 other t
ł	specify:
1	1 1 2 3 4 5 other:
	specify:
の町の町の町ののの	staffing technical support equipment replacement other: other: Do any of the above commitments cause difficulties? Please explain-
	(d) - Discussion of the critical issues of budgeting.
	Stratish R.
	The above description
	a wor description items on budgeting and the issues generated by the investigator, what other is
	the second s
	are significant to consider under budget (optional).
	ter are significant to consider under budget (optional).
	ter are significant to consider under budget (optional).
	ter are significant to consider under budget (optional).
111111	ter are significant to consider under budget (optional).
	The significant to consider under budget (optional).
	The significant to consider under budget (optional).
11111	The significant to consider under budget (optional).
	The significant to consider under budget (optional).
	Profile = Proc 5 of 7
ORGANIZATION, BUDGET, PERSONNEL, AND EQUIPMENT

(eap) wh	ich (line	c+1	y report to you for the following categories:
ERLY MI	i ca i	F	TE	professional staff
	-	F	TE	oraduate students
		F	TE	undergraduate students
		Ē	TE	technical support staff
		_F	TE	other:
		F	TE	other:
	Could	d yo	u p	lease identify the personnel you have access to but
	repo	ts	to	another administrative or academic unit.
		_FT	Εo	other:
		_FT	Εo	other:
		_F1	Eo	other:
Earen A	the b	1.	11	ist plance identify the amount of input the following personnel have
.Prom t	fine o	riow		d as a neesse bauino no input
	a-bei	CE!	E.	fina creat deal of innut
_	0 1	2 3	4 5	S advisory board
	0 1	2 3	4 5	5 department chair or administrative head
	0 1	2 3	4 5	5 station manager
	0 1	2 3	4 5	5 university or college officials
	0 1	23	4'5	5 cable company
	0 1	23	4 5	5 other:
	0 1	23	4 5	5 other:
ersonne leeded (is a el pr (opti 0=no	pot oble onal pro	ent ms -sp ible	tial list of personnel problems you may be experiencing. Circle your open which are representative of your particular station. Add clarification of pecify). em 5ma serious problem
s.Below Dersonne Deeded (is a opti 0=no 0 1	pot oble onal pro	ent ms -sp ble 4 5	tial list of personnel problems you may be experiencing. Circle your opin which are representative of your particular station. Add clarification in pecify). em <u>5=a serious problem</u> 5 inactive advisory board
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ORGANIZATION	, BUDGET	PERSONNEL	AND	EQUIPMENT	
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MENT	the of equipment.
	- Description of statements to quantify and qualify your facilities. Check off the appropriate
	the ste single yes no state
I WORKINS	No -Does the station have a production studio?
2.0	YesNo -Does the station have color canability?
	Tes No -Does the station have remote equipment?
	145No -Does the station have edition canability?
	YesNO "Does the station have editing capability?
	back the personniate blanks in helping us to define your equipment.
	fill-in or check the appropriate branks in helping us to berne your equipment.
-	VLKS: UgantityPormats
	Audio console: les Ho
	File chain capabilities: Iommonnoun silves
	Character generator: rages of menory
	Cameras: Number of studio Number of remote
_	Time base corrector: TesNo
	mitching capabilities: res Ho
300 in 1	down attailer identify the equipment anothers that your station may have . Add
eve in the	the mission of your station, identity the equipment problems that your station may have. Hoo
	prification statements if needed coptional-specify).
	geno problem
	5=a serious problem
	#12345 important equipment components are missing from a desired system
	specity:
	#12345 quality of equipment is not at desirable level
	specity:
310	112345 more of existing equipment (quantity) is desirable
1.000	specify:
	\$1234 5 equipment is outdated
ication the	specity:
ICALINE SIL	11234 5 inadequate physical plant and facilities
	specify:
	#12345 inadequate maintenance of equipment
	specity:
	012345 other:
	specify:
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	specify:
	(D) - Nicessian Annual An
	to viscussion of the critical issues of equipment.
	Mithdayt Connected
	The shore does in the line of
	the source description items on equipment and the issues generated by the investigator, what other issues
	the significant to consider under equipment (optional).
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	AND THE REAL PROPERTY AND THE
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STAND C.

TITLE: SELECTING MEDIA FOR INSTRUCTION

AUTHOR: L. J. EUANS

Selecting Media for Instruction

L.J. Evans

Department of Educational Technology Arizona State University Tempe, AZ 85287

Running head: Selecting Media

Recordent's

Abstract

effects of instruction in using a formal media selection edure on the media selection choices made by novice muctional designers is examined. An informal intuitive ruction procedure is compared with instruction (information, tice, and feedback) using a formal media selection procedure loped by Reiser and Gagne (1983). Results indicate that loped by Reiser and Gagne (1983). Results indicate that so who use the media selection model make more correct sions than when they don't use the model. Also, students a do not use the model correctly, but the redundancy in the and the restricted choices available increase the solid that a correct choice will be made.

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Selecting Media for Instruction

read Most formal media selection procedures are designed to WI1 assist developers in the selection of the appropriate medium. giv use in a given instructional situation. Higgins and Reiser (1985) reported that subjects who read a review of the characteristics of media selection models (Reiser and Gagne, read 1982) and a description of how to use the Reiser and Gagne m iser i model for media selection were more likely to make media choice ne 5 which matched those of experienced instructional designers. icle However, because of the relatively low percentage of students 112 5 made correct media selections, the investigators questioned r ce asi adequacy of the orientation the students received to the media king. selection model. The current study presents students with uired additional information, practice and feedback in using the row ca as

Method

Subjects

t ear Twenty-nine male and female graduate students enrolled in in in media design course at Arizona Sate University during the fall dpuor semester, 1985, participated in the study. t th

Materials

Four of the media design problems developed by Higgins and Reiser (1985) were used in this study. The problems were write In descriptions of various instructional situations in which an Sci instructional presentation had to be developed. Each problem ervi involved a different content area, a different type of learning stu outcome, and a different instructional setting. The problems obler entitled Personnel Interviewing, Aircraft Instrument dent Comprehension, C.T. Scan, and Instructional Objectives, each sun title reflecting the subject matter of the instructional prog to be designed. Af

Each problem included information about the purpose of stu instruction and specific instructional objectives. The problems w also included descriptions of the instructional setting, the Der 1 intended audience, the media budget available, and the perl instructional functions of the media to be selected. cent

Each media selection problem had a designated "correct" mari medium for use in that situation. These correct media choice In were identified by two experienced instructional designers up sele the Reiser and Gagne media selection model. e th

Procedures

The participants selected media under two conditions: an intuitive condition and a formal media selection The C.T. Scan, Personnel Interviewing, and Aircraft dition. Comprehension problems were randomly assigned to the rement Comprehension problems were randomly assigned to the dents under the intuitive condition. Students were directed dents under the intuitive condition. Students were directed dents under the intuitive for their selection. No feedback read the problem, select the most appropriate media or medium, it to write a brief rationale for their selection. No feedback dium a given on the appropriateness of their media selection.

Ser pollowing the intuitive condition, students were instructed igne, read the review by Reiser and Gagne (1982) and the material by ine (1) ar and Gagne (1983) describing how to use the Reiser and choise media selection model. Students were directed to read the choise media selection model. Students were directed to make a irs. Icles during the next week and use the formal model to make a dents a selection for the Instructional Objectives problem. They ned to asked to record the step-by-step decisions they made while media ring through the model, and to record the amount of time the model to study the readings and use the model, and again he mode asked to write a brief rationale for their decision.

At the end of the week, the correct answer as well as the ionale behind its selection was discussed in class. Questions barding the use of the model were answered. At the end of ass, students were assigned to the C.T. Scan, Personnel terviewing, or Aircraft Instrument Comprehension problem, such led in it each student was systematically assigned a different problem i fall in the intuitive condition. They were instructed to work rough the problem as in the practice, and they were informed at this was one of six graded assignments that would be used to termine their course grade.

Results

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Writte In the intuitive condition, 36% of those students with the han and Scan problem and 55% of those with the Personnel blen terviewing problem made the correct media selection. None of Parning e students assigned the Aircraft Instrument Comprehension

lens woblem made the correct media selection. A total of 32% of the udents made the correct media selection decision. These data ach e summarized in Table 1.

After reading the materials and working through the media lection model with the Instructional Objectives problem, 55% of roblem use who made correct media selections. However, 56% of the operly. Seventeen percent of the students used the model operly but made an error in final media selection. Fourteen rcent of the students neither used the model properly nor made e correct final media selection decision. These data are oices

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In the final, test condition, students again used the model select media for one of the instructional problems, but this they were told that their performance would count as part of eir grade. Of the 29 students, a total of 28 (96%) made the correct media selection, but only 40% of those who made corrections also used the model correctly. This inform is presented in Table 3.

Discussion

Performance in the intuitive condition indicates that selecting media for given problems is fairly difficult, since only 32% of the students made the correct media selection. If can also be inferred from the differential performance on the media selection problems in the intuitive condition that the problems vary in difficulty. None of the nine students who assigned the Aircraft Instrument Comprehension problem were at to make the correct media selection intuitively, although 36% those attempting the C.T. Scan problem and 55% of those attempting the Personnel Interviewing problem were able to make correct selections

After practice and self-instruction in use of the Reiser-Gagne media selection model, students are able to make correct choices more often. This may be partially due to the redundant built into the model, since the same media choices appear in several of the final choice boxes in the flowchart. Performant in the practice condition also indicates that students are unant to use the model effectively based upon reading alone.

Performance in both the practice and test conditions indicates that the model is fairly difficult to use. Only a of the students in the practice condition and 40% in the test condition were able to use the model correctly to make the correct media selection. However, in the test condition 96% d the students made the correct media selection, This again indicates that the redundancy within the model helps to restrice media selections, even though it is used incorrectly. It can also be seen that students get better at using the model correct as they gain experience.

It can tentatively be concluded from this study that stude who use the Reiser-Gagne media selection model make more corremedia selection decisions than when they don't use the model. Also, students often do not use the model correctly, but the redundancy in the model and the restricted choices available increase the probability that a correct choice will be made.

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Table 1

Intuitive !	Media Se	lection	Procedure:	Proportion	of Stu	dents
Making Cor	rect Med:	a Sele	ctions			

	Media Se	lection Problem	Assigned
	C.T. Scan	Personnel Interviewing	Aircraft Instrument Comprehensie
Correct Media Selected	4 (36%)	6 (55%)	0 (08)
Incorrect Media	7_(63%)	5 (45%)	9 (1008)
Totals	11	11	9

Table 2

its

eiser-Gagne Model Use: Practice (Instructional Objectives wisebop Problem) - Proportion of Students Using Plowchart preservy and Making Correct Media Selections

1.000			
aft ment ensi	Correct Model Use/ Correct Media Selection	7	(24%)
-	Incorrect Model Use/	9	(31%)
8)	Total Correct Media Selection	16	(55%)
03)	Correct Model Use/ Incorrect Media Selection	5	(17%)
	Incorrect Model Use/ Incorrect Media Selection	4	(14%)
	mable to complete assignment Total	4 29	(14%)

Table 3

Reiser & Gagne Model Use: Test

	с.т.	Scan	Perso Intervi	onnel lewing	Airce Airce Instru Comprehe
Correct Model Use/ Correct Media Selection	3	(30%)	7	(60%)	1 (1
Incorrect Model Use/	6	(60%)	4	(36%)	7 (1
Total Correct Media Selection	9	(31%)	11	(38%)	8 (2
Correct Model Use/ Incorrect Media Selection	1	(3%)	0		0
Incorrect Model Use/ Incorrect Media Selection	0		0		0

* n=29



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Feasibility Study of Bulletin Board and Electronic Mail Technologie for the Improvement of Student/Instructor Communications Used in "Distant" Education Course Offerings

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Department of Instructional Technology University of Georgia

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A Paper Presented at the 40th Annual Conference of the Association for Educid is Communications and Technology, Las Vegas, Nevada. January 17, 1986.

INTRODUCTION

ts the problem?

s Used

chnologie

Responding to direction from the Board of Regents, the College of Education at inversity of Georgia has entered into several cooperative programs to offer and graduate degree programs in the south Georgia area. While these programs are and very real needs for students in that area, they are causing more than ordinary desands of the UGA professional staff. Any technology that can reduce this reductive use of the instructor's time while maintaining or increasing the rection between instructor and students warrants further study and investigation.

is the specific context of the problem?

Since the spring of 1982, the College of Education at the University of Georgia operated a doctoral program for health professionals on the campus of Armstrong College in Savannah, Georgia. The program, which allows students to pursue the trate in Education (Ed.D.) in the areas of curriulum or instructional development, designed especially for health professionals who are involved in education or ining.

The opportunity to receive their doctoral instruction at the local campus gives dents several unique advantages. First, they avoid the turmoil, both to their ers and to their families, of relocating in Athens. They continue with their sent jobs, attending class during late afternoon and night. Second, they avoid the ense of moving to another town and of losing the income from their present jobs. rd, they have the singular opportunity to apply what they are learning immediately their jobs.

Operating a doctoral program so far away from the UGA campus in Athens, however, is special problems for faculty and students. For the faculty, the most obvious blem is travel. By car, travel from Athens to Savannah requires about four and a hours. Since classes begin in the late afternoon, faculty must stay overnight. a class in Savannah requires UGA faculty to spend two workdays away from campus. addition to the problem of physical distance, faculty must cope with the reduced ortunity to work and communicate with students. The College of Education and its ulty, then, face several problems: increased expenses due to faculty travel, loss productive faculty time in travel, and reduced opportunities to interact with tents.

Students also encounter problems in pursuing their doctoral studies away from the campus. Library resources are not always readily at hand, nor is the friendly the and presence of other doctoral students familiar with the program and with the fessors who teach in it. The faculty themselves are encountered one at a time with the opportunity for additional contact during the week.

or Educations is the purpose of this study?

The purpose of this study was to examine the process of introducing, maintaining, using an innovation, the electronic bulletin board, within the off-campus doctoral gram at Armstrong State College. In particular, we wanted to conduct the study hin a specific classroom setting, addressing several questions: 2. Will they voluntarily choose to use the electronic bulletin board?

3. How do they evaluate its effectiveness?

4. How do we evaluate its effectiveness?

5. What modifications can we make to improve its continued use?

METHOD

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Who were the participants?

Fourteen doctoral students enrolled in an advanced course, Research in Instruction, participated in this study. Students were employed, primarily educators, in the health fields such as nursing, dental hygiene, and radio technology. They have been enrolled in this program for approximately for have taken, for the most part, the same sequence of course work. The group of thirteen females and one male, and ranged in age from 30 to 52.

What was the context of the study?

A doctoral program of study involves several distinct phases: (a) the steep work; (b) passing preliminary written and oral exams; (c) developing a dist prospectus; (d) conducting the study; (e) writing up the results; and (f) approval of the dissertation via a reading committee and final oral exam. this study were at level (b) the quarter during which the electronic bullet was introduced. They were anticipating standing the written and oral prelime, we exams. In other words, they were moving from the familiar pattern of taking to the unfamiliar and anxiety producing stage of the preliminary exams. If and electronic bulletin board was introduced at a very stressful time for the start

Second, the course being offered (Research in Instruction) did not for A two typical pattern of students receiving instruction each week, taking quizzes ter, papers, and so forth. Rather, this course allowed each student to work induces to prepare for the preliminary exams. A different type of instructional struction then, was needed. Communication between students and faculty, rather than the study, was required.

Third, the use of the bulletin board was voluntary. It was presented the tool for facilitating communications between students and faculty. No one it t required, for example, to sign on or post a specified number of messages. Cated

Fourth, as one might expect, some students were familiar with using permits computers, others were not. Some students owned personal computers, moders, trong communication software, others did not. This information will be described 1000 avai

did we do?

We conducted two major activities: installed and monitored the electronic to board and provided a training session on the use of the system. Each of activities is described below.

3

Ilation and Monitoring

A Tandy 1200 (640K and a 10 megabyte hard disk) was installed in the Armstrong ment of Nursing, connecting the computer via modem to one of the departmental lines. We had previously tested the operation of this computer by running a s bulletin board on it for a two-week period.

The software package used was the Remote Bulletin Board System for the IBM mal Computer or, as it is more commonly known, the RBBS-PC. This program was loped and still maintained by the Capitol PC User Group in Gaithersburg, Maryland. TBBS-PC package is copywrited but is available at no cost. For a modest ribution of twenty-five dollars to the Capitol PC User Group, a user will be Research .. stered and notified of further improvements in the package.

The major features of the RBBS-PC are a message system, a bulletin system, and a system. The message systems allows 250 active messages, which may be private wailable to anyone. The bulletin system is operated only by the system operator The group contains announcements or other information that is permanently posted. The ng system allows the uploading and downloading of text documents or programs. AC also has an option for assigning different levels of security for users, which mase or decrease the user's access to the entire package.

A special program was written to initialize the RBBS program immediately when : (a) tain computer was turned on so with the flip of a switch the system was ready for use. ing a disser system initialized and was then ready. The board operated from 5:00 PH to 5:00 ekdays and 24 hours a day on weekends.

and (f) on The logic of placing the host computer in Savannah was that it required only al exam. Sel calls for students. We would call long distance on GIST from Athens, thereby nic bullets ming the major phone expense. The system, then, had to be monitored remotely from oral preimers, which was a disadvantage to the system operator. n of taking

exams. In staning Session for the st

id not folls. A two-hour training session was held during the second class meeting of fall ig quizzes, star, 1985, on the same day that the computer was installed. Students met one of work inder the systems operators, a graduate student enrolled in the on-campus program in tional structional development, who then demonstrated the major features of the RBBS ther than in lage. An eleven-page description of the program was distributed. Major topics

weed signing on, the help file, reading messages, leaving a message, the utilities resented as the files system.

No one At the time the training session was conducted, an informal survey of students icated that seven out of the eleven present owned a personal computer. Five ssages. using personnts owned modems and communications software; four had placed calls to an s, modens, ctronic bulletin board or electronic mail service. We made arrangements for a TRS

described and 100 computer, an inexpensive yet adequate computer with a built-in modem, to be available for each student who did not own or have access to a computer.

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What data did we collect?

Students knew generally that we would collect data at the end of the the operation of the system and on their reactions to this experience. reflection, however, we concluded that this informal approach was unfair u students. They should know very specifically what data we would collect, be collected, who would do it, and what use would be made of the data. We developed a consent form that clearly explained our intentions. Two major this form are given below.

The following points have been explained to me:

 The reason for the research is to assess the feasibility and effectiveness of the electronic bulletin board as a communication tool our off-campus doctoral program. The advantages that I may expect from are: (a) insures that specific problems you may encounter when using bulletin board are addressed, (b) provides a systematic record of your reactions to the bulletin board, (c) insures effective use of the board with future classes, (d) models action research dealing with use and acceptance of an innovation.

2) The procedures are as follows: (a) You will be asked, via intervie and/or self-report, to describe your level of use of the bulletin beam problems you encountered, and conditions that would make it a more effective of you will also be asked, via a questionnaire, to share your concern about this innovation. For example, -Do you need more information about you prefer to use a different way of communicating? This information will be collected once each quarter will be collected once each quarter. (c) Data will be collected over three quarter period. (d) Statistics on use and operation of the beam be kept. In no circumstance, however, will the content of a message beam of this study. Your messages will receive the level of security you assign and will not be seen by anyone other than the person or person you designate and the systems operator.

Students read the consent form, asked for a few clarifications, and then all present at the last class meeting signed the consent forms.

As item 2 in the consent form shows, three types of information were (a) self-report about their level of use of and reactions to the bulletin board; response to a questionnaire about their concerns about the bulletin board; statistics on the use of the bulletin board, which came directly from the program.

The self-report form consisted of nine items requesting such information Did you have any problem(s) in using the Bulletin Board?" and "6. Should the Board be continued next quarter?"

The Stages of Concern Questionnaire (SoCQ) developed by Hall, George, Rutherford (1979) was the questionnaire used to measure students' concerns bulletin board as an instructional innovation. Hall et al. make two major b about the individual adopter: first, that individuals move through seven si concern about the innovation, and second, that the intensity of concerns var stage to stage. For example, a person who is a "non-user" of an innovation.

iferent profile of concerns than a "user." Moreover, the non-user profile would that individual becomes an experienced user. Moreov and Tillman (1985, p. 366) described the seven specific stages of the

e. Up	5r0.	follows:	
llect. We h	0	Awareness	Little concern or involvement with the project.
, major	1	Informational	Need for general information.
	2	Personal	Uncertainty about her/his role in the project.
ion tool pect fra	3	Management	Attention to the processes and task of using the project.
of your the boan	4	Consequence	Focus on the impact of the project on the learner.
ve and	5	Collaboration	Focus on coordination and cooperation with others regarding the project.
interview in board nore effect ach quarter	6	Refocusing	Exploration of alternative uses of the project or a replacement.
concerts	t did	we find?	
1111 470	and the second se		

: inform: In reviewing the findings presented below, several important features of this ad over a by should be kept in mind. First, the introduction of the bulletin board came at a the board stressful time for students, taking preliminary written and oral examinations. essage ce le students generally welcomed it as a useful tool, it was clearly adjunctive or, ecurity e a few students, unnecessary at that moment. Second, the use of the bulletin board or pers purely voluntary. No minimum number of sign-on's were required. Third, at the

the host computer was installed, only five students had the necessary hardware to up with the system. Although we would have preferred that all students have the

then all stary equipment at the start of the quarter, this could not be achieved without bying the installation of the host computer. By the end of the quarter, most were of board prompted students to purchase their own personal computers. finding: are presented in four sections: summary of RDSS usage, colf-report board: soults, responses to the SoCQ, and initial costs.

formation ary of RBBS Usage

coer to December can be summarized as follows:

ould the The number of times each user signed on the RBBS over a ten week period from

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Person	Number of times signed or	ņ
Sysop 1	15	
Sysop 2	11	
Instructor	13	
Student 1	41	
Student 2	11	
Student 3	10	
Student 4	5	
Student 5	2	
Student 6	1	
Student 7	1	
Others	5	

These data show very clearly that only half of the students signed on the board during fall quarter. "Others" were callers who were checking out the board. No files were uploaded or downloaded.

Self-Report Results

A survey of RBBS usage was given during the last class meeting. Eleve fourteen students were present. Of those eleven, six had used the board and not. When asked "Why did you not use the board?" four replied "lack of eco one "didn't know how." Three of the four who lacked equipment also mentions they did not need the board that quarter.

Of those who used the board, a variety of problems were encountered: student was tagged with a security violation and access was then withheld the student repeated an incorrect command three times so the RBBS program criminal was at work); (2) several attempts to upload and download files unsuccessful; (3) use of nicknames in addressing messages would result in m messages; (4) a user would be knocked off the board automatically after ter inactivity; (5) occassionally, the computer would not be turned on at 5:00.

Also from those who used the board, several suggestions for improvement system were obtained: (1) increase access time by having a separate phone train other University of Georgia faculty in the use of the board; and (3) a information of general interest to all.

And finally, students were asked two specific questions: (1) "How in you plan to use the board next quarter?" Eight replied "more than this quart two "about the same." (2) "Should the board be continued next quarter?" "yes"; one record was incomplete.

Responses to the Stages of Concern Questionnaire (SoCQ)

Eleven students completed the SoCQ. For each record, raw scores for stages were converted to percentiles, then plotted. Two groups of student were formed. One consisted of the three most frequent users of the bullet The other consisted of five students who did not use the board. Profiles d groups were averaged, plotted, and then compared. The resulting profiles the predictions of the concerns model: the nonuser group of five showed vp of intensity of concerns in the first three stages (awareness, informational, P

with less intense concerns for the four remaining stages. Their concerns, in obtaining more information and in determining how they might use the the bard: they were not concerned about collaborating with colleagues about the atin board. The user group, however, showed a different pattern of concerns: etin boards, informational, and personal but much higher on collaboration. This group had yet to show concerns for refocusing, which the concerns model would ict for experienced users. In short, concerns theory appeared to describe quite the two user groups that we formed.

Our primary use of this data, however, was to develop an appropriate intervention student based on his or her unique profile. These data will also be shared students. The SoCQ will also be given at the end of winter and spring quarters.

Ial Costs

Our original projection for equipment called for a budget of \$9,600, which I on the buded one Tandy model 1200 with accessories, ten model 100 portable computers, and ing out the prister. Our actual equipment expenses, however, were these:

	1	Tandy 1200 HD with monitor, graphics adapter, and cables	\$2,	295
erana i	1	Modem		350
	3	Model 100 (24K) with cables, carrying cases, and AC adaptor	1,	555
7 80		- To	tal \$4.	200

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program de The system operator's salary for the guarter would add an additional \$1,000 to I files very total (10 hours per week at \$10 per hour for 10 weeks) as well as the GIST phone sult in us to Savannah, estimated at \$150 (GIST does not provide actual cost billing). The after two pl expenses then add up to \$5.350. This figure does not reflect any equipment at 5:00. Is from the Athens end. We already had the needed equipment. Additional improvement ovements, such as a printer in Savannah and a dedicated phone line, will of course and (3) = We did not project any sort of cost benefit ratios since most of this quarter was

rted to installing the system. With additional experience in operating the system, "How free "Ill examine carefully this important dimension.

this quark to to se go from here?

Our initial view of establishing a bulletin board focused on equipment, budget, logistical problems. And indeed, it took virtually the entire quarter to develop perational system, including installation and monitoring the system, training res for the ten. On this score, we have simply just begun. We have an operational system, student more that is not functioning well for all its potential users. Only half of the e bulletin ents have actually used the system. After ten weeks of operation, however, we have become more aware of the showed vering the basic custom. Yet athense want to share information about the bulletin

showed ven by the basic system. Yet others, want to share information about the bulletin

board with colleagues and locate and use additional bulletin boards in the areas. Also, more linkages, for example, need to be made between Armstron students and University of Georgia faculty and students.

We are encouraged that the students themselves, those who have used is and those who have not, strongly support the continued operation of the bill board. Both they and we ramain optimistic that a significant new community is being forged.

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The Accuracy of Cognitive Monitoring During Computer-Based Instruction

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Running Head: COGNITIVE MONITORING

Submitted September 25, 1985

Cognitive Monitor

THE ACCURACY OF COGNITIVE MONITORING DURING COMPUTER-BASED INSTRUCTION

Individuals process information in different ways. The stratege preferred by one learner are likely to differ from those preferre another. Ideally, every lesson should be individually tailored to such needs and abilities of each learner "so as to develop, compensate for capitalize upon student characteristics for the optimization of subjectlearning" (Messick, 1984, p. 69). One way to accomplish such indivitailoring is by transferring control of the lesson's structure and sec to the learner. The greater the learner control, the more individue instruction should become.

Unfortunately, research in this area has failed to demonstrate learner control consistently improves learning. Instead, studies indicate imposed control increases learning significantly over programs in what learner controls the instructional scope and sequence (See, for ema Atkinson, 1972; Park & Tennyson, 1983; Ross & Rakow, 1981; Ten Tennyson & Rothen, 1980; Tennyson & Buttrey, 1980; Tennyson, Christen & Park, 1984). Tennyson (1980, p. 505) stated that "instructional rese dealing with variables of learner control has failed to demonstrate students can make and carry out decisions of content element selection personal learning assessment."

A basic problem noted by locus on instructional control research has been that subjects who controlled their instruction freque terminated instruction prematurely. However, the cause of this phenome is not clear. If subjects who control instruction direct as much effort to as those under program control, then other factors must affect instruct control decisions.

One possible explanation is that many learners do not accurately their understanding of lesson information. Less skilled lear and perhaps learners who encounter new subject matter, tend not to entheir failure to understand new material (August, Flavell & Clift, 19 Baker, 1979; Flavell, 1979; Garner, 1981; Garner & Anderson, 1982; Gra-Mann, 1984; Markman, 1977; Robinson & Robinson, 1984; Whimbey, 19

5

Materials

The lesson concerned the discovery of a fictional ore (berkelium on an imaginary South Seas island. Although the details of the material fictitious in order to avoid the influences of prior knowledge, the content designed to avoid logical conflicts with concepts pertaining to the economics, anthropology, and mineral science.

The information was divided into four sections and presented form of computer-based instruction. The four sections were *The History Jexium Island*, *The Discovery of Berkelium Oxide*, *The Mining Berkelium Oxide*, and *The Market for Berkelium Oxide*. The avnumber of frames per section was 11 with a maximum of 13 and a minof 10. Each section also contained two graphic drawings which were us maintain motivation, but did not relate to items later tested. The main was designed to include a high information density within individual fra and sections in order to require students to sort among numerous factor concepts.

Following each section, students were asked to rate their level understanding of both the factual and inferential material on scales from (not at all) to five (very well). They then answered eight short-and embedded questions pertaining to the material. The eight embed questions consisted of four factual questions and four inferential question Questions following each section covered only information presented in section and were not cumulative.

Factual Lesson Content

Factual questions were those which required the recall of informawhich had been stated explicitly in the text. The questions were divided three levels, based on elements common to the parsing hierarchies of Meyer and Kintsch. The system used was considered more appropriate the individual frames of computer-based instruction. Factual questions divided into three Level 1 questions, eight Level 2 questions, and five 3 questions.

Level 1. Level 1 questions were the most general and could answered with the main idea of a computer frame. An example of a level question is: "What was the ore Groningen discovered?"

Level 2. Level 2 questions were more specific and require information which supported the main ideas. An example of a level question is: "Why was the discovery of the ore important to laboration scientists?"

Cognitive Monitoring

Level 3. Finally, level 3 questions were the most specific and covered details which were less significant to the main ideas of the story. An example of a level 3 question is: "In what decade did Groningen go to lexium Island?"

Inferential Lesson Content

Inferential questions required students to evaluate two or more related pieces of information in order to form a conclusion. The questions were divided into intraframe and interframe inferences. Intraframe and interframe inferential questions were distributed evenly across sections.

Intraframe. Intraframe inferences could be answered based upon information presented in a single frame. An example of an intraframe question is: "What important event occured on Jexium Island in 1945?"

Interframe. Interframe inferences required that information from two or more frames be evaluated simultaneously in order to form an appropriate inference. An example of an interframe question is: "Who built the towns around the mine site?"

Lesson Posttest

There were a total of 32 items on the posttest: half were repeated from the lesson and half were new items. The information tested using the new questions was evenly divided across the four sections and contained equal numbers of factual and inferential questions. Sixteen of the questions were factual and 16 were inferential, yielding four learning measures: Repeated Facts, New Facts, Repeated Inferences, New Inferences. One-half of the inference questions were interframe and the others were intraframe questions. Three of the factual questions were Level 1, seven were Level 2, and six were Level 3. The items were presented in random order. All test items were short-answer type questions.

Dependent Measures

Several dependent measures were collected. Dependent measures related both to students' ratings of their understanding and to their subsequent performance on both embedded and posttest questions were collected.

Separate measures were obtained for fact and inference ratings for each of the sections of the lesson. In addition, the number of correct responses to embedded factual and inferential questions was computed, as well as an aggregated fact and inference score for the lesson.

Student performance on the posttest was organized in two ways. First, correct answers were tallied to produce a fact and an inference scale. Next,

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factual items were classified as Level 1, Level 2, or Level 3, and interesting the series of the ser

Design and Data Analysis

The design was a complete repeated measures design, when participants received exactly the same instructional treatment dependent measures were gathered on all students. Regression procewere conducted to determine the predictive value of en-route assessments for corresponding factual and inferential learning both to embedded and the posttest questions.

Enroute ratings for factual understanding were used to predict s performance on embedded factual questions while enroute rating inferences were used to predict student performance on embedded infe questions. Enroute ratings were also used to predict posttest perform for each corresponding scale. In addition, enroute ratings intercorrelated in order to examine the relationship among ratings for or inferences.

Procedures

All students received the same treatment. Students reported UB microcomputer lab during one of eight periods reserved specifically for the study. They were told the study was designed to investigate how 60 people understand material presented via computer, what they under and how well they can evaluate their own understanding. They were 000 told that the lesson consisted of four parts with approximately 10 frame ser information contained in each section and that they would be asked a int answer questions over the material after each section. This information Un given orally at the beginning of each session and also repeated # re. beginning of the lesson. Since student input was recorded during computer program, students were told not to be concerned with an spelling, but to confine answers to a single line. No time limit was man for responding to the questions.

Students then completed the lesson. During each section they vie the lesson and answered the eight embedded questions. Students da receive any knowledge of their results on these questions. Following all sections, the 32 item posttest was completed.

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RESULTS AND DISCUSSION

Fictual Ratings with Performance

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1 with come t was impose **Factual ratings correlated with embedded scores.** Table 1 minuting correlations between students' ratings of their factual understanding and their scores on the factual questions following each section of the lesson. Summed across sections, the total factual ratings and performance on factual embedded questions were correlated at .30 ($\underline{p} < .05$). However, most of this correlation could be accounted for by performance on the fourth section. During the first three sections, the correlations between ratings and performance were not significant. Only during the fourth section were ratings and scores on factual questions significantly correlated at .30 (\underline{p} .05).

Insert Table 1 about here.

This could indicate that students improved in their ability to rate understanding as a result of the embedded questions. However, although the most accurate predictions were made in the fourth section, the effect was not progressive during the first three sections.

Intercorrelations among factual ratings. Table 2 contains correlations between ratings of factual understanding in each of the four sections. Factual ratings were intercorrelated fairly well (minimum $\underline{p} < .01$), indicating that students use an internally consistent system to rate their understanding of factual information, but that the system was not as highly related to their actual knowledge of the information tested.

Insert Table 2 about here.

n they view idents did a owing all for Correlations were generally highest as students progressed chronologically. Self ratings for Section 1 correlated more highly with ratings for Section 2 (.55) than with ratings for later sections. Ratings for Section 3 correlated highest with Section 4 (.59). This might indicate that adjustments in assessing understanding were made gradually as students progressed through the lesson, modifying their criteria for judgement based on experience obtained during the lesson. Factual ratings correlated with postlest scores. The contains correlations between enroute ratings of factual understanding postlest scores on questions from each of the four sections. Althe students performed approximately as well on the postlest questions as the embedded questions ($\underline{r} = .72$, $\underline{p} < .0001$), correlations between rating scores were generally lower than during the lesson and were energatively correlated in some instances.

Insert Table 3 about here.

Factual ratings correlated with levels of factual quest Table 4 contains correlations between ratings and performance on the la levels of fact questions. Because levels were not evenly distributed an sections and there were only a few examples of each level within a sec total scores are used.

Insert Table 4 about here.

The only significant correlations were found between Section ratings and performance during the lesson for each level. These correlates are also reflected in the overall correlation between Section 1 ratings in total score shown in Table 1. The general consistency across leve especially as seen in the total ratings correlated with levels, may indicate consistency in ratings across levels of information. The slightly low correlations for Level 1 questions throughout may be accounted for by 1 fact that there were simply fewer Level 1 questions. Although correlation with Level 3 questions on the posttest were slightly higher than for 10 other two levels, they were generally not significant.

Inference Ratings with Performance

Inference ratings correlated with embedded scores. The contains correlations between ratings of inferential understanding and sur on the embedded inference questionsummed across sections, the inferential ratings and performance on inferential embedded questions we correlated at .38 (p < .01). As with the factual correlations, however is Table 1), most of this could be accounted for by performance on an sections. The general trend for correlations between ratings is performance on individual sections was similar to the trend found for fact questions. Initially, correlations were low, but in section three ratings is

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performance were significantly correlated at .37 (p < .01). However, correlations declined in Section 4.

Insert Table 5 about here.

Intercorrelations among inference ratings. Table 6 contains correlations between students' ratings of inferential understanding in each of the four sections. In all but one instance (Section 3 with Section 1), ratings were significantly intercorrelated. The correlation among inference ratings was greater than for performance on either embedded or posttest inference questions. Again, this suggests that students use an internally consistent system to rate their understanding but that this system is not related favorably to tested knowledge.

Insert Table 6 about here.

Inference rating intercorrelations exhibited the same general trends as factual rating intercorrelations. This trend may indicate that students modify their criteria for self-assessment based on lesson experiences. However, it may required several lesson sections to form a reliable system for judging inference.

Inference ratings correlated with posttest scores. Table 7 contains correlations between enroute ratings of inference understanding and posttest scores based on information from each of the four sections. As with factual questions, students performed approximately as well on the inference posttest questions as they had on the embedded questions ($\underline{r} = .71$, $\underline{\varrho} < .0001$). The trends between ratings and performance varied, however, from embedded questions to the posttest.

Insert Table 7 about here.

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Correlations were strongest between ratings and performance on Sections 1 and 4, with a moderate correlation for Section 3 and virtually no correlation for Section 2. The global, seemingly random, relationships between ratings and performance were typified by the correlations obtained between non-aligned section reatings and scores. Significant correlations

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were found between Section 4 ratings and Section 1 performance (and between Section 3 ratings and Section 4 performance (p < .05).

Inference ratings correlated with type of inference quarter Table 8 contains correlations between ratings and performance on the types of inference questions (Interframe and Intraframe). Because were only four examples of each question type per section, total scores used. Significant differences for Sections 3 and 4 account for most correlation between ratings and scores for both embedded and pa questions.

Insert Table 8 about here.

Student performance on en-route inter and intra-frame infere was very similar (61% and 63.75%). It is therefore unlikely that differe in correlations could be attributed to differences in performance. Susappear to judge their inference comprehension more or less singularly do not seem affected particularly by either within- or interframe influen

Fact and Inference Ratings by Section

Table 9 contains intercorrelations between ratings of in understanding and inferential understanding for each section. Ratings within sections produced the highest correlations of the study (.48, 4), and .78 respectively) and were all significant at the .001 level, despin fact that performance on fact and inference questions within sections dis correlate highly. This supports the assumption that although students w using some system for judging their level of understanding, the system not highly related to their actual knowledge of the kinds of informatested. The system also did not differentiate effectively between faand inferential learning. Rather, both fact and inference ratings appear related to some global criteria on which students based their assessments

Insert Table 9 about here.

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GENERAL DISCUSSION

The results of this study suggest that learners are not good judges of heir en-route comprehension. Little or no correlation between ratings of inderstanding and subsequent performance for both factual and inferential material were found for either embedded questions or the posttest.

One possible explanation for these results may be related to the subjective nature of "understanding." Students may assess their understanding according to criteria different from one another as well as from the experimenter (Baker, 1979; Garner & Anderson, 1982). Though internally consistent both within and between ratings for fact and inference. the ratings are not related well to any of the scales employed in this study. In addition, the more or less random correlations with the different levels of factual and inferential learning suggest that the student ratings were not based on the types of learning addressed in this study. Ratings appear to be based more on the undifferentiated, global perceptions of students as to their understanding. This presents a potential problem in practice, where the specific intended lesson information may not be the basis for making learner-based instructional control decisions. Based on the findings of the present study, it is simply unclear as to what information is used by students to estimate comprehension.

Some degree of acclimation to the lesson content and procedures was presumed necessary before self-assessments could be considered valid. After several sections and attempts to answer questions, student ratings of understanding should be more accurate, and successive ratings more highly correlated with actual performance. Although this pattern was not demonstrated completely, the data indicated some trends in this direction. Correlations between ratings and performance for both factual and inferential questions were significant mainly in later sections. This trend might have been more pronounced if understanding of factual and inferential questions were more consistent across students. This might be accomplished by clarifying the rating task more through additional initial instruction, including examples of factual and inferential questions, specifying explicitly which questions were factual or inferential, asking students for ratings of specific facts or inferences, or providing response feedback.

Individuals may also evaluate understanding at levels other than those selected in this study. For example, learners may assess understanding correctly at low levels but fail to demonstrate understanding at a higher level. Low level assessment of understanding should reflected in higher correlations of ratings with factual questions than inferential questions. It was expected that ratings would correlate highly with main ideas (gist level) than with lower level facts, indicating to students based their assessment on knowledge of general ideas. The however, did not reflect any significant relationships between assess and level of factual information.

An assessment of understanding based on a high level of assimilof the material should have caused ratings to be more highly correlated inferential questions than with factual questions. In effect, one a predict that ratings of inference would be the best predictors of staperformance. Again, however, this was not demonstrated. None of the assessments were found to be uniformly more accurate than other forecasting student performance. Unfortunately, ratings were not be correlated with performance on any of the scales. Instead, there were accurate the ratings themselves. Scores on both the embed questions between the ratings themselves. Scores on both the embed an accurate assessment of this knowledge.

Finally, since understanding involves the integration of information with prior knowledge, studies which are relatively shore cover only a small amount of new information may not give lear sufficient time to develop new, or to adapt existing, schema effectively an inability to correctly assess understanding is related to the lack a integrated cognitive schema, assessment and performance should improvlater sections.

Cognitive monitoring can be particularly difficult to study. process can only be inferred from observed outcomes and from introspective reports of subjects. Subjects who lack experience with process of introspection may be unaware of how to attend or what the of the attention should be. The resulting reports may reflect processes anticipated by the experimenter. The findings of this study may be real to such problems.

The popularity of learner controlled computer-based instruct of accentuates the importance of further cognitive monitoring research tendencies reported for premature withdrawal from CBI lessons may associated with basic misperceptions of learning. The lack of sum correlations between self-assessed understanding and actual performing indicates the need for further research in this area.

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Table 1



		Section Scores							
	-	Sect 1	Sect 2	Sect 3	Sect 4	Total			
	Sect 1	.25	.22	.20	.17	.38**			
stings	Sect 2	.11	05	.43**	.14	.23			
act R	Sect 3	02	01	.10	.14	.07			
	Sect 4	.02	.11	.33*	.30*	.26			
	-			- 1. N. W. S. M. S. M					

Note. Overall fact ratings correlated with fact total at .30, g < .05. *p < .05 ** p < .01



			Fact R	atings	
	-	Sect 1	Sect 2	Sect 3	Sect 4
	Sect 1	х	.55	.35	.44
1010	Sect 2	(.0001)	8 *	.46	.47
act R	Sect 3	(.01)	(.001)	х	.59
E.	Sect 4	(.001)	(.001)	(.0001)	x

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Table 3 Retings of factual understanding correlated with scores on factual posttest questions by section

		Posttest Scores				
	Sect 1	Sect 2	Sect 3	Sect 4		
Sect 1	.16	03	.16	.33*		
Sect 2	.12	16	.20	.21		
Sect 3	.03	16	.17	.01		
Sect 4	.04	03	.17	.17		
		* * *	05			

Table 4 Ratings of factual understanding correlated with scores on factual questions by level

			Len	els of Fi	act	Questi	ons	
		Embe	edded To	tals			Posttest	
		1	2	3		1	2	5
- state	Sect 1	.28*	.33*	.29*		.12	.10	.29*
	3ect 2	.05	.23	.17		.02	.07	.22
OCL P	Sect 3	02	01	.11		.12	10	.11
~	Sect 4	.07	.24	.24		.13	.00	.19
	Total	.12	.25	.26		.13	.02	.26

* g < .05

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Table 5

Ratings of inference understanding correlated with scores on embi

Section Scores

		18 A	51		2	
	-	Sect 1	Sect 2	Sect 3	Sect 4	Total
ngs	Sect 1	.10	14	.25	.17	.17
e Rati	Sect 2	.06	.12	.12	08	.10
reno	Sect 3	.23	.09	.37**	.28	.49**
Infe	Sect 4	.27	08	.30*	.24	.31#

Note. Overall inference ratings correlated with inference total at .38, p < .01.

* e < .05 ** e < .01

Table 6 Intercorrelations among inference ratings

			Inferenc	e Ratings	
	_	Sect 1	Sect 2	Sect 3	Sect 4
50	Sect 1	x	.29	.10	.35
Rati	Sect 2	(.05)	z	.45	.30
1600	Sect 3	NSD	(.001)	X	.49
Infe	Sect 4	(.01)	(.05)	(.0001)	x

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Table 7 Ratings of inferential understanding correlated with scores on inferential postlest questions by section

Posttest Scores

	Sect 1	Sect 2	Sect 3	Sect 4
Sect 1	.30*	.25	21	.03
Sect 2	.06	.07	.08	.06
Sect 3	.23	.13	.24	.36*
Sect 4	.41**	.02	.21	.34*

*p<.05 **p<.01

Table 8

Ratings of inference understanding correlated with scores on inference questions by type

			Types of Infe	rence Questions		
		Embedded	Totals	Postt	test	
	-	Inter	intra	Inter	intra	
11033	Sect 1	.24	.01	.04	.16	
e Fut	Sect 2	.11	.00	.05	.11	
erenc	Sect 3	.48**	.37 *	.26	.36**	
101	Sect 4	.26*	.22	.18	.44**	
	Total	.39 **	.22	.20	.39 **	

* 2 < .05 ** 2 < .01

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Table 9

Ratings of factual understanding correlated with ratings of inference understanding

			Inference	Ratings	.*	
	-	Sect 1	Sect 2	Sect 3	Sect 4	
	Sect 1	.48**	.07	.30*	.42**	
tings	Sect 2	.21	.45**	.34*	.36**	
act Re	Sect 3	.02	.29*	.67**	.41 **	
εl	Sect 4	.40**	.29*	.49**	.78**	
		* e	< .05	** g < .01		

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TITLE: A TIME MANAGEMENT STUDY

RUTHORS: HELEN M. GOTHBERG DONALD E. RIGGS LRWRENCE M. RLEAMONI

A TIME MANAGEMENT STUDY

by

Helen M. Gothberg Associate Professor Graduate Library School University of Arizona, Tucson

Donald E. Riggs University Librarian Arizona State University Tempe

and

Lawrence M. Aleamoni, Director Instructional Research and Development University of Arizona, Tucson

Today's information managers are working under consident pressures -- pressures that are unique to this period of the our institutional and national development. Writers see Alvin Toffler and John Naisbitt have made us aware of them going change in our world from an industrial nation to information society. The roles of all institutions are process of change. New technologies are available to assis providing better control over information, and their us rapidly being adapted to a wide range of services operations -- but the cost is high. These high costs of man information have come about at a time when institutional but are considerably leaner than they were. If the challenge this new information society are to be met head-on, perso costs must be reduced. This means that along with the technological time saving devices, both staff and management need to become more productive. One road to increproductivity is that of efficient time management.

A study on time management practices was undertaken among group of information managers--the directors of large denic libraries--with the support of a Librarian/Scholar grant the Council on Library Resources. Although the study can be generalized to other groups based on the degree to which fit the description of the population surveyed, the results ill be of interest to all types of information professionals, cluding those in media services and telecommunications who work institutions of higher education.

Although there is a considerable body of writing and search on the subject of time management in the business conside terature, little existed in the library literature that dealt od of the clifically with management. A survey approach was deemed the ters most useful method to generate data that would provide insights re of the ful in evaluating time management practices among managers of nation are academic libraries. The results of this study provided a ns are dis for evaluating the training of library managers, to as semining the need for additional research in the field, and an their sortunity for academic library directors to compare their own ervice ponses to those of others in similar positions.

Objectives of the Study

s of the

ional four objectives of the study were designed to determine: halles 1. To what degree library managers are aware of and n, per practice efficient time management methods, including with t delegation of authority and leadership style. nagement 2. Time management practices as related to:

a. leadership style

- b. sex of manager
- c. number of people managed

d. years of experience as a library director

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- 3. Identification of the most serious time wasters.
- How library directors reportedly spent their time on twelve specified categories.

Sampling

The population that was surveyed consisted of 189 dire sports from large academic libraries. Two mailings of the survey as SP sent out to ensure at least a 60 percent return. The not 55% number of questionnaires returned was 159. Since the survey population of directors of large academic libraries were population and 82% of them responded, we may for all practical purp consider that we are dealing with a population as opposed in of sample in this study.

Data Collection, Analysis and Results

Items used to collect the data in the mailed survey based on the time management literature. They fell into: categories: 1) a profile of the respondents, 2) how a management time is reportedly spent, 3) delegation of authority, 4) wasters and 5) leadership style. The survey was pretested in the libre N = 12.

The SPSS statistical package was used to analyze the collected from the survey. Three types of analyses and calculated, including frequency, Pearson product-ro correlation and chi-square with cross tabulation.

In the areas of the academic library director profile

respondents' time was spent (Tables 1 & 2), the results of requency analysis indicated that the population was mature both age and experience, although almost half of them (46.5%) had ctor in their current position five years or less. Most of them sters. ministered staffs under 300, and only 21% of them were female. ir time by spent a large percent of their time involved in meetings and its committees and lesser amounts of time in planning, 189 directoporting, supervising, budgeting and personnel work. Few of ie survey has spent more than three hours a week on external fund raising, at 55% of the directors spent 21 days a year or more off campus The re 1. standing professional meetings or other work related events. ce the en

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TABLE 1

University Library Director Profile

opposed	ise of library staff	1-150	151-300	301-450	451+
	Percent:	57.9	31.4	7.5	3.1
l survey.	unber of years 'in Wirrent position	1-5	6-10	11-15	16+
11 into:	Percent:	46.5	25.2	15.7	22.6
w a manage	library director				
rity, 4)	Percent:	38	17.7	16.5	27.8
etested w	library administrator				
yze the d	Percent:	6.3	12.6	16.4	64.8
alyses W	Se challen a	23-35	36-45	46-55	56+
duct-zos	Percent:		22.6	47.8	28.9
profile,	ender	<u>M</u> 71	ALE 3.6	FEMALE 21.4	
		4			

TABLE 2

Hours per week:	0-3	4-7	8-11	12-15	16-1
Planning	18.2	46.1	22.1	11.7	1.3
Reporting (internal					
& external communi- cations)	18.5	48.4	22.9	7.6	2.5
Supervising	56.8	30.4	10.1	1.4	
Budgeting	44.8	43.5	9 1	2.6	
Buddeerud	44.0	45.5	5.1	2.0	0
Personnel work (including collective bargaining, labor					
relations)	42.2	38.3	14.3	3.9	1.3
Meetings with univer- sity administrators	49	13.9	5.1	1.9	0
Meetings with library administrators (e.g., assistant/associate directors, department					
heads)	3.9	55.5	30.3	8.4	.6
Library committees	63	30.5	3.9	2.6	0
University committees	67.5	27.4	3.8	.6	.6
External fund raising	69.1	24.2	4.7	1.3	.7
Number of days per year off campus for professional meet-					•
ings or work related	0-10	1-20	21-30	<u> 30+</u>	
Percent	4.5	41.3	33.5	20.6	

PERCENT OF TIME SPENT ON MANAGEMENT ACTIVITIES.

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Delegation of authority is considered an all important of in the management of time. Information about how knowledge the respondents were about the delegation of authority collected using a four-point "agree-disagree" Likert-type of in response to a series of statements on the subject (Tab)

sty-five to 90% of the academic library directors demonstrated ed to excellent knowledge in this area. The two statements in 'IVITIES ich fewer of them responded appropriately for an effective 16-19 legator had to do with permitting staff to make mistakes and 1.3 soing tasks that their subordinates should be doing.

TABLE 3

DELEGATION OF AUTHORITY*

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0	DELEGATION OF AUTHORITY*						
1.3		Agree Strongly	Agree	Disagree	Disagree Strongly		
0		AS	A	D	DS		
	1. I frequently allow my staff to make mistakes.	13.8	49.7	29.6	6.9		
.6 1	 My staff make most of the day-to-day decisions about their work without my prior approval. 	60.1	38	1.3	.6		
.6 .7	 I frequently do tasks that my subordinates should be doing. 	1.3	29.7	43.7	25.3		
	 The library does NOT function smoothly when I am absent. 	.6	2.5	37.1	59.7		
	 I seldom revise decisions made by my staff. 	28.9	59.7	10.7	.6		
iportant st	I give my library staff considerable authority over work (e.g., per- sonnel, finances,			12			
knowledge	 I frequently make 	44	50.9	5	0		
rt-type st	of my subordinates' jobs.	0	9.5	55.1	35.4		
ct (Table							

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TABLE 3 (CONT'D.)

+ 00	want of pardenia libuary divertant	MAGNAN	a d d un est		211
11.	My key people take the initiative for projects without waiting for me to think of them.	26.1	59.2	1.0	partie partie
10.	The department heads under my leadership do NOT delegate work well to their own subordinates.	1.3	9.2	64.7	rabil radeq alaye
9.	If I were incapacitated for six months, there is someone on my staff who could readily take over my job for that period of time.	44.9	41.8	10.1	nfus uthor rises rop-1
8.	I delegate most library operations to my staff.	42.1	51.6	5.7	iste Saory
		> Agree	A Agree	u Disagree	the sal

* Percent of academic library directors responding

The library directors who answered the time manage at of survey were asked to rank their top ten time wasters out atruclist of 15. This list was then compared to responses to the sol of list which had been submitted to sales representatives wing engineering managers in fourteen countries by Michael LeBoeu ached reported in the February 1980 issue of <u>Business Horizons</u> (P Hepho

riorit

Er

TABLE 4

TEN TIME WASTERS RANKED BY THREE OCCUPATIONAL GROUPS

		Library	Sales	Engineering
-		Manager	Reps	Managers
t Disag	compting too much at once stimating time malistically	1	8	
5.7	nettered desk and personal sorganization	2		
	mfused responsibility and thority			
	rises (personal and/or staff)	5	4	6
10.1	rop-in visitors	6	2	9
	subility to say no			
64.7	adequate, inaccurate, or alayed information	7		l
	necision and morrastination		7	8
1.0	reffective delegation and replement in routine and stail	9		, 2
	tion of objectives, riorities and deadlines		6	
manage	ack of, or unclear,			
ars out	Tructions	4	10	5
to the s	ack of self discipline	10	3	10
tatives	miving tasks unfinished		9	7
LeBoeuf	scheduled and	3	5	4
izons (14	elephone interruptions	8	1	3
	Contraction of the second se			

Engineering managers did not rank attempting too much among teir top ten time wasters, and sales representatives placed it

near the bottom of their list. Neither sales nor engineers personnel listed a cluttered desk and personal disorgan among their top ten time wasters. There were other differences the two management groups. For example, library indicated better control over the telephone than engineers and the set of the set

Much has been written about leadership style over the In the beginning there was an effort to identify the train leader. Later, researchers in the field of industrial psychol and management believed that leaders were either processis, people oriented -- or they were task oriented. Today the a trend toward team leadership which incorporates both and of leadership -- a concern with high productivity and a concern people. Based on the Blake and Mouton Managerial Grid C five possible leadership styles were identified depending @ respondents ranked an equal number of statements about how thou dealt with conflict (Table 5). These leadership styles are still on a task-process grid that identifies the degree to which Pedi #111t respondent is: primarily concerned with getting the work of organization carried out (9,1), primarily concerned with welfare and the people in the organization (1,9), concerned

	task nor people (1,1), equally concerned with task and				
ior engine	(9,9), or at some midpoint, balancing between either task				
disorgan	meople (5,5). A majority of the academic library directors				
ter differ	the team management conflict statement as the one that				
ibrary m	their most typical response. Team management integrates				
an engine	task and people concerns in a leadership style that works				
lves as b	developing trust and committment in employees in an effort				
f better a	foster greater productivity.				
larities					
3 relation	TABLE 5				
ation of	LEADERSHIP STYLE				
at175	Conflict Statement				
tives.	When conflict arises, I try to identify reasons for it and seek to resolve underlying causes. (9,9)				
ver the m	When conflict arises I try to find a compromise				
ne traits	that everyone will be satisfied with. (5,5)				
ial psych:	When conflict arises, I try to remain neutral. (1,1)				
process-	I avoid causing conflict, but when it does appear, I try to smooth things over so everyone will be happy.				
foday then	2 (1,9)				
both asp	When conflict arises, I try to cut it off or win my position. (9,1)				
a concern					

l Grid mod

ending c Correlations were run for all variables in the study. bout how though some writers in the field of research methodology are les are a fitical of this approach and regard it as a "fishing to which "Pedition", there are advantages in this type of a study. The work of ^{shaults} of the Pearson product-moment correlation were for the hed with ^{shaults} of the Pearson product-moment correlation were for the ned with ^{shaults} the respondent had been in a management position,

experience as a library director, administrator, inc. department head or assistant/associate director and aga 6).

TABLE 6

RESPONDENT CHARACTERISTICS

		Α	в	с	
Α.	Number of years in current position		.7729	. 623	1 12
в.	Number of years as a library director	.7729		.5560	2 1
c.	Number of years as a library administrator incl. dept. head, etc.	.4626	.5560		11 - L
0		.5294	.4847	.4768	
D.	Age	1			

Correlations among the hours spent on meetings university committees and the time spent in meetings university administrators and with library committees sugge that the meeting style of university administrators may prove role model or organizational style for the subsequent frequence of committee meetings within the library (Table 7).

TABLE 7

1	HOURS SPENT ON MAN.	AGEMENT ACTIVITIES
ige D		Hrs. Spent on Meetings w University Committees
	Ers. spent in meetings with university administrators	.3751
	mrs. spent with library committees	.4864

correlations among the delegation statements were also redictable with those respondents who were reluctant to give taff authority over operating decisions perceiving that their 560 ibrary would not run smoothly when they were absent. Those ibrary directors who did not feel that if they were acapacitated for six months, there was someone on their staffs to could take over, were more inclined to make decisions that are part of their subordinates' jobs (Table 8).

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DELEGATION OF AUTHORITY

TABLE 8

iY	prove	y staff make most of the day-to-day	i-
it	frequ	ecisions about their work without	i.
		A CONTRACTOR OF	

frequently do tasks that my bordinates should do.

seldom revise decisions made by Y staff.

give my library staff msiderable authority over beir work.

I I were incapacitated for six onths there is someone on my taff who could take over.

A	B	c
	.5013	
		.3667
		.3716
	3550	

with

- A: The library does NOT function smoothly when I'm gone
- B: I frequently make decisions that are part of my subs.
- C: I delegate most operations to my staff.

Chi-square with cross tabulations were calculated of the data. In this study we were interested in the exist of significant associations among the respondent character and the variables reflected by the data collected in Section and III of the survey instrument. These two sections deals how time was allocated for the various management activity delegation. Significant associations were found among for of variables. The first was a very significant associate the p = .02 level of confidence between the number of year library administrator, including that of department here assistant/associate director and the statement, "The deput heads under my leadership do NOT delegate work well to the subordinates". Those who responded in the "disagree" co were more frequently academic library directors with fewer of administrative experience. The appropriate response to statement for an effective delegator was in either one "agree" columns.

The age of the academic library director was a significant factor in two cases. The age of the respondent was a high significant factor in the number of days spent off campus at p = .0001 level of confidence. The older the director, the days he or she spent off campus attending professional meetings or work related professional meetings or work related even

a gone. y subord y subor

in Section cender was a factor in the number of hours spent on library ons dealt cenittees. At the p = .001 level of confidence, females were activitie and to have a highly significant association in the amount of mong four us spent on library committee work, with women spending more .ssociation are on this activity than men.

of years

conclusions and Recommendations

ment heat The implications for this study are that the academic the depart to their to their gree" cole th fewer parts delegation skills and for the most part, team th fewer parts oriented in their leadership styles. Their selection ponse to the top three time wasters helped to focus on those areas in er one of

isignification of time spent on committee work. As organizational incluse continues to evolve, new ways of dealing with decision was a hit wing and work flow, other than the committee, must be developed campus at or greater productivity, without the director falling back on an tor, the imoded authoritarian style. Second, the problem of taking on onal meet of much work at the same time should be addressed. This problem ated eve

could be a matter of more effective delegation; however, the results of the study, it is very likely that it has and do with identifying goals and establishing priorities. Util time management techniques can also resolve the problem of cluttered desk. Both of these latter two time wasters probably the outgrowth of a bureaucratic organization, such the university, where committees proliferate.

Additional research into these assumptions should be can out, including the effects of training decision making group group dynamics. A replication of this study with other group may also prove useful.

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IITLE: RELATIONSHIPS AMONG TEXT FORMAT URBIABLES IN COMPUTER-GENERATED TEXT

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Relationships Among Text Format Variables

in Computer-Generated Text

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A Paper Presented at the Annual Conference of the Association for Educational Communications and Technology Research and Theory Division Las Vegas, Nevada January 1985

Abstract

Relationships among Text Format Variables in

Computer-Generated Text

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Several text format variables were examined in an experiment to identify the ways in which these variables, under specific design combinations, interacted. Text format variables are those elements used to create legible instructional text. The variables examined in this study include heading location (embedded or isolated), line length (long or short), space between lines (single or double). paragraph indication (indented or spaced), use of running heads (present or absent), and directive cues (present or absent).

Sixty-four computer text types were designed using all possible combinations of the six bivariate text format variables. The text types were presented to the subjects, who sorted them into seven normally distributed categories (Q-sort procedure) based upon their perceived study-ability. Study-ability was operationally defined as the rating assigned by participants to models of computer-generated text based on the perceived ease with which a text model could be read and studied as if the model were actual text. Data from the Q-sort were analyzed via a 6-way repeated measures analysis of variance. Two significant (p <.01) 5-way interactions were interpreted.

Results suggested several text design considerations. The presence of a running head was a preferred design consideration and its interaction with the other variables usually served to improve the study-ability rating of the text type. The presence of directive ties is also a preferred design condition, tending to improve the fating. While double spaced text was preferred, a single spaced text with running head and/or directive cues would be preferred more than a double spaced version without running head or directive cues. The location of headings had the greatest affect on the ratings, probably because it had the most noticeable effect on the image of the text. though its affect on ratings was unpredictable. The more organized and structured appearance of the spaced paragraph condition probably combined with the running head and directive cue conditions to produce a more study-able appearing screen. Line length did not appear to be a significant factor in the study-ability ratings. though all things being equal, short lines were preferred.

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Problem Summary

Text format variables are components used to create legible instructional text. Some examples of text elements used within the realm of a cathode ray tube display (CRT) include headings, illustrations, line length, leading between lines, kern between letters, paragraph indication, the use of running heads, heading location, directive cues, type style, type size, empty space, and graphic devices.

Initially, legible text was thought to be a function of the size and style of type, therefore research concentrated on the effects of individual symbols upon visibility and recognizability. A symbol considered visible was considered legible. But, as more was learned about the processes of cognition and reading, the overall comprehensibility of instructional text was considered an important element of legibility. Legible pages or screens should designed to look like a collection of ideas, organized and understandable, rathe than like a collection of letters; they must flow, and be interpretable as well visible and recognizable (Ryder, 1979). However, there exist no formal guidelines for the design of screen layouts. This experiment investigated the manner in which several text elements interacted when specific arrangements were judged by perceivers.

Research into combinations of text elements presents unique methodological problems for, there is almost an infinite variety of text element combinations. For example, a researcher may compare three type sizes, two line lengths, three types of directive cues, two heading locations, two paragraph indications, three graphic organizers, and two conditions of running heads creating a 3 X 2 X 3 X 2 X 2 X 3 X 2 design with 432 different stimulus combinations--not to mention the implications of performing a 7-way analysis of variance.

In an effort to reduce the number of variables to a manageable, vet realistic number, the chosen text elements were leading, directive cues, paragraph indication, running heads, heading location, and lime length.

-----Insert Table | here.-----

Loding

teding was defined as the quantity of empty space between lines of For "paper" publications, Tinker (1965) suggested that under conditions, in terms of both line length and type size, the reading between lines be approximately 1.0 and 1.25 point between the bottom of the descender from the upper line and the top of the scender from the lower line. Hartley (1978) stated that the leading should be equal to the spacing between words, an amount similar to Tinker's suggestion. The key here is "optimal conditions," for when times are extremely long more leading is required (Tinker, 1963).

is ORT display research, Kolers, Duchincky, and Ferguson (1981) found that double spacing between lines of text on a CRT marginally increased reading speed over single spacing. However, they also found that reading single spaced text required less occular effort. because more densely packed text requires smaller and fewer eye muscle movements. Grabinger (1984, 1985) found that perceivers preferred double spaced text; but, this preference was not clear cut and appeared to interact with other text element variables. The two values investigated were single spacing (S1) and double spacing (S2).

Line Length

with regard to line length as a format variable, Turnbull and Baird (1964) recommended that lines of text be between 26 to 65 characters Iong for a given style and size for paper displays. Keenan's (1981) research with CRT displays supports this. Keenan used a computer to extermine the optimal line length in terms of meaningful phrase units for different readability levels and found that line lengths in the vicinity of 45 to 55 characters maintain the integrity of the greatest number of idea units. Yet, despite this research designers often persist in long lines of text. The two conditions investigated were 60 (LL) and 40 (SL) character lines. Both conditions fall within CRT and paper standards, yet are different enough to create distinct differences among the images.

Directive Cues

The use of directive cues is one of the few format elements that has Ned a positive effect on some types learning in both paper and CRT investigations. Cues such as underlining, upper case letters, or multicolored text have improved recognition and recall tasks when sed sparingly and related to desired outcomes (Christ, 1975, 1977; Martley, Bartlett, and Branthwaite, 1980; Tullis, 1981). Perceiver feactions to directive cues are harder to describe. When examined alone, directive cues appeared to have little affect on preferences expressed by participants; yet, in combination with other text elements the cues contributed to the appearance of well organized and structured designs (Grabinger, 1984, 1985). Since a wide variety of cues have been found to be effective, the main questions are related to whether cues are present or not and how they relate to other format variables. The two conditions investigated were Cues Present (CP) or Cues Not present (CN).

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Paragraph Indication

The shape of the text on the page or screen can be changed quite noticeably through paragraph spacing and indentation. Efforts to complicated indenting patterns to represent the structure of the on paper displays have not improved retention or recall under more circumstances (Frase and Schwartz, 1979; Hartley, 1980; Shebilske Rotondo, 1981). However, it has also been found that readers' des preferences are affected by spatial changes such as paragraph indication (Siskind, 1979), partly because the text may look more organized and structured (Grabinger, 1984). The use of spatial can is a highly visible format factor so two conditions were investigated: increased use of white space (PS) (double or triple spacing between paragraphs) and traditional indentation (PI).

Running Heads

Heines (1984) recommended the use of a format variable called hypertext, or running head, to help keep readers apprised of their location in a lesson, the lesson content, their progress, and essential computer commands. A running head is recommended becaus CRT text pages are short, change frequently, and the nature of a b lesson often prevents easily flipping ahead or backward. The run heads are usually placed along the top or bottom of the screen. though may also be found along the sides. Operationally, this variable took two forms: present (RH) or absent (RHN).

Heading Location

Heading location was the final variable included in the investigation. While, the use of headings, particularly in questa form, has facilitated learning (Hartley and Trueman, 1982; Holley, 1981) the location of the headings affect the appearance of organization and structure of the page. Since, the presence of headings has facilitated learning it was decided to test two conditions that affect the appearance of the screen: headings were either embedded in the text (HE) or isolated in a separate column (HI).

Research Questions

Several hypotheses could be listed that would predict the effect of one variable and one condition on another. However, the purpose of this study was to explore the way or ways in which these variables interact together. The purpose is analogous to examining the Gesta of the screen, to inspecting the affect of the whole as a sum of 10 parts. The purpose of instructional text is to provide material tw will promote learning; therefore, instructional text is intended to facilitate an interactive cycle between the learner and the stimulus. The basic problem is the identification of combinations text element variables that can be constructed or shaped or molded text designers or CAI writers in ways that facilitate the learning process. Or, how do specific combinations of variables effect each other?

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effect of purpose of variables the Gestall sum of its aterial that ntended to he binations of primolded by learning fect each A rinst step in answering that question was to determine the mitial preference reaction of a potential reader to specific text mitial why examine preferences, especially since preferences are unrelated to such tasks as recall or retention? First, Tinker and Paterson (1942) found that legibility was positively related to a material judged pleasingness of the text. Tinker (1965) also found that readers seldom preferred a text design of less than optimal that readers seldom preferred a text design of less than optimal that readers when students were more likely to purchase textbooks with invariant of when students were more likely to purchase textbooks with invariant of than same textbook without illustrations.

second reason for using preferences as a starting base is the nature of the perceptual cycle. If it is accepted that legibility is more than the recognizability of a symbol, then the whole cognitive cycle (Neisser, 1976) provides ground for research. The combinations of the text elements becomes more important that the individual symbols, because the potential affect of the initial perception of the document upon a reader's schema. The reader may have particular study or reading strategies that are activated by specific combinations of format variables

in conclusion, it was proposed that an examination of a "whole" would shed more light on the "parts" than an examination of each part separately. The variables chosen for study cover a range of design decisions from the placement of white space to cues that emphasize particular words. Highly organized and controlled designs were compared in an effort to identify ways text format variables interacted.

Methodology

This was an opportunity sample composed of 31 undergraduate student volunteers, all single, between the ages of 20 and 25, United States citizens, and predominately female.

Materials

Sample

Sixty-four computer text types (see Appendix A for samples) were designed through the use of different combinations of six bivariate format variables. To avoid confounding the treatment with contextual factors the text types were designed using the notation method (Twyman, 1981). In place of actual text, "X"s were used to represent the bulk of the print on a page: "O"s to reflect the occurrences of Italics, upper case, bold type, color, headings, or reverse type; and "I"s as a tertiary graphic unit to represent something particularly unique in style. As a result of participant comments in the Grabinger. 1984 study the standard use of the notation method was altered slightly by incorporating spaces to make groups of "X"s look more like words in actual text. Although it can be suggested that the use of the notation system reduces ecological validity, it is argued here that its use emphasizes the image of the page as whole visual entity. Each page was designed on an IBM PC computer with the Aultimate word processor program. The stimuli pages were printed on a dot-matrix printer, enlarged on a photocopy machine, and animated for durability.

Eliciting Preferences

The text types were presented to the subjects together with discriminating and sorting instructions to elicit perceptions about their study-ability. Study-ability was operationally defined as the rating assigned by participants to models of computer-generated text based on the perceived ease with which a text model could be read and studied as if the model were actual text. Inter

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Utilizing recorded instructions (see Appendix B), subjects were as to perform an unstructured Q-sort of the 64 text types or stimuli The Q-methodology was used because of its usefulness in exploratory research. in turning up new ideas and hypotheses (Kerlinger, 1973) Subjects sorted the stimuli into seven piles in quantities that reflected a normal distribution. In this sorting procedure, the retexts perceived to be the highest in study-ability were placed in pile 1. while those four perceived to be the lowest were placed in pile 7. From the remainder of the text types, those eight believes to be the highest in study-ability were placed in pile 2 and those eight considered to be of the lowest in pile 6. The forty stimuli left over were allocated among the remaining inner three piles with the 12 believed to be the highest in study-ability placed in piles and the 12 lowest in pile 5. The remaining 16 were placed in the middle or fourth pile. After completion of the sorting task the participant was interviewed about the criteria used during the task Responses were written down by the experimenter. Participants were shown the first pile and asked. "Why did you rate these the highest on the study-ability factor?" Then, they were shown their seventh pile and asked, "Why did you rate these the lowest?"

Results

The matrix presented in Table 2 depicts the raw data arrangements of 64 CRT text types generated by the sortings of the subjects in the sample. A single value in each column is a rating of the relative study-ability of the respective text as perceived by the particular subject, represented in the row of the matrix. This data was analyzed via a repeated measures analysis of variance (BMDP, 1981) A conservative .01 level of significance (suggested by Kerlinger, 1973) was accepted to offset the the dependence that may result and stimuli during the Q-sort. The main ANOVA results are presented in Table 3.

-----Insert Table 2 here.-----

-----Insert Table 3 here.-----

The primary ANOVA produced two significant interactions among the text element variables for further analysis. These were the "runnin head by heading location by cues by spacing between lines by line length" interaction (RHCSL) and the "running head by cues by spacing by line length by paragraph indication" (RCSLP) interaction.

one way of analyzing a multiple interaction is by isolating the interactions at each level or order (Keppel, 1982). In this way we an look at each variable under constant conditions. This, in turn, produces a set of marginal means that may be used to graph the information in a way that allows one to spatially inspect the results. This is accomplished via further ANOVAs. For example, the First step in the RHCSL analysis was to determine which condition of the Line Length variable was interacting with the other variables. WOVAS were run holding the conditions of RHCS variables constant oder both Line Length conditions finding that the short line length (L5) value contributed to the interaction (see Figure 1). Next, touble and Single Spacing were compared while holding RHCL constant. This process was continued for all five variables in the interaction. The ANOVA tables are not printed because there are several hundred. The results of this "slicing-off" process for both five-way interactions are presented in Figure 1.

-----Insert Figure 1 here.-----

-----Insert Table 4 here.----

RHCSL Interaction

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The variable conditions running head present (RH). directive cues present (CP), single spacing (S1), short lines (LS), and embedded mendings (HE) contributed to the interaction. This in itself tells little, but by taking the marginal means of the study-ability ratings. (see Table 4) the interaction can be "mapped out" in a series of graphs to aid interpretation (see Figure 2). By comparing the graphs of the RHCSL interaction the following statements can be made:

----- Insert Figure 2 here.----

- The presence of a running head in a design was always preferred over the same design with no running head (Figures 2a to 2h).
- The presence of directive cues were preferred over no directive cues (compare 2a and 2b, 2c and 2d, 2e and 2f, and 2g and 2h).
- 3. Short lines were preferred over long lines (compare 2a and 2e, 2b and 2f, 2c and 2g, and 2d and 2h).
- Double spacing was usually preferred over single spacing (compare 2a and 2c, 2b and 2d, 2e and 2g, and 2f and 2h).
- 5. Generally, it seems that isolated headings and directive cues work together to produce favorable designs. It seems that directive cues played an important role with the heading location. Designs using both directive cues (CP) and isolated headings (HI) were favored over those with embedded headings (HE) and directive cues (Figures 2a, 2c, and 2e). However, when directive cues were not present (CN) the embedded heading designs were preferred over the isolated heading designs (Figures 2b, 2d, 2f, and 2h).

- 6. The interaction of heading location with the running head condition is difficult to predict. The most visible change in a design combination is found in Figure 2e. The blend of isolated heading, running head, cues, single spacing and long lines was significantly preferred over designs with embedded headings, with and without running head. However, in Figure 2d the isolated heading condition combines with the no running head (RHN) condition to improve the appearance of the design.
- Though, comparison of Figures 2e and 2g show that isolated headings were favored in a single spaced layout while in the same layout with double spacing embedded headings were preferred.
- The most preferred design combination was composed of running heads, isolated headings, cues, double spacing and long line (see Figure 2c).
- The least preferred design combination was composed of no running heads, isolated headings, no cues, single spacing, and short lines (see Figure 2f).

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RCSLP Interaction

The significant variables found in the RCSLP interaction were running heads present, directive cues present and absent, single spacing, long lines, and indented paragraphs (see Figure 1). The following statements can be made about the variables, based on Figure 3:

-----lnsert Figure 3 here.-----

- Designs with a running head (RH) were always preferred over designs with no running heads (RHN) (Figures 3a to 3h).
- Double spacing (S2) was preferred over single spacing (S1) (compare 3a and 3b, 3c and 3d, 3e and 3f, and 3g and 3h). Note especially graphs 3c and 3d where the spacing between lines has a dramatic effect under the running head (RH), short line (LS) indented paragraph condition (P1).
- Spaced paragraphs (PS) were preferred over indented paragraphs (PI) (compare 3a and 3e. 3b and 3f. 3c and 3g. # 3d and 3h).
- There seemed to be a general preference for long lines (LL) over short lines (LS) (compare 3a and 3c. 3b and 3d. 3e and 3g. and 3f and 3h).

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The presence of directive cues (CP) was preferred over the no cue condition (CN) (compare graphs 3a through 3h). Figures 3a, 3c, 3e, 3g, and 3h show the significant effect of cues over no cues. The cues seemed especially sensitive to the running head condition (CP-RHN). When the both cues and running heads were absent from designs the disapproval went up further than when the running head was present without cues (CN-RH) (Figures 3a, 3c, 3d, and 3h).

6. In Figures 3d and 3e the absence of a running head had far greater impact on the design than did the absence of cues under double spacing, short lines, and indented paragraph combination.

 The most preferred design combination included running heads. cues, double spacing, long lines, and spaced paragraphs (see Figure 3f).

8. The least preferred design combination included no running heads, no cues, single spacing, short lines and indented paragraphs (see Figure 3c).

Discussion

in terms of study-ability preferences for images of text, the implications for design are many. However, since the effect of these 1 Funning resigns on achievement has not yet been established no generalization In that direction should be made. owing

The use of a running head is one of the most stable results of the study. No design combination without a running head was preferred over designs with a running head. Although it interacted with other variables in affecting preference its interaction was always in a d over positive direction.

The presence of cues as a preferred element in text design was also a (51) fairly stable influence. The use of cues seemed to improve the 3h). Rudy-ability rating in all situations except one (Figure 3d. running tween Med (RH) line). It could be that that particular combination produced the simplest and most spacious design, looking very easy to H), read and study.

Mother fairly consistent trend was found in the preference for Double spaced text over single spaced text. However, upon 3g. 300 tranination of the interactions it was found that spacing was easily influenced by other factors. For example, the absence of a running Mad had greater impact on the study-ability rating than did spacing 3 (LU) When comparing Figures 3g and 3h (compare the RHN dot in each 3e and Staph). While subjects probably preferred the more spacious look of duble spaced text, the spacing of the text did not seem as important in making a study-ability judgment as cues or running heads. This suggests that design features that affect the organization and hierarchical structure of the text are more important than the appearance of spaciousness.

Long lines were preferred over short lines, though this did not set to be a strong preference. Figure 2 shows this to a greater extenthan Figure 3. This is probably due to the heading location conditions in Figure 2 which may have emphasized the difference between the two line length conditions.

The usual interaction between line length and line spacing did not seem to occur. This may be explained by the narrow difference between the two line length conditions since, both the 40 character line and 60 character line fell within legibility recommendations.

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The affect of the heading conditions was widely variable. This may be due to the radical effect heading position has on the text design since it changes the margins, body of the text, and overall image more than any other change.

The affect of paragraph indication is consistent, though not great, Generally the spaced paragraph condition was preferred over indentes paragraphs. Its interaction with other variables was positive but slight. The only unusual incident is seen in Figures 3a and 3e. Here the paragraph condition appears to interact with cues and running heads. In Figure 3a there is a wide difference between cues present and the two running head conditions. Figure 3e shows a wide disparity between the two running head conditions in the no cues condition. The more organized and structured appearance of the spaced paragraph condition probably combines with the running head and directive cues to produce a more study-able appearing screen.

Conclusion

Generally, although the variables discussed combine to interact where influencing preference for studying they are for the most part predictable. A designer that followed a practice of utilizing running heads as general organizers, spaced paragraphs, and a few directive cues for emphasis would probably create pages or screens that produce a more positive opinion about study-ability within potential readers. Though the most preferred design in the RHCSL interaction had isolated headings, the position of headings is probably not as critical. The effect of no headings on a study-ability rating would probably be greater. While it appears that readers prefer double spacing and long lines, these factors dif not appear to contribute as much to the study-ability of the document as the other variables.

While preference is related to legibility, the ultimate test is learning. Remaining questions include the effect of these designs of learning and the activation of learning strategies.
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Appendix A: Stimuli Samples

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Appendix B

Instructions to the Subjects

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You will examine several models of computer-generated text. These are models of text that may be seen on computer television screens men using computer-assisted instruction.

Before you begin, look at some of the text models in front of you. Note that they are composed of "X"s and "O"s. The "X"s represent the body of the text. The "O"s represent words that are special, such as headings or subheadings. On some of the models you will see three sets of "X"s that are darker than the rest of the text. These dark sets of "X"s represent words that may be in italics, bold type, or underlined. Finally, some of the models have a box at the top of the page. This box is called hypertext and contains a summary of the content of the lesson and a list of computer commands that may help the learner during the lesson.

When you examine the text models evaluate each model on a factor called "study-ability." "Study-ability" refers to both readability and learning characteristics. For example, a text model with a high "study-ability" factor would appear easy to read and easy to study. On the other hand, a text model with a low "study-ability" factor would appear hard to read and hard to study. You are the judge of what appears easy or hard to read and study. There is no right or wrong answer. The best answer is whatever you decide. Look at each model and ask yourself, "If this were actual text would I find this style easy to read and study or hard to read and study?"

Sort the 64 models of computer-generated text into seven piles according to the "study-ability" factor. Remember to base your Judgements on how easy the model appears to study as if the model were actual text. Use the sorting procedure described as follows:

In Pile No. 1, place the 4 text models that have the highest "study-ability" factor. In Pile No. 7, place the 4 text models that have the lowest "study-ability" factor. One way to do this is to go through the text models sorting them into high, medium, and low "study-ability" piles. Then return to the "high" pile and find the four with the highest "study-ability" rating and place them in Pile No. 1. Then, go to the "low" pile and find the four with the lowest "study-ability" rating and place them in Pile No. 7.

After placing models in pile numbers 1 and 7 there will be 56 models left. Place all of the models together and repeat the sorting procedure. Place the 8 with the highest "study-ability" rating in Pile No. 2 and the 8 with the lowest "study-ability" rating in Pile No. 5.

Then there will be 40 text models remaining. Place all of the models together again and re-sort them. From these 40 models place the 12 with highest "study-ability" rating in Pile No. 3 and the 12 with lowest rating in Pile No. 5.

There will then be 16 models left and they are all placed in Pile No. 4.

The number of the text models to be placed in each pile also appears on the pile identification cards on the table in front of you. you may rearrange the models until you are satisfied with the placement, but make sure you place the specified number of text models in each pile.

you may refer to these instructions or ask the experimenter to help whenever you wish. Finally, remember to judge each model on a easy it appears to study as if it were actual text. 11 placed in

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Table 1

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Leading:

Variables Used in Stimuli Design

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	(S2) double spacing
Directive Cues:	(CN) no directive cues present
4.3	(CP) directive cues present
Paragraph Indication:	(PI) indented paragraph
3	(PS) spaced paragraph
Running Head:	(RHN) no hypertext present
	(RH) hypertext present
Heading Position:	(HE) embedded headings
	(HI) isolated headings
Line Length:	(LL) long (60 character) line
	(SL) short (40 character) line

Table 2

Raw Data Matrix

Subjects

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Text	2	- 2	2	1	1	2	5	4	1	- 3	2	2	3	4	2	2	1	2	2	4	2	4	1	2	2	2	6	5	2	15	8
Text	2	2	5	ó	2	4	7	5	5	4	6	5	3	2	1	ó	6	5	4	4	3	5	2	4	2	2	7	6	0	5	19
Text	4	3	2	7	1	6	ò	6	2	1	4	5	3	5	4	7	7	3	3	5	2	á	2	4	2	2	7	6	3	1	
Text	5	2	1	4	3	4	4	2	6	3	5	1	2	2	1	6	3	1	2	2	7	1	3	1	2	2	3	5	4	2	10
Text	6	2	3	3	3	2	5	3	5	1	4	1	2	2	2	5	2	1	2	3	3	2	3	1	2	2	4	5	4	1	30
Text	7	2	5	4	2	3	5	1	5	3	5	4	1	6	1	7	3	2	3	2	3	2	3	4	2	2	4	2	3	1	
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Test	10	4	3	3	1	2	5	2	1	3	2	2	5	3	4	2	1	2	3	5	4	5	3	4	5	3	5	2	3	3	200
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Text	13	4	4	5	4	5	4	3	6	5	4	1	4	4	3	4	3	4	2	4	4	1	4	3	5	4	2	5	1	3	28
Text	14	4	3	3	3	3	5	2	5	5	3	2	5	3	4	3	2	3	3	4	5	3	3	3	5	3	3	5	3	3	200
Text	15	4	3	4	4	3	5	1	3	4	5	4	5	5	4	6	4	3	4	3	5	3	3	5	5	4	3	4	1	2	20.0
Text	16	4	4	4	4	2	4	3	5	3	3	4	4	5	5	3	4	3	4	3	4	5	3	5	5	3	3	3	4	2	130
Test	17	2	1	1	3	1	3	4	1	3	3	2	1	1	2	5	3	2	1	3	2	4	1	3	2	1	6	1	3	4	11
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Text	19	2	4	2	3	2	4	4	2	4	7	5	3	4	2	3	5	1	4	5	1	7	1	6	3	2	7	4	7	-	43
Text	20	2	1	2	4	1	4	4	3	3	4	5	3	4	3	5	5	3	3	3	1	6	2	4	2	1	7	1	2	3	210
Text	21	1	1	4	3	3	1	3	ò	1	4	1	3	3	2	7	4	3	1	1	2	1	2	2	1	3	4	2	5	4	11
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Text	23	1	5	6	5	2	2	3	7	4	5	4	3	6	3	7	4	5	2	1	1	3	2	5	1	3	4	4	4	4	20
Text	24	1	5	6	4	3	3	1	4	7	7	4	3	6	3	5	5	3	1	1	1	3	1	4	1	1	4	2	5	5	150
Text	25	4	6	6	6	4	3	7	5	á	4	3	á	3	5	5	4	4	3	6	3	4	4	4	4	4	5	3	5	5	41
Text	26	4	2	2	2	1	3	4	1	4	3	3	5	2	4	4	3	2	3	5	3	5	3	1	4	3	0	1	3	4	12
Text	27	4	ò	6	5	4	4	7	3	7	5	-	4	5	4	4	7	3	4	6	3	4	4		4	4	6	5		4	225
Text	28	4	2	2	4	1	4	4	3	4	3	6	5	4	6	2	é	3	4	5	3	7	4	6	4	3	6	3	2	-	25
Text	29	4	4	5	4	3	1	4	4	5	3	2	. 4	3	4	6	3	3	2	4	2	2	1	5	4	4	3	4	5	4	188
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Text 49		5	5	6	6	2	6	3	5	4	5	4	2	4	4	4	5	5	2	3	1	4	3	4	5	5	4	4	7	2	5
Test 50	3	4	3	1	5	2	2	2	2	2	5	4	1	2	4	3	4	4	2	3	5	4	2	1	1	5	1	3	2	2	2
Test 51	3	0	3	1	0	1	0	1	3	0	1	5	0	1	3	1	3	0	5	1	0	3	0	1	3	10	1	1	0	1	-
Tert 52		-	1	0	2	1	1	4	3 6	3	0	3	-	0	3	ð,	1	0	3	1	0	1	4	1	1	0	-	1	3	3	-
Cent SJ	-	-	-	4	1	1	-	1	4	1		1	2	2	0	5	1	1	4	3	4	1	4	3	-	2	1	0	1	3	1
Tant CC	Ę.	-	3	-	1	-	2	3	-	4	1	-	1	3	-	2	2	2	-	1	-	2	1	-	1	-	3	2	2	3	1
lert St	T	-	2	6	1	-	5	1	:	3	2	-	0	3	3		2	3	1	-	5	9	0		-	1	3	-	2	1	0
fest 57	e.	7	4	4	3		5	1	*	0	-	4	1	1	2		-	-	1	1	-		-	3	1	-	:	5	-	2	-
Int Se	5	+	-	0	4	2	1	0	-	-	5	0		0	2	-		5	0	-	1		5	9	6	1	3		2	2	-
lext 59	0	1	3	7	-	1	-	-	7	4	7		-	7	-	3 7	1	3		-	1		-	-	7	1	-	,	;	0	
Int 60	6	1	1	2		1	1	-	1	4	1	0	0	-	2 5	1	0	1	0	0 5	7	4	5	3 6	e	1	-	2	1		-
lest 61	5	1	1	5	3	1	•	1	8	2		0	1	0	-	1	0	0 4	0	-	1	ę	1	4	2	1	2	-	-	-	-
Int 42	5	3	4	1	1	-	-			1	4	1	1	1	1	1		-	-		- 2	1	1	4	-	î	1	1	1	0	-
int as	6	7	5	7	4	2		7	1		1	5	i	7	ì		7		1	4	1	1	-	4	-	2	-	4	5	5	
Pet La	12	1		2	1	1	-	1	-	1		. "	1	-	1	1	-		1	1	1	್	-		1	2	1	1	1	1	1

Table 3

Repeated Measures ANOVA of CRT Text Models

So	urce	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
1	Mean	31720.00454	1	31720.00454	6992498.00	0.000
1	Error	0.13609	30	0.00454	04440455650	
	RngHd	373.64970	1	373.64970	21.42	0.0001
2	Error	523.30343	30	17.44345		
	Hdngs	0.84728	1	0.84728	0.07	0.788
5	Error	347.66835	20	11.58894		
	RngHd I Hdngs	0.18196	1	0,18196	0.24	0.629
6	Error	23.02117	30	0.76737		
3	Cues	236.50454	1	236.50454	15.28	0.000
5	Error	464.44859	30	15.48162		
	RngHd I Cues	0.36744	1	0.36744	0.43	0.516
5	Error	25.52319	20	0.85077		
	Hdngs I Cues	13.72228	1	13.72228	12.16	0.001
7	Error	33.85585	30	1.12853		
	RngHd I Hdngs I Cues	2.00050	1	2.00050	2.25	0.143
8	Error	25.64012	30	0.88800		
	Spcg	64.23841	1	64.23841	4.50	0.042
9	Error	428.65222	30	14.28841		
	RngHd I Spca	4.35937	1	4.35937	4.61	0.039
10	Error	28.34375	30	0.94479		
	Hdngs I Spcg	5.77967	1	5.77067	3.19	0.084
11	Error	54.24496	30	1.80817		
	RngHd I Hdngs I Spcg	0.84728	1	0.84728	0.74	0.340
12	Error	27.10585	30	0.90353		
	Cues I Spcg	0.48437	1	0.48437	0.47	0.529
13	Error	35.96875	30	1.19896		
J	RngHd I Cues I Spcg	0.00050	1	0.00050	0.00	0.976
4	Error	16.89012	20	0.56300		
	Hdngs I Cues I Spcg	2.39970	1	2.39970	3.44	0.073
15	Error	20.92843	20	0.69761		
	RngHd I Hdngs I Cues I	Spcg 2.00050	1	2.00050	2.91	0.098
16	Error	20.54012	50	0.68800		

Table 3 (continued)

lext Models		Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Tell	See to					
Preh	Leta	237.88760	1	237.88760	27.55	0.0000
	u Errur	259.00302	20	8.63343		
8.00 0.0000	and the second se	0.48437	1	0.48437	0.45	0.5070
	logit t Lata	32,21875	30	1.07396	** 14	
	a terar					
.42 0.0001	seens 1 Loth	19.96018	1	19.96018	9.40	0.0046
	in Error	63.68044	20	2.12268		
.07 0 7007	STREET, STREET					
	model I Hongs I Loth	4.17389	1	4.17389	10.30	0.0032
	18 Errar	12.15423	30	0.40514		
.24 0.6298	And I lath	. 0 42389		0 47789	0.51	0 4915
	Cors : cycn	25.02923	10	0.83431	0.01	V. 1013
	1 tun	10102/20				
.28 0.0005	Racht I Cues I Loth	0.93196	1	0.93196	1.19	0.2837
	12 Error	23.45867	30	0.78196		
12 1 510	R REPORTS					
45 0.3161	Hongs I Cues I Lgth	1.52470	1	1.52470	3.01	0.0928
	11 Error	15.17843	30	0.50595		
16 0.0015	Bartist & Melane & Dune &	Lath 0 00454		0 00454	0.01	0.0000
	It freer	17 24109	10	0.00434	0.01	0.4200
		15.20101	30	0.11201		
25 0.1438	Spcg 1 Lgth	12.74244	1	12.74244	8.96	0.0055
	21 Error	42.64819	30	1.42161	0.000	
50 0 0174						
30 0.0424	ingao I Spcg I Lgth	0.26663	1	0.26663	0.55	0.4624
	to Error	14.43649	20	0.48122		
1 0.0399	Hires 1 Sonn 1 Lath	74 47104	12	31 47191	14.11	
	I Error	49 70947	0.7	1 14079	10.11	0.0004
		41120001	30	1.04027		
9 0.0841	Raghd I Hdngs I Spcg I	Loth 1.11341	1	1.11341	2.31	0.1391
	a tror	14.46472	30	0.48216	68884	1920
·	A David					
• 0.3408	P Free	0.31502	1	0.31502	0.60	0.4430
		15.63810	30	0.52127		
0.5299	Fauld & Court & Save & A					
	To Error	.gth 0.024/0	1	0.024/0	0.05	0.8613
	Contraction of the second s	23.86343	20	0.74353		
0.9763	Hangs I Cues I Soco 1 1	oth 0.26663	1	0.26463	0.30	0.5861
	a trror	26.43649	30	0.88122		410000
	1.					
0.0735	D Street C & S x L	2.98841	1	2,98841	7.78	0.0091
	a uror	11.52722	30	0.38424		
0.0985	CONTRACT		0.00 2000			
414104	A NOT A STATE OF		293	3		

Table 3 (continued)

Source	Sums of Squares	Degrees of Freedom	Mean Square	F	Tail Prob.
Para	136.81502	· 1	136.81502	18.81	0.000
33 Error	218.13810	30	7.27127		
RngHd I Para	9.46018	1	9.46018	10.89	0.007
34 Error	26.05544	30	0.86851		
Hdngs I Para	0.31502	1	0.31502	0.25	0.617
35 Error	37,13810	30	1.23794		
RngHd I Hdngs I Para	0.69002	1	0.69002	0.95	0.336
36 Error	21.70060	30	0.72335		
Cues I Para	5.14163	1	5.14163	5.53	0.025
37 Error	27.87399	30	0.92913		
RngHd I Cues I Para	2.26260	1	2.26260	2.72	0.109
38 Error	24.94052	30	0.83135		
Hdngs I Cues I Para	1.63760	1	1.63760	2.91	0.098
39 Error	15.87802	30	0.56260		
RngHd I Hdngs I Cues I	Para 3.47228	1	3.47228	5.52	0.025
40 Error	18.85585	30	0.62853		
Spcg I Para	57.24244	1	57.24244	15.96	0.000
41 Error	107.58569	20	3.58619		
RngHd I Spcg I Para	2.68599	1	2.68599	6.34	0.017
42 Error	12.70464	30	0.42349		
Hdngs I Spcg I Para	0.01260	1	0.01250	0.01	0.919
43 Error	36.56552	30	1.21985		
RngHd I Hdngs I Spcg I	Fara 0.54889	1	0.54839	1.47	0.235
44 Error	11.21673	30	0.37389		
Cues I Spcg I Para	3.30696	1	3.30670	4.04	0.053
45 Error	24.58357	30	0.81946		
RngHd I Cues I Spcg i P	ara 12.74244	1	12.74244	25.77	¢.000
46 Error	14.83569	36	0,49452		
Hdngs & Cues I Spcg & P	ara 0.54889	1	0.54887	1.63	6.211
47 Error	10.09137	26	0.53639		
A = H x C x S < P	4.17389	1	4.1735=	5.10	0.031
48 Errer	24.52925	30	.617c4		

Table 3 (continued)

Tail Prob.	Serta	Sues of Squares	Degrees of Freedom	Hean Square	F	Tail Prob.
0.0001		2.00050	1	2.00050	1.92	0.1765
	in Error	31.32762	20	1.04425	12264	
0.0025	mut 1 Loth 1 Para	0.02470	1	0.02470	0.05	0.8290
	3 Error	15.61593	20	0.52053		
0.6176	among 1 Loth I Para	5.77057	1	5.77067	7.72	0.0093
	si Gror	22.43246	20	0.74775		
3365	seeted I Hongs I Loth I Par	a 1.21018	1	1.21018	3.75	0.0623
	12 Error	9.68044	20	0.32268		
0.0254	for 1 Joth 1 Para	2,12954	1	2,12954	3.19	0.0841
	SI Error	20.01109	30	0.66704		
1001	mult I Cues I Loth I Para	1.11341	1	1.11341	1.45	0.2372
. 1074	S Errar	22.96472	30	0.76549		
0007	Manes & Gues I Leth I Para	3.30696	1	3,30696	8,30	0.0073
.0483	11 Error	11.95867	30	0.39862		
.0255	RAH 2 C X L X P	0.93196	1	0.93196	1.94	0.1737
	Sk Error	14.39617	20	0.47987		
0004	Socg 1 Loth I Para	6.21018	1	5.21016	4.74	0.0373
-	S Error	39.24294	20	1.30810		
0174	Reght I Socg I Loth I Para	2.00050	1	2.00050	4.70	0.0382
	S bro	12.76512	20	0.42550		
3107	Maras I Soco I Loth I Para	2.00050	1	2,00050	3.19	0.0843
1117	5 Gra	18.82722	30	0.62759		
	RERESELEP.	0.42389	1	0.42389	0.61	0.4406
	40 Error	20.84173	30	0.69472	69033	
053e	Cues I Socg I Loth I Para	0.06099	1	0.06099	0.14	0.7097
	an Cirtor	12,95464	20	0.43182		
0000	S x C x S x L x P	4.94002	1	4.94002	7.55	0.0043
		15.51310	30	0.51710		
	HICISELEP	1 47740	10	1 41750	2.79	0 1411
1115	W Error	21.50302	30	ú.71577		v. 1411
315	REH: CESILEP	0.61744	1	0.61744	1.21	0.2805
1	C. C.	15.33569	30	0.51119		

Figure 1

Variable Conditions and Interactions

Conditions	RHCSL	RCSLP	
Running Head: present (RH) absent (RHN)	x	x	
Directive Cues: present (CP)	x	x	
absent (CN)		x	
Spacing (Leading): single (S1) double (S2)	x	x	
Line Length: long (LL) short (LS)	x	x	
Heading Location: embedded (HE) isolated (HI)	x		
Paragraph Indication: indented (PI	>		
spaced (PS)			







the other #





Figure 2d



. .



RHCSL Interaction







6.5T

6.0-

5.5-

5.0-

4.5-

4.0-

3.5-

3.0-

2.5-

HE









Figure 3a





Figure 3b

1.4







14.14



RCSLP Interaction





6.5-

6.0-

5.5-

5.0-

4.5-

4.0

3.5

3.0-

2.5-

CP







52 - LS - PS

RCSLP

Table 4

Marginal Means of Study-ability Ratings



INTE: EXTENDING GRADUATE LEVEL EDUCATION: A MANAGEMENT MODEL

AUTHORS: ROBERT L. HRLES STEPHEN B. FELT

undero EXTENDING GRADUATE LEVEL EDUCATION: A MANAGEMENT MODE are tar

by Robert L. Hales & Stephen B. Felt

Goals and Objectives

Project Goal: To develop a delivery system that is capable Dainging transferring professional, graduate-level education proc. the tr having identical content to those presented on universitien t campuses to adult audiences off campus. The model number we re inexpensive, flexible, easy to use, and capable of a high descripting P of educational transfer. audio

elacing

licional

Our original search for technology to facilitate the deliverents on system included both video and audio formats. Since matructo cassette players are not universally available, we turner pllowing HOW 1 audio cassette technology. It offered the following advanted compe for distance education: Will

Universal availability 1.

audio 2. Low cost for players and cassette tapes Will Portability, ease and convenience of use 3.

influ 4. Independence from broadcast schedules and bad weather W111 Learner control of place and time of information transfel 5.

justi

infor

It Resea We felt that these attributes would be significant in u Taical p technology as a bridge to carry courses to distant students the lea to extend the influence of our most popular and capable facult Verba

A review of the literature indicates that distance education provided by the various Open Universities, has been focuse GEMENT MOD: undergraduate level. By emphasizing the postgraduate level are targeting the needs of college alumni who are seeking itional training.

at is capably racing Interaction with Structure

cation prom the traditional classroom, patterns of interaction exist d on universeen teacher and students, and between individual students. model mutter we remove the instructor and other class members from the of a high derming process and incorporate a technological bridge (in this

audio cassettes) we are taking away the interaction and macing it with structure. We are interested in exploring the ste the deliverts on learning when the interaction between students and
Since vistructor is not present. We are looking for answers to the e, we turne lowing questions:

wing advants How is this type of learning experience going to compare or compete with personal classroom instruction?

Will the adult professional be motivated by a prerecorded audiotape of graduate level course work?

Will the lack of a regularly scheduled class meeting time influence the students ability to pace themselves.

ion transfer

ransfe: Will the educational value of the course be sufficient to justify offering university credit?

icant in us at Research has to say about Rapport and Pacing

nt students.^{Taical} proximity of instructor to learner has a causal effect pable facult^{the learning} relationship in at least three ways:

Verbal and non-verbal clues facilitate the interpretation of information.

en focused

 Rapport with instructor affects the intensity with which student participates in the learning process.

What

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mality

 Pacing, through regular instructor contact, directs toward regular achievement.

Audiotapes transfer only the audible clues through module. The experimental model and testing data is designed to inclute the effectiveness of the information transfer. In this model only element of pacing is provided in the deadlines for her in assignments, and contact with proctors.

Significant to this experiment is our capture of the and one on classroom experience on the audiotape rather than a dramating or special version recorded by professional readers. We this will add credibility to the course and make it more and table to universities.

There is some indication in the literature of rapport to vicariously attributed to the tape. A survey has been created obtain data on what rapport exists as a result of this count and what importance the expertise of the instructor may have.

Survey of Experimental Group

In the survey we attempt to evaluate specific elements the un rapport, pacing, and attitude towards the course as shown in courses following questions:

 Do you see this course as being helpful in your corr gua employment or future career? Explain.

ity with whis SS. :t, directs

what is your evaluation of the expertise of the instructor? would regular contact with the instructor have motivated you to complete assignments sooner? Explain

arough modul. igned to inte In this model llines for has

pid the taped version of the course offer any advantages over your past experience in a class room setting? would a more structured course with dates given for the completion of each lesson and assignment be helpful?

tter reviewing the available research in the area, we will now we on to our research design and preliminary findings. re of the ac

an a dramatiz

march Design aders.

We t

is research was undertaken with the object of finding a ke it more an livery system that can provide high-quality instruction to the enty three million college graduates currently living in the ited States. Many of these people wish to continue their of rapport) acation but are hindered by rigid university standards which is been create quire residency in daytime campus programs. For those : of this cou dividuals who are working during the day there are few, if tor may have. 7, options open for graduate-level education. If a delivery thed can be found for distance learners that will maintain the ality and the academic content of the day school campus class, fic elements universities may be influenced to allow credit for these as shown in Arses and thus meet a great need of their alumni.

. in your cur guarantee the academic quality and content of the course we

felt that it was necessary, so far as was possible. the by a distance learner to have the same academic experience. pean of on-campus student had. We theorized that if this ca ained to properly done, the motivation and additional experience off-campus learners might compensate for any disadvantages ralked t delivery system. After some deliberation it was conclude rement an audiotape transcription of the day class might mean Fessiona requirement. The tape can deliver all of the instruction Fistics student input that takes place. Everything that the day m welts fro hears in the class will be conveyed in identical land stu to the distance learner. Sit erp.

an the U

Our next step was to allow for the visual informatic: parisons planned to accomplish this by having a class member care mining copy all of the static visuals used in the class. The chalm fore the and overhead projector are most commonly used for vis entifyin instructional support at the university. Copies of the visiber. The used will be included with the class hand outs in a stabler who syllabus. Headings and lesson numbers on each visual wills. This it with the appropriate lesson.

Longs whi

Next we needed to select a course to tape. A survey was all be use ask local high-level corporate managers which graduate co al compar

from the School of Management's catalog they felt would have greatest value for management-level personnel in their orgunitations tions. An MBA course which was highly ranked in the surve th the de selected. Titled "Management Philosophy and Style", it ^{od} qualit

perience as perience to audiotape the course during the next semester.

dvantages is talked to the instructor and learned the course content and s concluded surgements. Then we were ready to develop a research design. night meet design help was obtained from a faculty consultant in the instruction extistics Department. He suggested that we compare the test the day statistics from both the midterm and the final exams taken by the ical lange word students with the same exams taken by the off-campus

coop. Since graduate courses usually have smaller enrollments can the undergraduate classes, we decided to use a T-test for formation. comparisons. A box plot is also planned to assist us in further mber care?. commining the data. We will keep copies of all of the tests The chalkbackfore they are graded. Then, after deleting all names or I for visu mentifying information from each test we will assign it a of the visu metr. The tests will all be corrected at the same time by one in a stud mader who has been trained for this assignment by the instructual will mont. This person will have no way of identifying either the

ey was made all be used to separate the two groups scores for the statistduate cours wal comparison.

vould have t

eir organis aducting the Experiment

he survey " "th the design in place we now proceeded to tape the course. A yle", it ** ^{Nod} quality reel to reel recorder was used. We used a two track

recording system with a lavalier mike on the instructor agreed additional mikes on stands in the room to pick up student adomly sel The taping went well except for the background noise we plot adents for from the classroom mikes on one of the tracks. We had an an actor to 9 attendance of eighteen students in the course. An observe assary to the classroom copied all of the visual information used is informat class for the student syllabus. He also took notes on state are informat attendance, the number of students who asked questions to use participated in class and other items of this nature. Is course instructor relied on the chalkboard exclusively and no is a testing slides or transparencies were used.

minister t

After completing the taping we decided to make two version the course. The first version would contain the entire on experiment with all of the lectures, class discussion and group session and group sets and grou inceived th The other version would have the student comments, questions group discussion sessions edited out. In this way we hop these paper determine whether or not the student interaction is a value order t his prelim part of the course for the distance learner. We edited out rediction much of the background noise as we could. At the end of me from a process we had two versions of the course available in the tader . B different formats; the reel to reel format, the standard case acognize t format, and a special slow speed format selected because it i appect to g us the advantage of putting the whole 30 hour course on the be study . cassettes. Now we needed a test audience.

We explained our project to training directors and two corport

instructor a greed to furnish us some management-level volunteers, up student could selected to take the course. We ended up with fifteen noise we pick tents for the first trial. Each one was asked to recommend a We had an a stor to give them the exams and to send us the information . An observe cassary to make the test arrangements. Students were given the ation used here information and course requirements that the campus class notes on statistical with the special long play recorder that was included in his nature. It course package. The students were given a schedule of when ly and no fine testing periods would be and when assignments were due.

wits will be mailed out to a proctor at the company who will minister the tests and return them to us.

two version

the entire to be experimental course is now underway with a small group of group sessing todents. We are beginning to get the data back. We have ts, questions to ive the midterm examinations from most of our test group. way we hope the papers are being graded by a competent grader and returned on is a value a order that the students can get feedback from their work. We edited out his preliminary information is helpful in making some early the end of the from a second grading of the tests done later by a different tandard cass is from a second grading of the tests done later by a different tandard cass is that the results that we obtain are not conclusive. We course on the test of gather data from many more students to give validity to a study.

d two corport

The limited information that we currently have suggest with following:

1. Distance learners in this study will generally achieve in chose scores on the examinations than the graduate students who the course on campus. Their field experience has given to depth and breadth that doesn't show up in the university one in dent's tests.

2. Information from the distance learners indicates that if course could be offered for university credit, it would by alle the interest to more people and provide a greater motivation for socation participants to complete it. We have received several express received ions from people saying that this method of distance lean all provides exactly what they have been looking for to further to dolt le education and their career. This suggests a market for comof this type particularly if universities will make them available: The able for credit.

Iterwa

went it

3. The delivery system involved here limits the course offer satage to classes that are not highly interactive. If this deliv system were to be used in a degree program, a combination of campus and distance learning experiences would be desired Further studies are planned to determine if this delivery syst coupled with videotapes, can successfully convey the education content for courses requiring laboratory experiences. with some testing and modification, this model has the stential to meet the needs of many adult learners. It could reate a significant market for those universities and colleges ily achieve to incorporate it as an alternative in their graduate

tudents who arse offerings.

has given

university the low cost of production and distribution of this delivery rstem make it capable of a high degree of profitability in the rest it adequately meets the expectations previously described.

ates that if a

it would to mile there are many ways of extending professional distance otivation for ducation courses to adult audiences, this one has the potential everal express freceiving university approval for credit. We hope that it listance learnell provide a much-needed option not presently open to most to further todalt learners.

rket for com

ike them available in the data from this research will be available in the early pring of 1986 and the outcomes of the study should be ready soon fterwards. For a copy of this information send \$2.50 to cover course offermestage and handling to:

f this delim bination of »

be desireat! delivery syste the education aces. Dr. Robert L. Hales 154 Harman Building Brigham Young University Provo, Utah 84602

Phone 801-378-4903

TITLE: A COMPARISON OF TASK ANALYSIS, ADUANCE ORGANIZER, AND CONCEPT ELABORATION METHODS IN TEACHING CONCEPTS AND PRINCIPLES

AUTHOR: WALTER U. HANCLOSKY

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	A COMPARISON OF TASK ANALYSIS, ADVANCE ORGANIZER, AND CONCEPT & Methods in teaching concepts and principles	Instruc- other an states instruc- evaluat curricu- concern is conc- at the being c develop has an concern with of
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	Dr. Walter V. Hanclosk. Assistant Professor of M Duquesne University	Hayer knowls struct should The instruct
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Inscructional design should be viewed in relation to the other areas of inquiry within education. Beauchamp (1968) sistes that education is comprised of knowledge about instruction, curriculum, counseling, administration, and evaluation. Snelbecker (1974) compares the areas of curriculum and instruction by stating that curriculum is concerned primarily with "what" to teach while instruction is concerned with "how" to teach. Looking more specifically at the area of instruction, Reigeluth (1983) views it as being comprised of five major activities: design, development, implementation, management, and evaluation. He further states that each of these professional activities has an associated discipline which is an area of inquiry with optimal results.

Instructional Design

Gordan (1968) defines instructional theory as "a set of statements based on sound replicable research, which would permit one to predict how particular changes in the educational environment would affect pupil learning" (p.3). Haver (1981) states that because of the explosion of useful inowledge concerning human cognitive processes and memory structure within the past 10 years, instructional theory should be based on cognitive theory.

The quest for the development of broadly acceptable instructional theory has led to a growing interest in the design science of instruction (Glaser, 1976; Reigeluth, Bunderson, & Merrill, 1978). The goal of this new science is to develop a cadre of those prescriptive principles of instruction which may be applied by instructional designers and evaluators. Reigeluth and Merrill (1979) state that when a sufficient number of these principles have been identified, defined, and validated instructional designers can then prescribe methods that will optimize learning for a quien set of conditions. In addition, when a set of models of teaching can be developed from these principles, they can then comprise a basis for an acceptable prescriptive charm, of instruction (Reigeluth & Darwazeh, 1952).

1931 Analysis

A widely researched aspect of designing instruction deals with structuring and sequencing information. Structure refers to the general organization of instruction while sequencing "refers to the design decisions pertaining to the order in which subject matter is presented (ie., the relationship of concepts and principles within a knowledge domain), which build upon existing cognitive structures to Produce new or elaborated cognitive structures" (Tillema, 1782, p.170). A major researcher who has helped to shape this area of study is Robert Gagne (Merrill, 1977). His theory, known as the cumulative learning theory (Gagne 1968a), is based on the construction of learning a for the purpose of systematically organizing in a be learned through an analysis of the final task of behavioral outcome of the instruction.

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More specifically, this task analysis begins with the behavioral task from which all subordinate capabilities identified. The hierarchical relationship of these capabilities is then organized by evaluating what the individual would have to know how to do in order to a this new capability or task (Gagne, 1968b).

The levels of these capabilities in the hierarch. is related to the levels of learning (Sagne and Briggs, where each capability corresponds to a type of learning classification, ic. problem solving, principle learning concept learning, multiple discrimination. Each level type of learning is also designed as being prerequision the one above and, therefore, must be learned before student can go up the structure to successfully concept desired task.

This analysis of prerequisite learning is necessory designing sequences of instruction. Although the learn hierarchy itself does not directly present the desired needed sequence of instruction, according to Gagne and Briggs (1974), it represents a kind of intuitive logic provides a meaningful context for a design.

Concept/Principle Learning

The teaching of elaborate concepts and principles and difficulties for the application of learning hierarching These types of learning often require the synthesis of multitude of obscurely related concepts or ideas whose relationships do not fit into a traditional linear top

Tennyson and Boutwell (1974) define a concept as a disobjects or ideas which are characterized by the same critical attributes. If the definition is applied to analysis method of learning, a subject would have to competency in three major task levels: 1) remembering instance, 2) remembering a generality, and 3) applied generality (Merrill, Reigoluth & Faust, 1779; Marrie Tennyson, 1977). A generality is defined as an atsogeneral statement that can be applied to a variaty specific situations, such as the definition of a const the statement of a procedure. An instance is defined as specific object, event, or symbol such as an example of concept or an application of a procedure.

Reigeluth and Merrill (1979) define a principle as a concept of the second defines a cause-and-effect relations of a generally found in the teaching of large amounts of Su information or macro-strategies which Reigeluth (1979) ab defines as "ways of organizing those aspects of instruction and which relate to more than one topic, such as sequencing potential topics, showing interrelationships among the topics, and

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ple as an relation of prince mounts of th (1979) of instruct sequencing topics, and previewing or reviewing the topics" (p.8). Two models of teaching which deal specifically with the presentation of large amounts of information or acco-strategies are the "Advance Organizer" (Ausubel, 1968) and the "Concept Elaboration Model of Instruction" (Merrill, 1977).

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Advance Ocganizer

One model of teaching advocated for use in task analysis is the "Advance Organizer" (Gagne & Briggs, 1974). This model, pased on the theory of meaningful learning, has been a topic of research for the past 15 years. Joyce and Weil (1980) state that the primary goal of the advance organizer is to convey large amounts of information in as meaningful and officient a manner as possible. Therefore, the advance organizer is well designed to teach concepts and principles which require the synthesis and assimilation of subconcepts and facts into broader, more meaningful thoughts. Ausubel (1968) defines advance organizers as "appropriately relevant and inclusive introductory materials ... introduced in advance of learning ... and presented at a higher level of abstraction, generality, and inclusiveness" (p.148). Ausubel (1977) further states that the function of the organizer is "to provide specifically relevant anchoring ideas for the sore differentiated and detailed material that is subsequently presented" (pp.167-68). This organizer may then represent a design for the optimal sequencing of those competencies necessary to successfully teach the desired principle, concept, or fact. Mayer (1979) presents tive wejor characteristics of the advance organizer:

 (1) Short set of verbal and visual information; (2)
 Presented prior to learning a larger body of to-be-learned information; (3) Containing no specific content from the to-be-learned information; (4)
 Providing a means of generating logical relationships among elements in the to-be-learned information; (5)
 Influencing the learner's encoding process. (p.362)

Essentially Augubel (1978) has identified two cypes or edvance organizers: the expository organizer tenton is used to teach completely new material) and the comparative organizer (which is used to teach familiar or relatable ideas). In both models the bulk of the synthesizing information is presented at the beginning with a prief reinforcement synthesis or summary at the end of the presentation of information.

One important characteristic of an advance organizer is that it is not designed as a summary or an overview. Summaries or overviews are presented at the same lavel of abstraction, generality and inclusiveness as the learning materials themselves. "They simply emphasize the salient points of the material by omitting less important information, and largely achieve their offect of a and simplification" (Ausubel, 1968,p.148). The go advance organizer, in contrast, is to prescribe a framework within which all subsequent instruction logically fit.

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Concept Elaboration

Another distinctive task analysis model of teaching theory is the "Concept Elaboration Theory of Instruct (Merrill, 1977). Like the advance organizer, concept elaboration prescribes a framework within which conc principles, or procedures may reveal logical orde . unlike the advance organizer, in which the entire or structure is presented at the beginning and end of the instructional process, the concept elaboration model intersperses its organizers or epitomes throughout m entire instructional experience by moving from a general-to-detailed sequence of instruction. Reigolu-(1979) draws an analogy with the process of zooming out of a camera lens. In order to see all of the parts the picture, a person starts with a wide angle view a is to be learned. Then the person zooms in on one part halting the zoom at different levels, to study the interrelationships of the explored part with the other of the picture. After part of the picture is satisfied explored or elaborated, the person zooms out and read process with another part. After all of the significant parts of the picture have been explored, the person : back out to the wide-angle position. At this point, the broadest topic of the instruction, or epitome, will be satisfactorily understood.

revi Reigeluth and Darwazeh (1982) define an opitome as a infe overview of the relationship between principles. curl The objects, events or ideas which are presented at an 1974 application level including generalities, examples of adv. practice" (p.31). The definition is again uniquely distinctive from the advance organizer in that it doe emphasize "higher levels of abstraction, generallies" 197 inclusiveness" (Ausubel, 1762.p.148). Instead, it di 1217 exactly what an advance organizer does not do. 14. "umphasizes the salient points of the material ... str achieve their effect by repetition and simplification 197 (Ausubel, 1968, p. 148). The concept elaboration model sub uniquely presents the epitomes or organizers at aver apd of elaborative instruction instead of only at the beg 41and end of the presented information. The elaboration of structure and sequence, therefore, naturally income increasingly higher levels of abstraction, generality inclusiveness through a continual synthesis of information throughout the entire presentation.

An example can be found in creative writing. If a write applies in greater detail the relationship between plot theme, and characterization, his/her creative writing
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of teaching of Instructu r, concept which conceral order. H entire dre d end or us tion model roughout the From a n. Reigeluts f zooming is of the parts ngle view of on one parts tudy the th the other is satisfacto it and recover a significut ne person co is point, the ome, will by

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J. If a wrid between plot ve writing # iscroves. The concept elaboration model assists the student riscr by presenting the cognitive information and relationships of this information at each deeper level of the learning experience. Since this is an application approach, the student practices what he/she has learned at each level of elaboration. The result increases the students field of experience and lays the foundation for deeper investigation and understanding.

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From these ideas, definitions, concepts, and principles the two structure and sequence models may be compared.

Related Besearch

Three major reviews (Barnes & Lawson, 1975; Mayer, 1978; Faw & Waller, 1979) and four critiques of the reviews (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) have been written about advance organizer research within the past nine years. To date there are few reviews of concept elaboration research.

In a review of concept elaboration as an emerging instructional theory, Mayer (1981) states that "in some ways the epitome is like the advance organizer, because it is intended to provide a general context for all new incoming information" (p.23). He further states that the analogical model and assimilative context for learning of the advance organizer have a relationship with the sequencing, inthesizing and summarizing components of the elaboration theory and that this relationship needs to be explored in more detail.

Mayer (1981) states, "It strikes me that the definition of an epitome should be consistent with what we know about the characteristics of advance organizers" (p.25). Therefore reviews on advance organizer research will be used to make inferences about research related to concept elaboration. The critiques (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980) of the reviews of earlier advance organizer research addressed the five following wejor problems as cited by Weil and Murphy (1982):

1) test measure incompatability (Ausubel, 1978; Mayer, 1977). Most studies used tests measuring verbalim recult and isnored meaningful verbal learning and long term recention;

2) failure to control for existing subsumer's in cognisive structure (Lawton & Wanska, 1977; Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Lack of control for existing subsumers renders the effectiveness of the advance organizer model impossible to ascertain because subjects may have already possessed the prerequisite knowledge;

3) failure to assess the presence of appropriate bridge Cognitive structure (Ausubel, 1978; Mayer, 1979; Kozlow & White, 1980). Subjects may lack the ideational scaffolding necessary to utilize the advance organizer;

 failure to show that learners used relevant subsumers (Lawton & Wanska, 1977; Mayer, 1979); and

5) failure to analyze whether the main concept in the

advance organizer is an appropriate subsumer for information in the learning material (Korlow & m An analysis of the conceptual content in relation structure and sequence of the instruction to be lear necessary before conclusions can be drawn.

In addition, another major problem found in this or organizer research is an inequality in instructional treatment time between control and experimental group & Murphy, 1983; Wilcox, Merrill, & Black, 1981).

Background of the Study

Although task analysis has been a subject of research many years, there is little consensus (Carlisle, 1/a) what "task analysis" means or how a task analysis intends done. Davies (1973) describes task analysis in tends subtasks. These subtasks are used to design instruction which will reduce error in human performance. This pro-(Patrick & Stammers, 1978; Carlisle, 1982b, 1983; Sprin Powers, 1983) primarily requires a:

 breakdown of the task, content etc., into constitue elements;

determination of the relationships among the elements and

restructure in accordance with the underlying princip or optimal learning design.

The models of teaching which apply this process of teanalysis are numerous and varied in their design. Two task-analysis based models dichotomous in their design "Advance Organizer" and "Concept Elaboration." Both demodels are espoused as being reliable for teaching 1% a concepts or principles. The advance organizer may be described as presenting synthesis instruction at the beginning of a presentation, logical sequence of instruction for summary instruction at the end of the presentation. The concept elaboration model, in contrast, presentation throughout the ontire presentation by Meaving them is at each elaborated lavel of instruction.

The Problem

The "Concept Elaboration Model of Instruction" has been linked closely with the "Advance Organizer" (Mayer, 1981 These two models may be defined as parallel in their def but divergent in their application. One major distinction that the advance organizer presents its synthesizing and summarizing information at the beginning and end of the instruction. The concept elaboration model, on the otage hand, emphasizes its synthesizing and summarizing information throughout the entire instruction, drawing interrelationships among all of the concepts, ideas,

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on" has been (Mayer, 193) In their dep distinction emizing and end of the end of the n the other zing , drawing ideas, objects, and events at each lavel of the slaboration. Dra doal of instructional design research (Reigeluth & Marrill, 1979) is to develop a cadre of prescriptive principles which will organize information for instructional purposes. Task analysis is one method of analyzing information for instructional purposes. This analysis of information is applied primarily through the development of a learning hierarchy. It is the purpose of the learningg hierarchy to graphically represent all of the specific levels of learning related to the instructional content. This hierarchy, containing the detailed information to be taught, will then provide a context for the design of instruction. Two models of teaching which use this task analysis approach are "Advance Organizer" and "Concept Elaboration."

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The advance organizer model as described by Ausubel (1968) is designed to teach information through provision of ideational scaffolding for the stable incorporation and retention of the more detailed and differentiated material that follows" (p.148). According to Reigeluth (1979), concept elaboration is primarily designed to teach information through macro-strategies which are "ways of organizing those aspects of instruction which relate to more than one topic, such as sequencing the topics, showing interrelationships among the topics, and previewing or reviewing the topics" (p.8). However, there is little or no research related to the efectiveness of the concept elaboration model of teaching. There is also little research (Wilcox, Merrill & Black, 1981) which explores these sequencing, synthesizing, and summarizing approaches to teaching concepts and principles.

From a historical perspective this general-to-detailed approach to designing instruction has substantial support. The spiral curriculum, as described by Bruner (1960), explains how anyone can be taught something about any topic of study, as long as the information is presented at the learner's appropriate reception level. Additional research on schema theory (Anderson, Spiro & Montague, 1977; Collins Collian, 1970; Lindsay & Norman, 1977; Rumeihart & Gitony, 1977) based on Ausubel's meaningful learning theory and Norman's (1973) web of learning based on Bruner's Approach to the spiral curriculum have further advanced research in this area.

With the recent introduction of concept elaboration into the literature, Mayer (1981) states that there is a need for empirical support to further analyze and develop the theory. Mayer further notes that the relationship between the structure and sequence characteristics of the advance organizer and concept elaboration models needs to be explored in more detail.

One of the purposes of instructional design research is to

validate the use of instructional principles. Accor Reigeluth (1983) and Mayer (1981), the instruction principles of sequencing, synthesizing, and summarize they relate to teaching concepts and principles via advance organizer and concept elacoration models of a are in need of exploration.

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Therefore, the purpose of this study is to compare by advance organizer and concept elaboration models of the with a task analysis approach. This will be accompliascertaining if pursons given synthesis and summa, instruction at every sequential level of an instruction program will achieve differently from persons given synthesis instruction only at the beginning and synthesis/summary instruction at the end of an instruprogram. These two approaches will also be compared a persons given a logical sequence of instruction even any synthesis or summary. To maintain the integrit, or approach, all instruction will relate to the same down and principles.

Design of the Study

Because of the limited research in this area a need of to perform an investigation to identify if different a of achievement exist between subjects instructed three varied approaches of sequencing, synthesizing and summarizing information. One method of investigatine to potential differences is to develop three instruction programs for the same topic of study. The first program to be based on a general task analysis approach. This be used as a basis for the development of advance organ and concept elaboration programs.

If these three instructional programs of task shalls advance organizer and concept elaboration are administr to randomized subjects, then the levels of achievement measured by a common evaluation instrument will determ the effectiveness of each model of instruction.

Limitations

Although the study will compare the advance organize concept elaboration models of teaching, it will compare primarily the effects of the three characteristics of sequence, synthesis, and summary common to both models Although these are major characteristics of the models results will in no way reflect the greater value of co model over the other for all conditions. Instead, the significance of these results will relate only to the teaching of concepts and principles.

It need also be noted that the Advance Organizer and Concept Elaboration Theory of Instruction are primaril designed to incorporate macrostrategies or numerous to sessions in their design. A distinction needs to be established where a microstrategy begins and a macrost ends. Examples of the models by Reigeluth (1979) and to According Actional Summar res les via ba dels di te

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zer and primarily erous test to be macrostran 9) and Jon and Wail (1980) present them to be open to interpretation. For instance, the teaching of the principle of supply and demand may be the foundation for a series of sessions in a course or a single session in a course. The importance relates to the depth of learning that is necessary and the ability of the audience to quickly understand the information being presented. This study will deal with the presentation of microstragies or a single presentation of informatic utilization of these models of teaching is necessary if the instructional theories are to have proad-based application to teachers and instructional designers.

The Study

it was hypothesized that the concept elaboration group would achieve significantly higher than (a) the advance organizer group and (b) the task analysis group on concept learning and principle learning when evaluated upon completion of instruction. It was further hypothesized that the advance organizer group would achieve significantly higher than the task analysis group on concept and principle learning upon completion of instruction. It was also expected that similar results would occur when assessed with an equivalent evaluation form 5 weeks after instruction. The sample was comprised of 92 undergraduate teacher education students who were exposed to one of three instructional treatments related to task analysis, advance organizer, and concept elaboration. The three treatments were validated and pilot tested. All of the hypotheses were supported from the results of the pilot study.

This investigation required subjects to take two positiests. One was taken upon the completion of instruction; the second were taken five weeks after instruction. Each posttest consisted of fifteen questions related to concept learning and fifteen questions related to principle learning. To insure accuracy of the instruments, a Kuder-Richardson ME=20) produced evidence of a reliability of .840 and .804 In PostLast 1 (11) and PostLast 2 (T2) respectively. 11 posttest results were then reported as. A. the sum Sotal of concept learning in the first postest (CGN-Tir; 0. the sum total of principle learning in the first posttest (PRIN-T1); C. the sum total of concept learning in the Second or delayed positest (CON-T2); D. the sum total of Principle learning in the second or delayed posttest (PRIN-T2); and E. the sum total of both concept and Principle learning (CON/PRIN-T1/T2).

In addition posttest 1 (T1) and posttest 2 (T2) scores were compared for achievement according to the categories of A. concept learning and B. principle learning.

The final study was performed on a summer school population

which required additional control of potentially con variables. To control for the preidentified independent of a variables, a series of One Way Analyses of Variance orga IA C was performed using the variables of A) levels of achievement, B) levels of experience, C) gender, and NYPO The one variable of age was found to have a signific Bas effect. This variable was then Covaried using Analysis CONC exam Covariance (ANCOVA) for the remaining results. supe

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A one-way analysis of variance was performed on the independent variables of achievement (GPA), levels a experience, gender and age. The only significant fine occurred with the variable of age. An analysis of a student Newman-Keuls reported a significant difference age between the task analysis control group and the co elaboration group.

94<u>9</u>9 After the effect of of age was covaried, the remain results found the task analysis group to achieve Sin significantly higher (.05 level) than the advance or adva and concept elaboration groups in (a) concept learning CONC completion of instruction and (b) principle learning the after instruction. The task analysis group also achieve resu significantly higher (.05 level) than the advance oran post group in principle learning upon completion of instru-In p The results of concept learning 5 weeks after instru grou found no significant difference in achievement betware tast of the groups. scor

Therefore, the task analysis group, containing only prerecommended sequence of instruction, achieved significe 1974 higher than the advance organizer and concept eleboric pose groups, containing variations of sequencing, synthes: before and summarizing of instruction, in five of eight evaluated instruments. All of these findings were in direct correspondent to those anticipated, based on earlier pilot results. Price How

Conclusions

From the findings, it is concluded that:

1. Given the sample and instructional programs, the banalysis approach appears to be a more affective worker instruction than concept elaboration or advance or advance teaching concepts and principles.

2. Given the sample and instructional programs, neit advance organizer nor concept elaboration appear to a superior to the other as an instructional strategy.

3. As an unanticipated outcome of the study, age is apparently a more important factor in determining appropriate instructional strategies than previously expected.

Discussion The findings of this investigation support the super-

itentially con fied indepo. . of Variance levels of) gender, and ve a signific using Analys esults. formed on the PA), levels of gnificant Fine halysis of a s cant difference oup and the

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of a task analysis approach to toaching over the advance erganizer and concept elaboration models. These findings and in conflict with the pilot study results and the proposed hypotheses for this study.

Based on the literature, a need exists to examine the conclusions in greater detail. First, a need exists to examine through the literature why task analysis may be a superior approach to teaching concepts and principles. second, a need exists to explore what research or theoretical assumptions related to advance organizer or concept glaboratioin are either confirmed or questioned. Third, a need exists to describe the effect of age on the study and compare that effect with other research.

superiority of Task Analysis

Since the task analysis group emerged superior to the advance organizer and concept elaboration groups, it may be concluded that it is a superior design of instruction for the samples and treatments in this study. In the final results, the task analysis group emerged superior in the e advance orge posttest 1 related to both concept and principle learning. In posttest 2 there was no significant difference between after instruct groups in concept learning; but in principle learning the task analysis group again achieved significantly higher scores than both groups. If one considers the process of prerequisiste learning in task analysis (Gagne & Briggs, 1974), the subjects in this study would have needed to possess an appropriate understanding of concept learning before they could go up the learning hierarchy to principle learning. Therefore, one would have expected the task analysis group to be superior in concept learning as well as principle learning on the delayed posttest.

> However, the task analysis group did perform significantly better than the advance organizer group in three out of four tests. An analysis of the instructional programs shows that the entire content of the task analysis program is conlained In the advance organizer slide/ tape program. The advance organizer contained an additional number of meaningful Withesis statements at the beginning and a number of auxmary statements at the end of the program. The results indicate that subjects exposed to the most concise instructional program achieved the highest. It may therefore be suggested that the concepts and principle in the instructional treatment are not as complicated as previously anticipated. Instead the concepts and principle may be concrete enough to allow easy understanding through use of a brief simple program instead of the longer programs of advance organizer and concept elaboration.

Although these findings support a superiority of task enalysis, it need also be recognized that all of these results are in contradiction with the pilot study results, the advance organizer literature (Ausubel, 1974), the

concept elaboration literature (Reigeluth, 1983) and learning hierarchy literature in task analysis tokan Briggs, 1974). Lindalan.

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Advance Organizer and Concept Elaboration

Two models which incorporate task analysis are advan organizer (Gagne & Briggs, 1974) and concept elaborat (Reigeluth, 1983). Since both of these models in the took the sequence characteristic of task analysis one on the elements of synthesis and summary, these progwere both longer and more comprehensive than the tage analysis program. If one accepts the suggestion this. concepts and principle are not as complicated as preanticipated, then the longer programs of advance organization and concept elaboration may have produced boredom and fatigue in the subjects; or at least did not concrise. additional factors. This problem of unequal instruction treatment time between control and experimental groups been acknowledged in the literature on advance organ (Weil & Murphy, 1983; Wilcox, Merrill & Black, 1981). Howevever, this literature would generally correlate instruction time with increased achievement. Thereton, assumption correlating instructional treatment time and achievement is difficult to accept.

Both of the advance organizer and concept elaboration recommended for use with large amounts of instruction macrostrategies. These approaches usually require instruction to be performed in more than one session. Reigeluth and Darwazeh (1982)have indicated an offort subsume the ability to teach microstrategies into the elaboration theory. But can a macrostrategy ever be perceived as a microstrategy; and if so, when? Reigeld (1979) presents an example of a macrostrategy in the # economics. He states that the principle of macroeconom require an elaborated understanding of supply and use debits and credits. This may in fact be an appropriate macrostrategy for a high school student; but how diffe is this principle and concept to for adult who has formal instruction in economics? For the adult, one likely to be working at a formal operations level the high school student, this instruction may simply be logical process which is easy to understand. Therefore may be perceived as a microstrategy by an adult who can quickly comprehend this information. Results of this in then pose further questions rather than clarify reasons apparently conflicting findings.

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When age was compared between the subjects in the prim study and those in the pilot study, the means of 27.357 and 22.17 years exist respectively for each population 1983) and 515 (064)

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rebalance in age is a further concern because it indicates that two substantially different age groups were reprosented in the pilot and primary study. Therefore, the factor of age may have contributed to the failure to reject the null hypotheses.

Because students in different courses comprised the sample of the primary study a unique population distribution emerged. The mean age for the task analysis group was 24.87 years old, the advance organizer group was 26.68 years old, and the concept elaboration group was 30.42 years old. There was a significant difference in age between the task analysis and concept elaboration groups at the .01 level. Even though an analysis of covariance was used to statistically neutralized the effect of age on the achievement results one wonders if age could have had an effect.

(Praget (1971) in his analysis of cognitive development describes the final or formal stage of development as occurring around 12-15 years of age. This level of cognitive development is characterized by the ability to reason hypothetically. It'is the opinion of many educators of adults (Long, McCrary & Ackerman, 1979) that cognitive development continues into and across adulthood. Research in this area (Elkind, 1962; Watson, 1968; Papalia, 1972; Renner s Stafford, 1972) report the existance of college and graduate age individuals who are not yet functioning at a formal operations stage. McKinnon and Renner (1971) reported only 25% of a college freshman sample to be at the formal stage. Arlin (1975) reported that 31 out of 60 female college seniors studied were classified as formal thinkers. Chiapetta (1975) found only 47% of 15 K-8 female teachers to be formal thinkers. The results of these studies suggest that age effects the development of learning styles and individual competence. Therefore the older the learner, the greater his/her chance of working at a formal operations level and achieving higher on a test requiring little to no Evothesis or summary information. Within the context or chis study, the older the subject the higher he/she achiavad Using an instructional approach onich perceived the information as a microstrategy.

The results of the pilot study gave valid support for the primary study to proceds, but when the treatments were administered to different age levels a new patterns of responses occured. The older subjects showed greater achievement with the simplest and fastest approach, the task analysis approach; the middle mean age group showed greater achievement using the more in-depth program, the advance organizer; and the younger mean age group showed greater achievement using the other more in-depth approach of concept elaboration. It then appears that the older subjects responded better to simple well sequenced instruction; the alidle age subjects responded better to a well sequenced instruction with a synthesis at the beginning ang a summary at the end; and the younger subjects responded become listruction with synthesizers and printerspersed throughout the antire presentation of information.

An examination of the difference in ages between , study (22.17 yrs.) and the primary study (27.33 yrs. suggest that the primary study subjects were compose combination traditional/nontraditional college audie Many of the subjects who work in business or inquire full-time and enroll in classes part-time may be non accustomed to dealing with short concise pieces of information from which to draw conclusions than trad college age subjects. A traditional age subject, on other hand, may be used to the more traditional coard approaches. Knowles (1978) states that the cradition learners are conditioned to have a subject-oriented curriculum while adult learners tend to have a problem-centered orientation to learning. This is on adult's need to apply immediately what he learns, while traditional learner continually postpones his application he graduates from one program into another. This may, in part why concept and principle learning were higher the task analysis group for posttest 1 as well as why principle learning was higher in the task analysis and posttest 2.

Implications for Euclider Research

From the conclusions of the study, a suggestion for a research is to replicate the design of this study use instructional topics of varying difficulty. This win to correlate instructional strategies with easy-to-deconcepts and principles. The outcome of this effort all in evaluating the effective parameters of task analysis advance organizer and concept elaboration as instructu approaches to teaching. A second suggestion for further research is to replicate this study using the same traditional subject population as used in the pilot st and randomization techniques as described by Campbe Stanley (1763).

The unanticipated results of this study have suggets consideration of correlating age with instructional strategies.

The nomenclature of the nontraditional learner emerges the 1970s. The <u>Encyclopedia of Educational Research</u> described the standard American college student as bein between 17 and 23 years of age, living on or near conce attending classes at fixed times and determined places following a set curriculum of sequenced courses. Allow this may still characterize the regular academic year student, the older nontraditional student has emerged of campus with a new set of needs and demands. Unfortunite much of the research in this area has related to proexperimental learning (Commission on Non-Traditional 20 ied beto i and so ition of

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TITLE: THE EFFECTS OF PRESENTATION LATENCY AND EMBEDDED ORIENTING STRATEGIES ON LEARNING FROM COMPUTER-BASED INSTRUCTION

RUTHORS: M. HANNAFIN T. L. PHILLIPS L. P. RIEBER C. GARHART

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THE EFFECTS OF PRESENTATION LATENCY AND EMBEDDED ORIEND STRATEGIES ON LEARNING FROM COMPUTER-BASED INSTRUCTOR

Hannafin, M., Phillips, T. L., Rieber, L.P., & Garhart, C. Center for Research and Development in Education Computing The Pennsylvania State University In this time on th fictionalize cognitive c 10 or 30 s presented more gene posttest rr strategy e: marginal The resul sufficient

Presented at the Annual Meeting of the Association for Educational Communication Technology, Las Vegas, January, 1986.

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In this study, the effects of explicit versus general orienting strategies and varied access time on the learning of facts and inferences were studied. A CAI lesson focusing on factionalized science concepts was presented. Students were randomly assigned to either a ergnitive or behavioral embedded orienting strategy group, receiving CAI which used either 10 or 30 seconds of access time to branch to lesson segments. Orienting strategies were presented throughout the lesson, and addressed criterion information either explicitly or in more general, abstract terms. Upon completion of the lesson, students were administered a posttest measuring both factual and inferential learning. Results indicated that orienting strategy explicitness did not affect the learning of either facts or inferences differentially. A marginal effect was found for access time, with students performing best with 30 seconds. The results suggest that differences in orienting strategies may not be as important as sufficient time for strategy utilization.

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In this study, the effects of explicit versus general orienting strategies and varied access inte on the learning of facts and inferences were studied. A CAI lesson focusing on fictionalized science concepts was presented. Students were randomly assigned to either a regultive or behavioral embedded orienting strategy group, receiving CAI which used either 10 or 30 seconds of access time to branch to lesson segments. Orienting strategies were presented throughout the lesson, and addressed criterion information either explicitly or in more general, abstract terms. Upon completion of the lesson, students were administered a posttest measuring both factual and inferential learning. Results indicated that orienting strategy explicitness did not affect the learning of either facts or inferences differentially. A marginal effect was found for access time, with students performing best with 30 seconds. The results suggest that differences in orienting strategies may not be as important as sufficient time for strategy utilization.

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THE EFFECTS OF PRESENTATION LATENCY AND EMBEDDED ORIEN STRATEGIES ON LEARNING FROM COMPUTER-BASED INSTRUCT

Each new instructional technology brings with it the potential to solve current problems. In many instances, the expected contributions to education never material reason for for these unfulfilled expectations is not faulty technology per se but an technologies are incorporated. One recent computer-based instructional technologies interactive video. Floyd defined instructional interactive video as "... any videop which the sequence and selection of messages is determined by user's response to the (Floyd, 1982, p.2). During the past few years, interactive video has been the increased interest and utilization for instructional applications (Hannafin, Garhan Phillips, 1985). However, this growing interest is founded in very little research from develop guidelines. To obtain optimum results from this technology, research performed from which empirically based guidelines can be developed (Dwo Hannafin, 1985).

A current concern involves the type of video delivery system best suited to a video: videodisc or videotape. The videodisc is considered by some to be the month breakthrough in instructional technology since the invention of the printing press (Re Garfield, 1984). Because of the ability of videodisc to access video segments random much greater speeds than videotape, it is considered by many to be superior for video (Hoffos, 1983).

If speed of access were the prime consideration, videodisc would indeed be the technology. However, other factors must be considered. For example, there are line

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at which learners can process information. Providing learners with more information than bey can process effectively may inhibit learning (Travers, 1982). Delays in access time between lesson segments of a lesson may provide an opportunity for the learner to process information (cf. Chu & Schram, 1967). Delays might also be utilized to present meaningful information or instructions, such as advance organizers, to improve learning and retention Stone, 1983).

In effect, the "access time" issue may be more a learning and processing than a technology issue. Since the principal issue in the tape vs. disc arguement pertains to access time, perhaps the study should center initially on time and processing variables in learning from any computer-based lesson (Hannafin & Hughes, 1986).

Processing of information requires sufficient time to select, encode, and integrate (Tennyson, Christensen, & Park, 1984). When individuals are provided more information than able to process, they became disorganized, to the point of being unable to process information at all (Travers, 1982). Rest times between portions of video instructions increase learning by providing information process time (Chu & Schramm, 1975). From this research, it can be concluded that processing time is often useful in improving learning.

Delayed access time between lesson segments could be utilized to present advance organizing strategies to the learner. In a meta-analysis of 112 studies, Stone (1983) found that advance organizers were associated with increased comprehension and retention of material to be learned. The use of "concrete" advance organizers have had a strong effect upon the learning and retention of specific information (Mayer, 1984). Explicit strategies aid in the karning of cued information, but inhibit the learning of uncued information.

The purpose of this study was to examine the effects on learning of presentation access latency, organizing strategies, and the combination of latency and strategy. Specifically, the

effects of behavioral and cognitive organizing strategies and varied processing factual and inferential learning were studied.

Methods

Subjects

The subjects were 49 college upper-division undergraduate and graduate enrolled in computer literacy courses. Students participated during a regularly class session and were provided extra credit for participation.

Materials

The instructional treatments were modified versions of a computer-assisted (CAI) lesson which was initially developed for a previous research study (see Gen Hannafin, 1986). The lesson described the discovery of a fictitious element on a island, and the scientific, cultural and political ramifications of the discovery on a primitive society. The lesson was presented as a factual account of the discovery were not informed as to the fictitious nature of the lesson until the study was can This lesson was chosen for the following reasons: 1) the fictitious content was place thus eliminated the effects of prior learning; and 2) the relative ease with which has inferential test items could be identified

Three orienting strategies were developed: 1) instruction with embedded to orienting strategies; 2) instruction with embedded cognitive orienting strategies instruction with prompts for the learner to use individual learning strategies.

Behavioral orienting strategy. This strategy oriented the student with process were specifically related to the factual content of the lesson segment which follows prompts provided the learner a specific orientation to the factual material subsc assessed. The strategy consisted of a single computer frame, directing the student Co

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a two specific informational items which included subsequent lesson text. One example of this strategy is: "In the next section be sure to learn this information: When the actropologists began arriving on Jexium Island." These factual items consisted of names of people, places, specific events, and other details presented during the following lesson rement.

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n embedded be nting strategies: itegies. int with prompt it which followed material subset ng the student bi <u>Cognitive orienting strategy</u>. This strategy oriented the student with broader, more abstract prompting to the instruction which followed. These prompts were not tied to specific facts, but were designed to provide a broader contextual orientation to the content which followed. The strategy consisted of a computer frame directing the student to consider two general concepts which were to follow in the lesson text. An example of this strategy is: "In the next section, you will be presented information about: The importance of studying cultures."

Individual orienting strategy. This strategy provided no prompts to direct student attention to lesson information. Instead, the strategy simply advised the students to pay close attention to the information which followed. An example of this strategy is: "In the next section, try your best to learn the information." As in the prior two cases, three strategy frames were given before questioning.

All treatment strategies were embedded at identical lesson locations. Each strategy was presented in two access time versions: 10 seconds and 30 seconds. The strategy remained on the screen during the access interval and the computer ignored student input during the alloted processing time.

An introductory section was included to obtain general information concerning student identification, gender, age, and study preferences. The student was also given a general orientation as to the nature and organization of the lesson as well as directions for answering the questions on the computer.

The lesson consisted of four parts. Each part consisted of 10 to 14 text frames are read, double-space paragraphs. Six graphic displays which supported the themas of the lesson were also included at various points, but were not related to specific information. The orienting strategies were embedded at three evenly spaced intervaeach of the four parts.

Each part was followed by six questions: three factual type and three inferential embedded questions also served as posttest items. Feedback was not provided after the questions, either during the lesson or the posttest.

Each part of the lesson began with a banner page which was displayed for 3 The first orienting strategy frame was then displayed for either 10 or 30 seconds. To followed by four to six frames of instruction. This sequence was repeated two artimes. The student was then presented a transition frame explaining that the lesson concluded and that six questions would follow. After answering these open-ended answer type questions, the student was presented with the next banner frame forth lesson part. This cycle was repeated for all four lesson parts.

At the conclusion of the lesson, the student was given a transition frame explaposttest. The posttest presented all 24 embedded questions, but in random order student was continually informed of the number of questions remaining in the p Additional prompts were given one-third and two-thirds through the posttest. At the the posttest, the students were informed of the fictitious nature of the lesson m directed to signal the proctor that the lesson was completed.

Dependent Measures

Embedded postadjunct questions. Each of the four parts of the lesson was follow

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at postadjunct questions: three factual and three inferential. These were open ended, short inswer questions. Factual questions measured recall of information presented during the lesson: the inference questions assessed the accuracy of conclusions based on lesson content. Reliability was .91 for the factual scale, and .81 for the inference scale. Validity was established through test item-lesson congruence and review by four evaluators.

Posttest. The 24 item posttest was a repetition of the four groups of six embedded sustions presented in a random order.

Student response time. Time required by students to answer each of the two types of questions, adjunct and posttest, was also collected and collated by scale: factual and inferential. Response time was calculated by the computer and rounded to the nearest second.

Procedures

Students were randomly assigned to one of the six treatments upon arrival to class. All students were given an instruction sheet which was summarized briefly by the proctor. Each student was assigned a microcomputer terminal and given a computer diskette in accordance with their treatment group. Participants completed the lesson and posttest at their own rate, signaling the proctor when finished. During the study, all data were collected and recorded on separate diskettes.

The study was conducted during three sessions spanning a four-day period. Students completed the study in times ranging from approximately 45 to 105 minutes. In order to avoid possible contamination between the sessions, students were briefed following their participation and urged not to discuss any portions of the lesson until completion of the study. Also, the students were randomly assigned to the treatments during each day of the study in order to randomize possible contamination effects over time.

Results and Discussion

Learning Effects

The mean percent accuracy and standard deviations for both the embedded one the posttest are contained in Table 1. Marginally significant effects were obtained to time, E(1,43)=2.92, g<.10. Students provided 30 seconds of controlled access utilize the orienting strategy performed slightly better overall than those given to This effect was consistent across orienting strategy, although the magnitude of the modest.

Insert Table 1 About Here

Marginal differences were also found between en-route performance on maguestions and the corresponding items on the posttest, E(1,43)=2.62, p<.10. There of this effect, however, was not anticipated. Student performance on posttest im slightly better than on the embedded questions during instruction. Since the mining questions did not include either feedback or remediation, this effect cannot be amining either correction or confirmation resulting from practice. Instead, the effect we attributable to the cuing function served by the question. En-route questions appendix students to presumably important lesson information. The inclusion of a question are direct students to retain the information contained in the question, while permitting ease cognitive overload by either forgetting or attending less to non-questioned information.

Although an orienting strategy main effect was not found, an orienting strategy metwork scale interaction was detected, E(2,43)=4.08, p<.05. This interaction, illustrated where se 1, was characterized by better performance for the cognitive and behavioral strategy conclusion.

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factual versus inferential learning, while the individual strategy was most effective for inferential versus factual learning.

Insert Figure 1 About Here

Response Time

Means and standard deviations for response times are contained in Table 2. As shown, the time required to respond declined significantly from the embedded to the posttest, E(1,43)=96.65, p<.0001. This may be due to the familiarity of students with the items contained in both embedded questions and posttest portions of the study. It is also possible that students were simply more confident of their responses during the posttest, and responded more rapidly.

Insert Table 2 About Here

Students also responded more rapidly to factual versus inferential questions, E(1,43)=80.16, p<.0001. The level of learning and processing required for the retrieval of sufficient information to permit inference could contribute to the observed differences. Vickers and Packers (1982) posited a cognitive complexity paradigm. Conclusions that involve greater evaluation of "below-surface" information integrated within existing cognitive networks require greater time to retrieve. This is likely to be the case for inferential tasks, where several pieces of learned information must be evaluated concurrently in order to form conclusions. Conversely, learning that is more explicitly defined, such as factual recall,

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In addition, a test interval-by-test scale interaction was also up E(1,43)=21.95, g<.0001. This interaction, shown in Figure 2, was characterise regression toward the mean during the posttest. Inferential questions still a significantly more time to answer, but the differences in response time from enterposttest items was not uniform.

Insert Figure 2 About Here

General Discussion

The results suggest that within the limits of this study greater access time impreperformance. This appears to be true regardless of the type of orienting strategre This is inconsistent with research by Belland, et al (in press), who suggested that mi in allotted processing time tends to intensify effort and improve learning. Since m processing times, 10 and 30 seconds, were studied it remains to be seen if this do would continue beyond 30 seconds, and if so, how far.

Another implication of this study pertains to the role of embedded question organizational strategy. Embedded questions seem to provide an additional cue with to organize and retrieve both factual and inferred lesson material. This come supported by the decrease in response time during the posttest. Since posttest were were identical in form to the embedded questions, students were already familiar style and content of the posttest. It is also possible that students gained insight to answered incorrectly on the embedded questions as they continued through the less

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emetting mistakes made during the lesson.

The increased time necessary to answer inferential questions is not surprising. Retrieval time for questions which require higher level cognitive tasks should generally be greater than for tasks which required only a lower level cognitive task, such as factual recall (Vickers & Packers, 1982).

The surprising result found in this study was the general lack of differential effect attributable to orienting strategies. It was hypothesized that students in the cognitive orienting strategy group would generally perform better than the other two groups, especially on inferential questioning. However, this was not found in this study. An explanation for this comes from Carlson, Kincaid, Lance & Hodgson (1976), who noted that students tend to revert to their own individual strategies regardless of how they are prompted during instruction. If this is the case, orienting strategies would all assume the characteristics of a "use your own" strategy. This might account for why access time resulted in more noticeable effects.

Several directions for further research are indicated. The study of access time needs further refinement in order to expand the contention that increases in time aids learning. Also, further research is necessary to determine if a ceiling level for processing time exists, and if so, the relationship between access time limits and different cognitive tasks. Further research is also needed to study whether or not students use imposed orienting strategies, or if they simply revert to individual strategies acquired over time. It would also be of interest to study developmental influences with young subjects, since they may not be as likely to have highly refined existing cognitive strategies to rely upon.

This study has raised several questions concerning how students learn from computer-based instruction. Based on this study, we can tentatively conclude that students

cess time improve ienting strategy p uggested that relaarming. Since of e seen if this diffe

bedded question Iditional cue with al. This content lince posttest que lready familiar with ned insight to que through the lesse. may profit from increases in access time to process instruction, and that the potential for rapid access may need to be controlled to ensure adequate process. Further research should clarify the roles of orienting strategies and cognitive process in supporting learning.

Belland, J., T instruction of addres Technolo Carlson, R. J mnemon Chu, G. C. & 31-32). Dwyer, F. (1 Trends, Floyd, S. (1 Publicat Garhart, C. monitor Associa Orleans Hannafin, 1 Comm Hannafin, video i In E. I Denve Hannafin,

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viations for Fact and Inference Sca	les on Embedded						
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ll Cognitive Own Total	5						
Embedded Questions							
	•						
68.3 64.4 6	7.7						
(17.2) (27.3) (13	3.2)						
67.3 79.8 73	3.1						
(21.3) (10.8) (1	7.3)						
67.8 72.1 7	0.3						
(18.7) (21.6) (1	7.8)						
69.3 65.9 6	2.9						
(11.8) (17.3) (1	8.2)						
76.1 77.3 7	0.8						
(11.8) (16.8) (1	5.9)						
72.7 71.6 6	6.8						
(11.9) (17.5) (1	7.4)						

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Table I (con	Verns and Star					
	During Embeda					
Processing T	ime	Behavioral	Cognitive	Own	Totals	
		Post	test Questio	ons		
						Processing Tim
Facts			4			
10"	Mean	70.1	65.4	64.4	66.8	
	(SD)	(9.8)	(16.4)	(27.3)	(18.4)	Easta
30"	Mean	74.0	71.2	83.7	76.3	10"
	(SD)	(16.9)	(19.6)	(13.3)	(17.0)	a same
Totals	Mean	72.0	68.3	74.0	71.4	30"
	(SD)	(13.3)	(17.7)	(23.1)	(18.2)	
Inferences						Totals
10"	Mean	61.6	71.6	67.0	66.5	
	(SD)	(23.1)	(17.1)	(21.1)	(20.3)	Inferences
30"	Mean	59.1	78.4	77.3	71.6	10-
	(SD)	(12.9)	(16.1)	(16.8)	(17.2)	20*
Totals	Mean	60.4	75.0	72.2	69.0	30
12	(SD)	(18.4)	(16.4)	(19.2)	(18.8)	Totals

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Table	
standard Devi	ations for Response Time Per Item for Fact and Inference Ouestions
Vienes and Grant Press	
Embedded Questi	oning and Posttest.

Totals

Orient

		Cognitive Processing Strategy							
	Bocessing	Bocssing Time		Behavioral Cognitive Own					
			Embe	adea Quest	ions				
66.8									
(18.4)	Exca								
76.3 ·	10"	Mean	19.7	19.2	22.6	20.4			
17.0)	a Shield	(SD)	(8.1)	(10.2)	(5.6)	(8.0)			
71.4	30"	Mean	20.7	19.9	20.8	20.5			
18.2)	1 2005 -	(SD)	(7.2)	(7.2)	(8.2)	(7.3)			
	Totals	Mean	20.2	19.5	21.7	20.5			
66.5		(SD)	(7.5)	(8.6)	(6.9)	(7.6)			
(20.3)	Inferences								
71.6	10"	Mean	25.3	28.3	33.8	29.0			
(17.2)	CONT.	(SD)	(7.7)	(6.0)	(8.6)	(9.8)			
69.0	30"	Mean	26.9	30.6	29.4	29.0			
(18.8)	1000	(SD)	(14.3)	(12.8)	(15.4)	(13.7)			
(10.0)	Totals	Mean	26.1	29.5	31.6	29.0			
		(SD)	(11.0)	(9.8)	(12.3)	(11.1)			

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Table 2 (cont)

		Cognitive P	rocessing Str	rategy		
Processing '	Time	Behavioral	Cognitive	Own	Totals	1985
		Post	test Questio	ns		
Facts						
10"	Mean	15.6	11.7	14.5	14.0	Perc
	(SD)	(6.1)	(4.5)	(2.8)	(4.8)	Accur
30"	Mean	13.7	13.9	12.9	13.5	100
	(SD)	(4.1)	(3.1)	(2.9)	(3.3)	80
Totals	Mean	14.7	12.8	13.7	13.8	60
	(SD)	(5.2)	(3.9)	(2.9)	(4.1)	40
Inferences						20
10"	Mean	18.4	17.9	18.9	18.4	a state of
	(SD)	(5.5)	(2.7)	(5.2)	(4.5)	B HKAS
30"	Mean	18.3	18.5	17.9	18.2	
	(SD)	(8.0)	(5.5)	(6.5)	(6.4)	A STREET
Totals	Mean	18.3	18.2	18.4	18.3	BERNE.
	(SD)	(6.6)	(4.2)	(5.7)	(5.5)	BEERS!





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THE EFFECT OF FLUID ABILITY, UISUAL ABILITY, AND UISUAL PLACEMENT WITHIN THE SCREEN ON A SIMPLE CONCEPT TASK

NITHOR: RUSS A. HART

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A paper presented at the national conference of the Association for Educational Communication and Technology Las Vegas, Nevada January, 1986

ABSTRACT

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the purpose of this exploratory study was to examine the potential staractions between the media attribute, horizontal screen placement, and the cognitive aptitudes, fluid ability and visualization. Treatments excluded three versions of a videotaped program (left, central, or right) mat were identical in every respect with the exception of ten visual mimuli. Stepwise, multiple linear regression was utilized to investigate is major hypotheses with the Group Embedded Figures Test, the Advanced hogressive Matrices Test (APM), APM subtests I and II, sex, age, and all missible interactions forming the predictor variables (N=252). The multing equation revealed a highly significant F ratio with 14 simificant interactions accounting for 54 percent of the total variability. Sex and age interactions were noted. Alternative treatments gromoted improved performance for many low-ability learners but actively finished performance for many high-ability learners and vice versa. The inflications of this study have affirmed the need for future research incorporating additional cognitive factors and alternate media attributes.

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THE EFFECT OF FLUID ABILITY, VISUAL ABILITY, AND VISUAL PLACENER WITHIN THE SCREEN ON A SIMPLE CONCEPT TASK S15

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Recent discussion has surfaced in regard to the role of confounding 10003 effects in visually-based media research. Clark (1983) has asserted w stroc do not influence learning under any conditions, but rather the instr instructional method employed is the crucial factor which fosters learn 11182 A second rival hypothesis offered by Clark is that the increased attern tom. paid by students to media may result in increased effort or persistence and of which yields achievement gains. Clark's argument is based upon the small should but positive, effects of student achievement found in meta-analysis (Com in som Ebeling, & J. Kulik, 1981; C. Kulik, J. Kulik, & Cohen, 1980; J. Kulik, 138 0.8 Bangert, & Williams, 1983; J. Kulik, C. Kulik, & Cohen, 1979). Clark sould (1984a, 1984b) has continued to insist that media attributes do not at per influence learning in unique ways. Further, Clark and Salomon (1985, P acedic: 474) have advanced, "Any new technology is likely to teach better than a MN tec predecessors because it generally provides better prepared instructional Michael materials and its novelty engages learners." Th

In a critique of Clark's article on learning from media, Petkovich ⁶ ¹fural Tennyson (1984) have noted the lack of consideration for how the operation ¹fut (W of the various components of the human information processing system a^{ffed} ⁴f is o learning. The need for consideration of processing demands has been ¹

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arfare better in tasks in which they are suited by their cognitive style Crembach & Snow, 1977; Witkin, Moore, Goodenough, & Cox, 1977). Snow (977) first postulated an intercorrelational paradigm of general ability s) which incorporated human performance characteristics. Following the Merarchical model of ability organization interpreted by Cattell (1971) ed extended by Horn (1976), Snow (1980) noted the relation of crystallized mility (G_c)--a constellation of measures of verbal knowledge, reading of confounding omprehension, and prior educational achievement -- to learning outcomes is estructional treatment is modified to reduce the need for conventional fosters learna assembly and control processes, the relation of G to learn outcomes goes reased attents for. Fluid ability skills (Gf)--a constellation consisting of abstract : persistence and often nonverbal reasoning tests and some spatial and figural tests-upon the small mould relate to learning outcomes under instructional conditions that are analysis (Cobe in some sense new, unlike those that the individual learner has faced in 0; J. Kulik, the past. Ability to apply previously crystallized learning skills (G_) 3). Clark wild not be relevant here, but ability to adapt to new kinds of learning i do not # performance requirements (G_f) would be relevant. Snow (1980, p. 59) ion (1985, p. Redicted, "...that as an instructional situation involves combinations of etter than 10 Mr technology (e.g., computerized instruction or television)...Gf should nstructional tecome important and G less important."

weblighted by research which has shown that individuals are likely to

The distinction between "visualization" (G_v) --a constellation of , Petkovich # furral and spatial relations tests in which the Group Embedded Figures the operation int (Witkin, Oltman, Raskin, & Karp, 1971) is frequently included--and ; system affer 'i is often difficult to make, because they appear separable in Middimensional scaling but not in factor analysis. G_{f}^{f} and G_{v}^{v} are as been

separable at times, with some measures, and in some populations. One esplay however, the close correlation between measures from each constellation mojects suggested that some individuals, or all individuals, sometimes use a stimuli 5 processes to perform G, tasks. Extensive reanalyses of figural and Hakamp spatial test batteries, conducted by Lohman (1979), have suggested the wular pr spatial abilities do not fit neatly into a smoothly progressive hieren stalling factor model, as verbal and numerical abilities seem to do. Again it significa be individual differences in the novel assembly and control of spatial Nonethele processing that underlie this relation, rather than a basic relation alacement between fluid-analytic and spatial performance processes. Therefore, differenc tests that measure to a greater degree the kinds of assembly and contrawell, and processes needed to organize on a short-term basis adaptive strategies significa solving novel problems should be included in studies on interaction efference on learner and media attributes. In a radex topographic model of abilm occurred test intercorrelations, Snow and Lohman (1984) have shown Raven's (1962) The different Progressive Matrices is in the center of the map, and is to date one difference of the map and is to date one difference of the map. vas varra best measures of G or G_f.

laumers This exploratory study was conducted to investigate the potential should pe interaction between the media attribute (Salomon, 1979), "asymmetry of a strategie: screen" (Zettl, 1973), and the cognitive aptitudes, fluid ability and differs in visualization. Metallinos (1979) has reviewed the theoretical basis of meking at forces operating within the television screen and has noted that, with U learning (exception of a few experiments with inconclusive results, the investigate shallower of left, central and right placement within the frame has been largely ignored. While some research has been reported, none has shown any cogently significant differences (e.g., Avery & Tiemens, 1975; Fletcher 1977, 1980; Herbener, Van Tubergen, & Witlow, 1979). Using a newscast

populations. Complay format, Metallinos (1980) obtained significant differences for each constellar spects describing the shape, perceiving the color, and recalling visual sometimes use 6 [multiplaced on the left side of the screen over the right; however, of figural and stapp (1981) reported that mean fixations of test stimuli measured by ave suggested in all photography favored the right. In regard to learning effects, rogressive hier tallinos (1975) and Metallinos and Tiemens (1977) have reported no to do. Again is prificant differences for the retention of news information. Introl of spatia outbeless, Hart (1985) reported a predominant superiority for right basic relation meant on a simple concept task by older females. A meaningful es. Therefore, afference was found for left placement over the central orientation as sembly and controll, and interactions were noted. Field-independent females scored wive strategies splificantly higher than field-dependent females, and significant interaction efficiences for and between field independence and field dependence c model of abinexured with right placement.

*n Raven's (19:1) The purpose of this research was to ask whether, under the impact of to date one of different aptitudes, a particular frame position (left, central, or right)

As varianted. The primary experimental hypothesis tested was that low-G the potential earners who are without well developed assembly and control operations "asymmetry of should perform more ably than high-G students who may find the visual d ability and strategies dysfunctional. Thus, the study compared a media attribute that stical basis of differs in the degree to which it imposed common assemblies on students, ed that, with preventing aptitude by treatment interactions in which the regression of the investigat during on G is steeper in the treatment that is least imposing and been largely deallower in the treatment that is the most imposing.

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Fluid Ability, Visual Ability, And Visual

METHOD

Subjects

Students in a central California university enrolled in a multisection, "Radio-Television as Popular Culture" course were selected a subjects for the experiment. The sample consisted of 252 undergrate ranging in age from 17 to 44 years (M=22.8, SD=4.0). Of the total group, 129 were male, and 123 were female. The ethnic composition a primarily Anglo American, with a representative minority of Hispanir American, Afro-American, and Asian-American students.

Materials

Stimuli and Criterion Test. A nine-minute videotaped program is test instrument developed by Hart (1985) were employed. The program contained ten simple concepts on sex role indicators which formed the for a visual stimuli set and a 22-item criterion test (KR_{20} =.76). Exstimulus was constructed in three versions for left, central, and right screen placement. The three electronically edited experimental videous were identical with the exception of the embedded stimuli set.

<u>Group Embedded Figures Test (GEFT)</u>. On the 18-item perceptual ter (Spearman-Brown=.82), a field-independent person is able to better loce simple figures embedded in more complex designs than is a field-dependent individual (Witkin, Oltman, Raskin, & Karp, 1971). Field independence versus field dependence refers to a consistent mode of approaching the environment in analytical, as opposed to global, terms (Messick, 1977). The field-independent pole includes competence in analytical functionial such as mathematical reasoning, verbal fluency, and spatial abilities, combined with an impersonal orientation and a tendency to have self-defin goals and reinforcements (Witkin, Moore, Oltman, Goodenough, Friedman, Owen, & Raskin, 1977). On the other hand, the field-dependent pole

mater social sternally defi Mitkin, Hoore, Repeated a scores typical] Consequently, V spendent than function of age increasing fie. Significant de reported with . Mexander, 197 Advanced ust of analogi satterned afte mly 12 proble section of the consists of 36 of the 36 item stalogy is rer the array. A stimulus array a high retest scoring as age Stoner (1980) groups but no

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mater social orientation and social skills as well as the need for marnally defined goals and reinforcements (Goldstein & Blackman, 1978; ettis, Moore, Goodenough, & Cox, 1977).

Repeated age and sex differences have been noted on the GEFT. Mean

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evers typically tend to be slightly, but significantly, higher for males. resequently, women, on the average, are inclined to be more field mendent than men (Witkin & Goodenough, 1981). Field dependence is also a fection of age. At some point after the age of 24, the process of ecreasing field dependence begins (Witkin, Oltman, Raskin, & Karp, 1971). imificant decreases in GEFT scoring across'the life span have been moorted with adequate reliability and validity (Panek, Barrett, Sterns, & Lurander, 1978; Panek, Funk, & Nelson, 1980).

Advanced Progressive Matrices (APM). Raven's test is a widely used 10=.76). Each st of analogical reasoning instruments which use geometric figures al, and right atterned after Spearman's wall chart (Burke, 1958). Set I consists of ental videota may 12 problems and is used to provide task training, similar to the first action of the GEFT. Set II is administered immediately thereafter and arceptual test misists of 36 problems, arranged in ascending order of difficulty. Each > better locat the 36 items consists of a stimulus array in which a 3 X 3 figural ield-dependent malogy is represented with a missing piece in the lower right portion of ndependence the array. A set of eight response alternatives is located beneath each oaching the Rimulus array (Raven, 1962). Raven, Court, and Raven (1977) have reported sick, 1977). thigh retest reliability of 0.91. The test manual also noted a decline in 1 functioning Miring as age increases, particularly after the age of 30. Panek and ^{3coner} (1980), have reported a significant decrease in performance for age ive self-defus poups but no significant sex differences.

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Fluid Ability, Visual Ability, And Visual No.

Several factor analytic studies have been carried out with early sicture tube be a forms of the APM. The results of these studies have prompted investing mitial overview to conclude that the tests constitute a measure of general intelligners the instruments 1 ability or fluid G (MacArthur, 1960; Olsen & MacArthur, 1962; Spearman the GEFT and APM 1939; Vernon, 1965a, 1965b). When the Progressive Matrices measures in umials (Witkin, factor analyzed along with other tests, the evidence is supportive of a the completion o high G loading and relatively trivial loadings on other factors. When and administered matrices are factor analyzed by themselves; however, evidence of multiple of informed of factors emerge (Carlson & Wiedel, 1979; Coreman & Budoff, 1974; Rimoldi us presented la 1948; Wiedel & Carlson, 1976). Dillon, Pohlman, and Lohman (1981) for istructors. two factor solution to yield the most interpretable structure. The two factors isolated in the factor analysis measured performance items in the group Equivalence a solution required (a) the addition and/or subtraction of elements or in Because the the ability to perceive the progression of a pattern. The first subter of the three tre measure the pattern progression factor was formed by combining items 2.1 montant quest: 4, 17, 26, and 36. Items 7, 9, 10, 11, 16, 21, 28, and 35 were used to hypothesis. A 1 form a second subtest to measure the addition/subtraction factor. These malyzing the da three researchers recommended subtest scores on the two factors be inclusive and -MT. F (2,249) in all future studies predicting behaviors.

Procedures

A total of nine randomly-assigned experimental sessions were conical sples Chi-Squ within a period of one week at the beginning of the fall semester. Each "mificant dif session followed the same format. As the volunteer subjects entered the ¹³ level of si room, they were encouraged by the experimenter to seat themselves in close proximity to a television receiver in order that (a) no one be farther as ¹⁴ with might hav than 12 times the horizontal width of the screen, and (b) a line of visit ¹⁴ witions on the of not more than 45 degrees from the center line axis perpendicular to the ¹⁴ ysis of van

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ith early tube be maintained as a maximum viewing angle (Chapman, 1960). An d investing instruments to be completed and of the videotaped program to be viewed.
Spears and APM were administered, respectively, according to their test beasures and a Witkin, Oltman, Raskin, & Karp, 1971; Raven, 1962). Subsequent to prtive of a completion of the cognitive indices, one of the three visual treatments ins. When a ministered and immediately followed by the posttest. Subjects were informed of the intended purpose of the experiment until a short report 4; Rimoldi as presented later in the semester by the participating course

1981) found a metructors.

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RESULTS

items in we peop Equivalence

ements of () Because the study employed nine experimental sessions, three for each tst subter of the three treatments, equivalence of the three combined groups was an g items 2, 1 montant question to investigate prior to testing for the experimental re used to mothesis. A three level, one-way analysis of variance was used in for. These malyzing the data between the groups for each of the following subject is be inclum witground and cognitive variables: age, $\underline{F}(2,249) = 1.56$, $\underline{M} = 22.8$;

WT. E (2,249) = .45, M = 11.48; APM, E (2,249) = 1.31, M = 17.13.

Afferences between sexual composition were analyzed using the independent ere conduct apples Chi-Square Test, $\chi^2(2,\underline{N}=252) = 2.06$. The results showed no ter. Each applicant differences between the groups on any of the variables at the ntered the ⁵ level of significance.

ves in close To determine if the subjects had dissimilar life-history experiences farther and which might have altered the equivalence of the groups, two multiple choice ne of visis for the posttest were analyzed using the Kruskal-Wallis one-way cular to the subjects of variance for ranks. No significant differences were noted

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between the groups at the .05 level for subjects having read sex material, χ^2 (2,<u>N</u>=252) = .91, or having had a recent encounter with sex typing situation, χ^2 (2,<u>N</u>=252) = .52. The mean for both question was between the last two responses, "over two years" and "no encounter Regression Analysis

Multiple regression analysis has become an increasingly popular relation statistical technique (Serlin & Levin, 1985). Cronbach and Snow (1977 cirve. S have noted that linear regression equations are most useful in explore r, sin aptitude-treatment-interaction designs, because the technique provides mrcenta simple method for establishing a functional relationship among variate mrt. For example, in an experiment with several treatments (a categorical in learn variable), aptitudes of subjects (a continuous variable) may be used to ACCRETIS study the interaction between the variables in their effect on a dependent Ap variable. transfo

 $Y = a + b_1 X_1 + b_2 X_2 + b_3 X_1 X_2 ...$

In this study, the parameters of the multiple linear regression ariatic equation for testing the major hypotheses were computed in a stepwise meffic manner. The independent or predictor variables were visual placement, Thus, to GEFT, APM, APM Subtest I, APM Subtest II, sex, age, and all possible interactions. Table 1 presents the intercorrelations among the main variables.

Insert Table 1 about here.

Two dummy variables were created for visual placement (K-1 levels), left placement and right placement, with membership being assigned 1 and nonmembership being assigned 0. As a nominal variable, sex was treated d Visual Plan

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and sex role with a 1983). The dependent measure was the 22-item posttest. The other with a commutation indical Computer Program (BMDP2R) was utilized to facilitate the no encounter walysis (Dixon, 1983).

following the examination of residuals on the initial attempt, the "lationship was found to be a nonlinear "S" shape. The linearizable ly popular i Snow (1977) _________ the logistic response function, was chosen to represent the date: I in exploring $P_i = \ln (P_i/1-P_i)$, where P was the posttest expressed as a ue provides . The logistic model has been used extensively in biological ong variables med. Besides medicine and pharmacology, the logistic model has been used a learning theory, the study of consumer behavior (response to tegorical evertising) and market promotion studies (Chatterjee & Price, 1977). y be used to Applying the weighted-least-squares (WLS) method as is required on the on a dependent ransformed logit variable, heteroscedastic residuals were observed on APM latest I and APM Subtest II. Heteroscedasticity is resolved by applying wiations of WLS (Draper & Smith, 1981). Estimates of the regression gression cefficient were carried out using WLS with weights $W_i = 1/\sigma_u^2$. stepwise

> Dus, the nonconstant residual variance was accounted for by case weights mociated with the variance of the logistic response function, APM Subtest 1. and APM Subtest II. Table 2 presents a summary of the final regression malysis, and Table 3 presents the estimated regression coefficients.

> > Insert Table 2 and Table 3 about here.

vels), left The stepwise multiple regression analysis yielded 14 significant 1 and ^{Priables:}

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$$Y' = -1.2842 - .1243X_{1} + .0046X_{2} + .3187X_{3} + .0145X_{4} + ... The end of the sectors. The sectors is the sectors in the sectors is the sectors in the sectors is the sectors is$$

Y' is the predicted score; X1 is the interaction of GEFT and sex; X is averal treat the interaction of GEFT and age; X3 is the interaction of APM subter acceptical v and right screen placement; X_4 is the interaction of sex and age; $X_{e,1}$ Two othe metors repre the interaction of sex and right screen placement; X6 is the interaction of APM, APM subtest I, and left screen placement, X7 is the interaction of multiplyin of APM, APM subtest II, and sex; X8 is the interaction of APM subtest reactor for th sex and right screen placement; Xg is the interaction of sex, age, and is used, the is turn by ea right screen placement; X10 is the interaction of GEFT, APM, sex, and is continued age; X11 is the interaction of GEFT, APM, APM subtest I, APM subtest D, standard regt and right screen placement; X12 is the interaction of GEFT, APM subtest coefficients I, APM subtest II, sex, and left screen placement; X13 is the interaction mriables wer of APM subtest I, APM subtest II, sex, age, and left screen placement; " deviation. 1 X_{14} is the interaction of GEFT, APM subtest I, APM subtest II, age, and left screen placement. In all, five first-order interactions, four setmemfficient, is the best I order interactions, one third-order interaction, and four fourth-order micates the interactions were entered into the equation. The resulting multiple nccessful pr correlation was .72 with a standard error of estimate of .40. An F-test aten, 1983; the multiple correlation revealed F (14,237) = 181.17 which was signific Applying beyond the .001 level.

The method of variable coding will aid in the interpretation of the interactions. The test of a coefficient is tantamount to testing the difference between the group assigned 1 in the vector with which the coefficient is associated and the mean of the group assigned 0s in all the statement of the group assigned 0s in all the statement of the group assigned 0s in all the statement of the group assigned 0s in all the statement of the group assigned 0s in all the statement of the

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tors. The tests of the coefficient are therefore relevant when one +.0145X4 + uples to test, in turn, the differences between the means of each group usigned 1 in a given vector and that of a group assigned 0s in all meters. Dummy coding is not restricted to situations in which there are and sex; X, is great treatment groups and a control group. They can be used to code any APM subtest a categorical variable, for example, sex (Pedhazur, 1982).

Two other points are worth mentioning. First, recall that product and age; X, is the interactive actors represent the interaction terms. Interaction vectors are created he interaction is multiplying the vectors representing the categorical variable by the APM subtest H meter for the continuous variable. When more than one continuous variable is used, the vectors representing the categorical variable are multiplied sex, age, and a turn by each of the vectors for the continuous variables. This process ?M, sex, and a continued until all possible combinations are produced. Second, the IPM subtest II. rundard regression coefficient may be thought of as the regression , APM subtest ifficients that would have been obtained if the various predictor the interaction utiables were equal to one another in terms of means and standard n placement; # mistion. The predictor variable that has the largest standard regression II, age, and mificient, disregarding whether the coefficient is positive or negative, ons, four second the best predictor; conversely, a small standard regression coefficient fourth-order mutates that the corresponding predictor variable is not contributing to g multiple "cossful prediction as much as the other predictor variables (Cohen & 10. An F-test c sten, 1983; Draper & Smith, 1981). 1 was significat

Applying the above, the examination of the interactions will prove Wit informative. Since sex was assigned by designating 1 for males and 0 tation of the Ir females, the X, variable, GEFT by sex, indicated GEFT scores for male esting the Adjects had a significantly negative impact upon the prediction equation which the (X, 101). On the other hand, the sex by age interaction, X_4 , indicated d Os in all the

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older male subjects had a slightly higher predicted score (p<.05). of the fi interaction of sex and right screen placement, X5, also indicated and micions, and profited from participation in this treatment group (\underline{p} <.05); however, Jux. Unlike greated GEFT higher-order interaction of sex by age by right screen placement, x indicated older male subjects were dehabilitated by participation is a mution when cond cond very same group (p<.001). The second-order interaction X₀ and the placement inte first-order interaction X1 had the two largest standard coefficients scores profite -2.19 and -1.49, respectively. Thus, they contributed greatly to the interaction al prediction equation.

The variable sex interacted in five other conditions. The APM, in subtest II, and sex interaction, X7, had a small positive contribution the prediction equation (p<.05). Male subjects who scored well on the APM and APM subtest II performed slightly better as a result. Sex also interacted with APM subtest II and right screen placement, Xg, indicate males with high APM subtest II scores benefited from placement in that treatment condition (\underline{p} <.01). Variable X_{10} , the interaction of GEFT, APM, sex, and age, indicated older males who possessed high GEFT and AM scores had slightly larger predicted scores (p<.01). The higher-order interaction X12, GEFT by APM subtest I by APM subtest II by sex by left screen placement, evidenced high scoring males on the cognitive variable profited from placement in that treatment condition (p<.001), but the fourth-order interaction X13, APM subtest I by APM subtest II by sex by age by left screen placement, indicated older males who performed well # on the APM subtest I and APM II were dehabilitated by placement in that very same group (p<.001). Variables X_{12} and X_{13} had almost equal but opposite standard coefficients, .84 and -.89, respectively.

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p<.05). icated main ; however, p ament, X. ind the ficients. ly to the

The APM, IN ntribution m ell on the . Sex also , indicativ it in that of GEFT. EFT and AP her-order ex by left ve variables but the by sex by med well and it in that ual but

of the five remaining interaction variables, four included treatment ditions, and one included a first-order interaction with a cognitive Unlike variable X1. GEFT by sex, variable X2, GEFT by age, maled GEFT scores had a small positive impact upon the prediction pation in p_{p} mation when considering the subjects' age (p<.001). In regard to the restment conditions, variable X3, the APM subtest I by right screen interaction, indicated that subjects with high APM subtest I recres profited from participation in that treatment (p<.001), and the

> staraction also had a heavy positive impact upon the prediction equation mth a standard coefficient of 1.12. On the other hand, variable X11 sclosed APM subtest I and right screen placement interacted at a higher with GEFT, APM, and APM subtest II, producing a slightly withilitating effect in the very same treatment for high scoring subjects all the cognitive variables (p<.001). When considering left screen incement, the interaction of APM, APM subtest I, and left screen placement I variable X6 had a slightly positive effect on the prediction equation With high scoring subjects on those measures being aided by the placement mition (p<.001). Again, the higher-order interaction of GEFT by APM extest I by APM subtest II by age by left screen placement, X14, milted in a slightly diminishing effect for the prediction equation ¥.001). Yet on the variable, those older, high scoring subjects on WI, AFM subtest I, and APM subtest II were only slightly dehabilitated by at same treatment.

Among the 14 significant predictors, 11 contained cognitive indices in "Deraction terms. All the cognitive tests and subtests were represented. of the variables also contained screen placement treatments. Of """, five contained right screen placement and four contained left screen

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STT: Snow & placement. When considering those variables with standard coefficient f insptitud approximately one or greater which would have contributed the most to wigh-G learnprediction equation, right screen placement was contained in three cla Results four interactions: X3, X5, and X9. Of the four major predictors, alder female cognitive indices contributed only to two interactions: X1, GEFT by an facilitate s and X3, APM subtest by right screen placement.

DISCUSSION

Before commencing with a discussion of the resulting data, a erter intera circumspection should be observed. In interpreting multiple-regression factors from an aptitude-interaction standpoint, third-order and highinteractions must be interpreted cautiously, if at all, without well grounded theory (Cronbach & Snow, 1977). Unreliability may have especia powerful effects in a multivariate study. Index error, sampling error, sample size may have produced anomalies. Thus, this study should be considered exploratory in nature.

Performance on a simple concept task presented via three screen placements was found to possess a significant aptitude-treatment predict equation, although age differences and sex differences were noted. The relationship between variables may be interpreted as substantial support for a cognitive aptitude theory of learning from instruction (Cronback Snow, 1977; Witkin, Moore, Goodenough, & Cox, 1977) and the media attritheory (Salomon, 1979). This rationale is particularly warranted when considering that alternative treatments promoted improved performance for many low-G learners but actually diminished the performance of many high learners. In other words, the treatment that was mathemagenic (gave bir to learning) for one kind of individual appeared to be mathemathanic (gif death to learning) for another kind of individual and vice versa (Snow,

adependent Friedman, Ow differences *dehabilitate* mientation mla subject stitia, Moor to increase alled upon Soov. 1980) malated diff MI; Panek, HO; Panek

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ndard coefficient; Snow & Lohman, 1984). To say it still another way, different kinds sted the most proptitudes showed through from the inner environments of low-G and lead in three or ph-G learners, depending on the nature of the outer environment. predictors, Results confirmed Hart's (1985) findings of a general superiority for : X_1 , GEPT b, user females (M=40.0 years) when right screen placement was utilized to

cilitate simple concept learning. Older males were severly dehabilitated der the right screen treatment in the present study, despite that males, ing data, a sa whole, performed better under right screen placement in the lowertiple-regressing der interaction. Niekamp (1981) had noted, by ocular photography, mean order and high mations favoring the right for a small group of subjects who were without well redominately males. In addition, field-independent females were at a may have especialistict performance advantage, as they had been in the earlier Hart study, sampling error, mfirming that modeling cue attendance favored only the highly fieldidy should be meendent learners (Salomon, 1979; Witkin, Moore, Oltman, Goodenough,

three screen reatment predict ire noted. The tantial support ion (Cronbach i he media attribuversanted when performance for e of many highmic (gave birth memathanic (gim versa (Snow,

Midman, Owen, & Raskin, 1977). Contrary to expectations for reported sex differences (Witkin & Goodenough, 1981), field-independent males were wabilitated over all the visual treatments; however, the lower social muntation of field-independent males may have interacted with the sexnle subject matter to produce this effect (Goldstein & Blackmen, 1978; utkin. Moore, Goodenough, & Cox, 1977). Older male performance was found a increase generally when fluid ability skills evidenced on the APM were alled upon to direct spatial visualization abilities exhibited on the GEFT (Sow, 1980). This performance advantage partially supported the agealated differences noted on the indices (Witkin, Oltman, Raskin, & Karp, 371; Panek, Barrett, Sterns, & Alexander, 1978; Panek, Funk, & Nelson, (30); Panek & Stoner, 1980).

In regard to the APM and its subtests, right screen placement was mirated by found to increase simple concept acquisition for those high ability creased 1e subjects who possessed increased pattern addition/pattern subtraction inter-order skills (APM subtest I). Individuals performing well on the factor are stainment. expected to successfully ferret out figures from more complex forms, to segic pr identify figures placed in the periphery of vision, and to recognize and orier or figures with portions erased (Dillion, Pohlman, & Lohman, 1981). When G the high-ability Gf skills were combined with the first subtest, the inter who po screen placement interacted for subject performance. Perhaps the flerit mition/pat processing control of Gf directed the application of what may be merept atta considered a Gy skill in the solution of the visual task (Lohman, 1974, Longer, old Snow & Lohman, 1984), since normal eye scanning patterns are initiated in maintainment the left in western cultures (see, for example, the eye scanning researches with o reviewed by Niekamp, 1981). In other words, the solution of a visual tangatraction for concept acquisition required the intervention of higher-order skills presen orien the left orientation, but the solution was readily apparent in the risk mained in screen orientation to those individuals who possessed increased levels a wills in the pattern addition/pattern subtraction visualization skills. alevision.

Right screen placement was also found to increase simple concept atter four acquisition for those high-ability males who possessed pattern progress. Alled upon skills (APM subtest II). Individuals exhibiting high performance levels content atta this factor are expected to demonstrate a high degree of success in estimating projected movement and assessed consequences, as well as in performing various mental rotations (Dillon, Pohlman, & Lohman, 1981). Where the assembly and control processing of G_f interacted with the second subtest, males were at a performance advantage, irrespective of screen placement. Apparently, the G, skill of pattern progression was

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placement v_0 is ability subtraction exacted by right screen placement in males who possessed the ability at subtraction exact of function, when this same skill was called into play by the subtraction exact of function, screen position made no difference in concept e factor an example. In other words, those males operating at higher-order lex forms, to extegic processing levels were able to obtain salient cues despite the recognize model of the statement (Snow, 1977, 1980).

1, 1981). then G, skills interacted, some interesting effects were observed. stest, the lab who possessed high levels of field independence, pattern ps the flexil, wition/pattern subtraction, and pattern progression were facilitated to scent attainment over females through the left screen orientation; ay be ohman, 1979; Junear, older individuals with these same G skills suffered a 3 initiated in maintain performance under the same placement. Note that older ming research with only two of the three G measures, pattern addition/pattern a visual tax extraction and pattern progression, were dehabilitated under the left order skills green orientation. Perhaps some form of perceptual pretraining has been in the right lograined in high-ability mature individuals who automatically activate sed levels of skills in search of information in center of the screen when viewing Mevision. Tentative support for this interpretation is provided by wither fourth-order interaction. When the fluid-analytic G_{f} skill was : concept n progression alled upon by individuals to direct the G_v skills, a diminution in ance levels a catept attainment occurred under the right screen treatment over central Hacement. Thus, as strategic processing was called into play, the central ess in Nacement proved superior over the right orientation, indicating at least all as in ^a initial preference for this position. Once again, the reader is , 1981). ^{Dainded} this interpretation of the high-order interactions is offered h the ^{darily} until a better grounded theory of cognitive aptitudes is developed. ctive of

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In summary, the media attribute (Salmon, 1979), "asymmetry of the screen" (Zettl, 1973), was found to interact with the cognitive apting fluid ability and visualization, under 14 conditions on a simple compared task. Sex differences and age differences were noted. Yet visual placement helped many lower ability learners by giving them component assemblies they could not produce on their own. On the other hand, the highest aptitude students were hindered by the visual treatments because the intervention interfered with the strategies they normally used. The importance of aptitude-treatment hypotheses and methodology is thus as clear for a research on learning strategies in mediated instruction as in is for education generally (Petkovich & Tennyson, 1984). While the menu organization, and novelty of instruction are important factors (Clark, 1983, 1984a, 1984b; Clark & Salomon, 1985), a cognitive aptitude theory learning from instruction will account for the involvement of assembly control processes that marshal, adapt, and monitor the operation of response components assembled into a performance program for a given tal (Snow & Lohman, 1984).

This exploratory study has indicated further research is warranted with media attributes when considering the impact of different learner aptitudes. Only 52 percent of the total variability of visual placement was explained by the variation in the included cognitive aptitudes. Other cognitive factors will have to be considered for a better explanation of visual placement. Further, Zettl (1973) had identified other media codia systems within the frame: main direction of horizontal and vertical orientations, attraction of symbol mass, figure-ground relationships, psychological closure, vectors or directional lines, and movement. The relationship between the processing demands of these media attributes and

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symmetry of the processing capacity of the learner must be also investigated. Without ognitive aptime a simple concernent in the educational process--the human information Yet visual system.

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INTERCORRELATIONS AMONG THE MAIN VARIABLES

_									Contraction of the second s
Var	riables	1	2	3	4	5	6	7	
1.	Posttest	-	.32	.26	02	.17	22	.16	Sentce OI Tating
2.	GEFT		-	.12	08	09	10	06	tegression
3.	APM			-	. 31	.40	19	.07	leror
4.	APM Subtest I				-	.08	.11	06	The second second
5.	APM Subtest II					-	.03	02	1 + 252
6.	Sex						-	.21	***p <.001
7.	Age							-	
									CONTRACTOR DURING THE OWNER

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Fluid Ability, Visual Ability, and Visual Placement

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TABLE 2

SUMMARY OF REGRESSION ANALYSIS

marte of Variation	SS	df	MS .	F
gression	41.49	14	2.96	18.17**
For	38.66	237	.16	
- 252	R ² =	. 52		s = .40
Map <.001				
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	8			
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	385	1		

TABLE 3

ESTIMATED REGRESSION COEFFICIENTS

Variable	Coefficient	SE	Standard Coefficient	
CEFT X Sex	1243	.0180	-1.49	
GEFT X Age	.0046	.0005	.88	
APM Subtest I X Right Screen Placement	.3187	.0367	1.12	
Sex X Age	-0145	.0076	. 33	
Sex X Right Screen Placement	1.4898	.6750	.99	
APN X APM Subtest I X Left Screen Placement	.0149	.0029	.81	
APM X APM Subtest II X Sex	.0053	.0026	. 35	
APH Subtest II X Sex X Right Screen Placement	.3145	.1140	.91	
Sex X Age X Right Screen Placement	-,1238	.0201	-2.19	IITLE:
GEFT X APH X Sex X Age	.00013	.00005	. 69	B (22)
GEFT X APH X APH Subcest I X APH Subtest II X Right Screen Placement	00020	.00003	78	RUTHORS
GEFT X APM Subtest 1 X APM Subtest 11 X Sex X Left Screen Placement	.0052	.0012	.84	aution's
APM Subtest I X APM Subtest II X Sex X Age X Left Screen Placement	0033	.0006	89	
GEFT X APM Subtest I X APM Subtest II X Age X Left Screen Placement	00015	.00004	62	BER!
CONSTANT	-1.2842			ERST.
				and the second se

*p < .05 **p < .01

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8	Standard Coefficien		
80	-1.49		
05	. 88 .	1000	π.
57	1.12	1000	
16	- 33	Reflect .	
10	- 99	1000	
:9	.81		
:6	. 35	1222.1	
-0	.91	1111 5.	COLLECTING MERPING IN SCHOOL LIBRERY MEDIA
05	-2.19	uice.	CENTERS
03	78	AUTHORS:	MAY LEIN HO
2	.84		DRUID LOERTSCHER
5	89	1883	
34	62		
	1		
		1	390

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COLLECTION MAPPING IN SCHOOL LIBRARY MEDIA CENTERS

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by

May Lein Ho, University of Arkansas P.O. Box 2661, University of Arkansas Fayetteville, AR 72701

David Loertscher, University of Oklahoma P.O. Box 1801 Fayetteville, Ar 72702 COLLECTION MAPPING IN SCHOOL LIBRARY MEDIA CENTERS by May Lein Ho and David Loertscher 1

Collection evaluation is a process that allows a school library media specialist to analyze the collection and its use in order to anticipate demand and shape it accordingly. This activity can help determine how the collection meets the personal and academic needs of the library users. Evaluation also demonstrates the extent to which the materials in the scnool media collection support the instructional goals of the curriculum (Mancall and Swisher, 1983, pp. 257-258). In an era demanding excellence and, at the same time, accountability, collection evaluation has been playing an important role in a school library media center.

For many years, collection size measure has often been the single most important way to evaluate the collection. Yet, simply measuring collection size is not sufficient enough to reflect how a collection matches the school & curriculum it is designed to serve. Nor can this measure clearly indicate the strengths, weaknesses, or balance of a collection. The collection mapping technique with its attendant quantitative and qualitative measures might be an answer to problems like these.

Introduction of Collection Mapping Technique

The collection mapping technique was first designed by Dr. David Loertscher (in press) for guaging the potential of school library media collections to support the instructional program in schools. The basic theory behind mapping a school library media collection is based on the philosophy that a collection in a school should serve the curriculum. According to Loertscher, the total collection in a school library media center should be divided into three major divisions for the purpose of collection development: (1) A basic collection designed to serve a wide variety of interests and needs. This collection provides breadth. (2) General emphasis collections which contain materials that support a whole course of instructin such as U.S. History and beginning reading. These collections provide intermediate depth in a collection. (3) Specific emphasis collections which contain materials that support units of instruction such as "Civil War" or "dinosaurs." These collections provide full depth and support as advocated by the national standards. The mechanism by which a collection is divided into the three main collection

TERS

segments, evaluated and then managed has been the indication collection mapping. Mapping the collections will areas a library media specialist identify collection area strengths which can be compared to the curriculus media the school. The library media specialist can also specific compare collection size in topical areas to a nation instrustion sample of emphasis collections.

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Purposes of the Study

The purpose of the present study was designed field test collection mapping as a technique and the collect enough data so that individual schools course compare their collections against a national pool school collections. The study attempted to explanation following questions: What are the characteristic school library collections when they are mapped? types of collections do school library media specialists build? Can the collection mapping technique be applied to a large number of schools in various geographical locations? Can a national data pool be developed which will allow school library w specialists to compare their collections with a national sample? And, finally, how do the collection in schools compare to nationally recommended lists as Brodart's Elementary School Library Collection (1984), the H.W. Wilson's Junior High School Library Catalog (1980), and Senior High School Library Cate (1982)?

Methodology of the Study

To explore these questions, questionnaires will cover letters were sent in October 1984 to 120 libre media specialists in elementary, junior high, and his schools in 11 states (Arkansas, California, Colorada, Connecticut, Florida, Georgia, Indiana, Iowa, Oklahu Texas, and Wisconsin). Eighty schools returned the questionnaires. Of these, 68 provided sufficient dif and were judged typical enough to be included in the study. These 68 schools included 37 elementary schools, 10 junior high schools, and 21 high schools

There were four sections in the questionnaire. Part 1, the library media specialist was requested uprovide school name and address, the grade levels is the school, and the number of students. In Part 2, 7 respondent provided the total number of items in eld of the following segments of the collection: reference, 000, 100, 200, 300, 398.2, 400, 500, 600, 700, 800, 900, biography, fiction, story collection, easy, periodicals, and professional collection. In Part 3 and Part 4, the respondent identified general and specific emphasis areas if there were any, and been tick Lons will b sction irriculum d : can also to a matis

; designed a que and to :hools could nal pool of to explore teristics e mapped? dia pping schools is tional date library and with a e collectim ded lists m ollection ool Library brary Catala

naires with 0 120 library igh, and hip a, Colorado, 0 wa, Oklahow turned the fficient data ided in the antary igh schools.

cionnaire. cequested :: levels is In Part 2, tw cems in each on: 500, 600, collection,

ed general any, and

indicated the total number of items in each of the areas identified. In the study, a general emphasis area was defined as a collection strength in a library media center to support courses of instruction, while a specific emphasis area supports a single unit of instruction.

A computer program written in Basic was designed by the researcher during the Summer of 1984. The program generated a collection map and a collection chart for each school (see Table 1 and 10 as examples). A sample collection map for a typical school is shown in Table 1.

Table 1 maps a collection into three segments: (1) The number of items per student in the total collection graphed horizontally at the base of the map. (2) General emphasis area collections which generally support courses of study mapped vertically on the left. In this case, animals and folklore & fairytales are charted. (3) Specific emphasis areas which generally support units of instruction mapped vertically on the right. In this collection three areas were identified: dinosaurs, frontier and pioneer life, and Indians of North America. The collection map shows the collection strengths in terms of size. For example, there are enough materials about Indians to merit a superior rating and might be recognized by other schools in the district as a source for supplementary materials.

Creating the Collection Map Scales

One of the major purposes of the study was to establish the scales for the collection map segments, to give the scales reliability, and to provide a comparative picture across many schools. The national standard of 40 items per student was used as a guide to graph the total collection at the base of the map. The labels selected to denote progress in building collections were as follows: "Mediocre," "Making Progress," "Good," "Excellent," and "Exemplary." All segments of the collection were charted in items per student. Table 2 shows the five labels and the number of items designated for each label.



Table 2. Scale for the Total Collection Graph

Label	Items/student
Mediocre	1 - 7.9
Making progress	8 - 15.9
Good	16 - 23.9
Excellent	24 - 31.9
Exemplary	32 - 40

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-1-.10 FAIR

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The creation of labels and scales for general and specific emphasis areas was more difficult since there was no standard or professional judgment in the literature to call upon for guidance. Four labels were chosen as indicative of emphasis area size: "Fair," "Good," "Superior," and "Exemplary." All of the emphasis collections in the participating schools were pooled to create the scales. Since there were two types of emphasis areas, e.g., general and specific, two pools were created. Each of the emphasis area collection sizes was divided by the number of students in each respective school and then pooled for comparison. The results revealed a tremendous difference between the largest and smallest emphasis collection sizes. Usually, a graphic scale would be divided into equidistant intervals for charting. In this case, however, such an equidistant scale proved inadequate. Therefore, the emphasis size figures were divided into four quartiles and the resulting numbers of items per student became the scale intervals. Table 3 shows the emphasis area scale intervals.

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Table 3. Emphasis Collection Quartiles (Actual)

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	General Areas	Specific	- Contraction
# of areas indicated	258	204	rel
Mean items per student	1.11	-13	asentary
Largest # of items per student	15.62	2.05	aler arg
Lowest # of items per student	.01	.01	
lst quartile	. 27	+ 0x	standa of ele
2nd quartile	.56	. 14	16 to while
3rd quartile	1.13	- 23	high s studer
4th guartile .	15.62	2.05	report

In order to generalize the scales and make the state the practical for general usage, the scales were rounded shown in Table 4.

Table 4. Rounded Emphasis Collection Quartiles

Labeis	General Areas	Specific Areas	mier High
Fair Good	0030	0010	Mule: Medioc Making
Superior Exemplary	.61 - 1.20 1.21 - 7.00	.1625 .26 - 2.00	Good Excell Exempl

Note: One school in the 4th quartile had a general emphasis collection so large (15.62 items per studen that it was eliminated when the quartiles were route

Findings of the study

I. Total Collection Sizes Across Schools

After collections for all the participating schools were charted and mapped, the resulting data were analyzed across the schools. As is shown in Tab 5, the average collection size ranged from 8,372 in elementary schools to 18,306 in high schools. Average Collection Size, Average Number of Items Per Student, Average Emphasis Area Size of the Participating Schools

205 wel	∅ of Schools	Avg. ∅ of Students	Avg. Coll. Size	<pre># of Items Per Student</pre>	Avg. Size of Emphasis Area
.19 maantary	37 10 21	432 891 1257	8372 12521 18306	21.16 16.31 15.79	2680 2803 3571
.01 .08 of	When compa ndard of 40 elementary s	ired with th items per s chools (14	e national tudent, the schools) we	recommended greatest num re in the ran	nber nge of

id make the size Categories for rounded

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rtiles	and	Mediocre	Making Progress	Good	Excellent	Exemplary	Total
	Mementary mior High	0	10 6	14 2 8	11 2	2 0	37 10 21
Areas 10 15 25 00	ule: Medi Maki Good Exce Exem	ocre ng Progres llent plary	= 1 - ss = 8 - = 16 - = 24 - = 32 -	- 7.9 it - 15.9 it - 23.9 it - 31.9 it - 40 it	ems/studen ems/studen ems/studen ems/studen ems/studen		21
a general per studen were rouss	II. Way sch ide "to	Emphasi The col of compa ools. Li ntify emp pical col	s Collect lection ma ring the brary med hasis col lection so	ions Acro apping te strengths ia specia lections agments l	ss Schools chnique pr of collec lists were which were arger than	ovided a u tions acro asked to defined a a 'typica	nique ss s
pating ting data hown in la 8,372 in ls.	sch 68 eli the ide sci ite	ool might schools i minating re were l ntified. ence, rea mizes the	have." dentified duplication 34 discre Collection ding and emphasis	Library m 462 emph on and st te emphas ons relat literatur areas id	edia speci asis colle andardizin is collect ed to soci e predomin entified i	alists in ctions. A g terminol ions al science ated. Tab n the stud	the fter ogy, , le 7

Table 7. Emphasis Collections Reported in Participating

		100	31ª 7.
Area Name F	requency	Area Name	ATAL HARE
			LITERATUR
1. SOCIAL SCIENCE	134	2. SCIENCE	mater
J. S. history (general)	20	Animals	archology re
states	17	Astronomy	arican lice
Indians of North America	14	Science (general)	stans poet
orld War I & II	8	Computers	Anerican auth
Countries	7	Earth science	merican play
llacks	6	Biology	auchorsan liter
iolidays	6	Physical science	cant stories
ivil War	5	Insects	theater
eography/travel	5	Mathematics	181
Presidents	4	Medical science	ALL CALLER OF ALL OF AL
forld history	4	Plants	Art
American government	3	Zoology	MASLC CRACCS
conomics	3	Botany	Braving
forth America	3	Diseases	MI-Western
iiddle ages	2	Geology	Calocs
Political science	2	Anthropology	Costume
levolutionary War	2	Archeology	sunters & pa
iocial science (general)	2	Construction	Fuppets
J.S. history-20th century	2	Horticulture	WEATTH
Colonial America	1	Industry	1. deourn
longress	1	Invention & inventors	General healt
rime & criminals	1	Natural history	brack
eath education	1		Alcohol
Explorers	1	3. READING	litness
rontiers & pioneers	1		largality
Pioneer days	1	Folklore & fairytales	
Political election	1	Picture books	. LANGUAGE
Renaissance History	1	Beginning reading	faglish lang
Social interaction	1	Biography	Mctionaries
Social problems	1	Fiction	foreign lang
Sociology	1	High/low reading	Granmar
Theodore Roosevelt	1	Children's authors	Latin
Iravel	1	Award winning books	ilgo Languag
J.S. geography	1	Jokes & riddles	ang a a g
J.S. foreign policy	1	Mystery & detective stat	POR A DESCRIPTION
J.S. history-1856-	1	Science fiction	2003025
J.S. history (The West)	1	Animal stories	APROXED IN .
omen	1	Historical Fiction	Contraction of the local division of the loc
		Language arts-junior 31	CONTRACTOR OF T
		Scientific biographies	ACCESSION OF
		Young adult authors	A DAY OF A DAY AND A DAY

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	ATES ATES	Frequency	Area Name	Frequency
	TERATURE	41	8. SPORTS	12
E	ritology ritology ritology ritology ritology	12 6 5 4	Sports Games Ball games Recreation	7 3 1
eneral)	mas poetry	2	9. VOCATIONAL EDUC	ATION 10
nce	merican plays	1	Agriculture Careers	19
ience	Short stories	î	10. HOME ECONOMICS	5 7
Lence	S. ARI	20	Cookbooks Food Home economics	4 2 1
	art mutic	42	11. PROFESSIONAL	COLLECTION 5
-12	riving U-Vestern	2	Prof. coll. (genera Teacher aids	1) 4 1
1.1	alers	i	12. PSYCHOLOGY	5
n	Midicraft Midters & painting Mopets	1	Exceptional childred Applied psychology Child development	20 2 1
e	. REALTH	13	13 prespence	a. 1 2
inventors	Meral health	43	Reference (general,) 2
	Alcohol	1	14. LANGUAGE ARTS	1
1.58	Autonal growth	i	Creative writing	1
airytales	I. LANGUAGE	12	15. RELIGION	. 1
ading	Iglish language	3	Religion (general)	1
ding uthors g books les	Actionaries Areign languages Arman Atinar Atin Anguistics Algo language	2211111	Controversial know	ledge 1
tective station es iction s-junior gra- lographies authors				

Table 7 is instructive because it reflects the diverse curriculum areas included in the schools. frequency of collections in topics such as U.S. domit history, states, Indians of North America, animals deal folklore & fairy tales, picture books, poetry, and CUTT astronomy indicates that those are the most conner "cyp curriculum areas in the country which are well III. Those areas supported by library media resources. might also be the collection targets that current List library media specialists tend to build constantly comparison of topics missing on the list but include in a school's curriculum would indicate neglect to part reco collection building policy. In this case, the libra media specialist might make an analysis of the ream Coll for collection overlap and collection neglect. Texa Seni edit which are unique in one of the 68 collections give are idea of collection breadth. Schools that have larm but collections of Renaissance history, costume, perc horticulture, etc. are important in resource sharing clas networks. These are the collections which could be shared effectively among the schools in a network. Resource sharing is advantageous among schools if Tabl collections are diverse. To summarize Table 7, the emphasis areas were combined further into 15 central curricular subjects and ranked. Table 8 gives them rankings.

Curriculum Topics	Total ∉ of Areas Mentioned	∉ of Discrete Areas
Social Sci.	134	38
Science	112	22
Reading	85	16
Literature	41	13
Art	20	11
Health	13	7
Language	12	9
Sports	12	4
Voed.	10	2
Home Ec.	7	3
Prof. Coll.	5	4
Psychology.	5	2
Reference	2	1
Lang. arts	1	1
Religion	1	1
Others	1	1
Total	462	134

Table 8. Number of Emphasis Areas Grouped According Curriculum Topics

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reflects o e schools. as U.S. ca, animal, poetry, and most commu re well Those areas at current constantly, t but inclus neglect it se, the litte of the real aglect. Top stions give a it have litp cume, ource sharing ich could be a network. schools if [able 7, the to 15 central 3 gives them

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An analysis of Table 8 reveals that emphasis areas dominate in social studies, science, and collections dealing with reading and literature. These are the curriculum areas which will be served best by the "typical" school library media collection.

III. Library Media Collection and National Selection Lists

In this study, the collections of the 68 participating schools were compared with the nationally recognized selection lists: <u>Elementary School Library</u> <u>Collection</u>, <u>Junior High School Library Catalog</u>, and <u>Senior High School Library Catalog</u>. The current editions of the recommended lists contain titles which are considered representative in many topical areas, but some areas predominate. Table 9 lists the percentages of materials in each of the Dewey Decimal classes.

Table 9. Recommended List Percentages

Dewey		S	
Area	Elementary	Junior High	High
Ref.	1.82	3.00	3.00
000	0.82	1.59	1.32
100	1.08	1.82	1.81
200	1.08	1.10	1.71
300	5.09	10.63	13.74
398.2	6.11	0.00	0.00
400	0.80	1.40	1.87
500	10.29	11.55	4.60
600	6.70	9.73	7.15
700	6.31	13.65	7.93
800	2.50	1.84	13.85
900	5.45	13.45	15.89
8	3.47	10.12	12.60
Fic	23.52	15.27	9.42
SC	1.13	2.35	2.61
Easy	15.87	0.00	0.00
Period.	1.64	0.50	0.50
Prof.	6.32	2.00	2.00
lotal	100.00	100.00	100.00

Interpretation: 1.82% of the titles included in the elementary list are reference materials.

Note: None of the Wilson lists have a separate reference or professional collection. The researchers

had to estimate the size of these collections three careful analysis of each Dewey section.

In a practical sense, Table 9 suggests that. library media specialist might use the national II percentages as purchasing guidelines. A number at specialists have had such purchasing targets, but . a practice has dubious value. It is, however, help to compare a school's collection against the stand list as a preliminary step in collection mapping. library media specialist who is new to a collective might create a chart like Table 10 to assist in the identification of emphasis collections. The library media specialist examining Table 10 would examine m Reference section, 500's, 900's, Biography, and Land sections first in order to identify emphasis collections. The total collection chart, however, would not help identify emphasis collections which would span several Dewey classes.

Table 10 Total Collection Chart

School Name:

No. of Students: 597

Total Collection: 8289

No. of Total Collection Items Per Student: 13.88

1	1999 - P. 1999 -	1	1	1	1	1 13
Dewey Areal I I	Recom- mended List %	lShould Have 	IActually IHave	IDiscrep- lancy l	ILikely IEmphasis IArea	IAreas That IMay Need IPurchase
Ref. I	1.82 %	1 151	1 259	1 108	1	1
000 1	0.82 %	1 68	1 86	1 18	1	1
100 1	1.08 %	1 90	1 39	1 -51	1	1
200 1	1.08 %	1 90	1 56	1 -34	1	1
300 1	5.89 %	1 422	1 407	1 -15	1	1
398.2 1	6.11 %	1 506	1 305	1 -201	1	1 1
400 1	0.8 %	1 66	1 110	1 44	1	1
500 1	10.29 %	1 853	1 1112	1 259	1 .	1
600 1	6.7 %	1 555	1 499	1 -56	1	1
700 1	6.31 %	1 523	1 516	1 -7	1	1
800 1	2.5 %	1 207	1 247	1 40	1	1
900 1	5.45 %	1 452	1 981	1 529	1 .	1
B I	3.47 %	1 288	1 496	1 208	1 .	1
Fic I	23.52 %	1 1950	1 1343	1 -607	1	1 1
SC	1.13 %	1 94	1 61	1 -33	1	1
Easy	15.87 %	1 1315	1 1641	1 326	1. *	1
Period.	1.64 %	1 136	1 19	1 -117	1	1 1
Prof.	6.32 %	1 524	1 112	1 -412	1	1 +

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When all the schools in the study were compared to their respective national list, some interesting data were generated. Table 11 compares all the elementary collections in the study to the <u>Elementary School</u> <u>Library Collection</u> percentages.

Table 11. Distribution of Collections - Elementary Schools

Dewey Area	% in School Collections	Recommended List %	Difference in %
Ref.	1.72	1.82	-0.1
000	1.02	0.82	0.2
100	0.54	1.08	-0.54
200	0.61	1.08	-0.47
300	6.58	5.09	1.49
398.2	3.43	6.11	-2.68
400	0.73	0.8	-0.07
500	12.91	10.29	2.62
600	6.29	6.7	-0.41
700	5.84	6.31	-0.47
800	2.67	2.5	0.17
900	10.31	5.45	4.86
в	5.23	3.47	1.76
Fic	21.20	23.52	-2.32
SC	0.62	1.13	-0.51
Easy	18.22	15.87	2.35
Period.	0.28	1.64	-1.36
Prof.	1.71	6.32	-4.61
Total	99.91	100.0	

Table 11 shows that more than 62 percent of average elementary school's library holdings were categories. These categories in ranking order was Fiction (21.20%), Easy (18.22%), 500's (12.91%), and 900's (10.31%). When compared to the recommended percentages, an average elementary school maintain more materials in 900's, 500's, and easy sections the recommended list. Practically, this means that national list is not as helpful in some areas as in might be. For example, a library media specialist needs hundreds of easy books to assist beginning readers will find very little help in the list. The specialist would also need additional bibliographic develop the 900's and 500's collections further.

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The Brodart list contained more materials in the areas of the Professional collection, 398.2's and Fiction than the schools in the study. This means a library media specialists needing to build large collections in these areas could use the recommended list to good advantage.

Table 12 compares the collections in the junior high schools of the study with <u>Junior High School</u> Library Catalog.

Dewey	X in School	Recommended	Difference
Area	Collections	List %	in %
Ref.	6.27	3.0	3.27
000	1.05	1.59	-0.54
100	0.81	1.82	-1.01
200	0.85	1.1	-0.25
300	8.46	10.63	-2.17
400	1.28	1.4	-0.12
500	10.75	11.55	-0.8
600	7.71	9.73	-2.02
700	8.61	13.65	-5.04
800	3.82	1.84	1.98
900	14.54	13.45	1.09
в	5.60	10.12	-4.52
Fic	26.96	15.27	11.69
SC	1.52	2.35	-0.83
Period.	0.35	0.5	-0.15
Prof.	1.40	2.0	-0.60
Total	99.98	100.00	

Table 12. Distribution of Collections - Junior High Schools

In the junior high school collections, the top ranking categories were: Fiction (26.96%), 900's (14.54%), and 500's (10.75%). Table 12 indicates that Fiction collection in an average junior high school was significantly larger than that suggested in Junior High school Library Catalog. The reference collection was also larger. On the other hand, Junior High School Library Catalog provided many more titles in 700's, Biography, 300's, and 600's.

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Table 13 compares the collections of the 21 high schools in the study to Senior High School Library Catalog.

Table 13. Distribution of Collections - High Schools

Dewey Area	Z of Total Coll.	Recommended List %	Difference in %
Ref.	5.82	3.0	2.82
000	1.5	1.32	0.18
100	1.7	1.81	-0.11
200	0.97	1.71	-0.74
300	12.44	13.74	-1.3
400	1.46	1.87	-0.41
500	8.5	4.60	3.9
600	7.63	7.15	0.48
700	7.83	7.93	-0.1
800	9.88	13.85	-3.97
900	15.99	15.89	0.1
В	6.12	12.60	-6.48
Fic	17.12	9.42	7.7
SC	1.69	2.61	-0.92
Period.	0.45	0.5	-0.05
Prof.	0.89	2.0	-1.11
Total	99.99	100.00	

In the high school collections, more than one third of the collection in the average high school was devoted to two categories: Fiction and 900's. The third largest section was the 300's. The schools had significantly more materials in Fiction, 500's, and Reference, while the recommended list was stronger in Biography and 800's.

Conclusions and Recommendations

The main purposes of this study were to test the collection mapping technique and to compare collections of materials in schools with nationally published

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recommended lists. The research provided evidencollection mapping is a viable and effective term for collection analysis and collection management provides a different picture of a collection ration than just size figures. The mapping procedure is simple enough to be done without extensive training the resulting graphic representation of a collect not only a representation of collection strengths also charts strength against a national sample of schools.

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The collection mapping technique, as tested in this study, works well in schools with student populations of 500 - 1000. Schools with smaller and larger student bodies would need altered scales. In schools should have fewer items per student needed excellence ratings and small schools need more item per student.

The study gave added evidence of the breadth and depth of school library media collections in the country. The library media specialists identified emphasis collections in the 68 schools covering like distinct topics. These collections provide sufficient diversity to support a network of resource sharing. The potential to share collections as evidenced is a study is one of the nation's richest untapped resources.

The 1975 national guidelines recommend a minim of 20,000 items or 40 items per student for every school over 500 students. The guidelines also state that library media specialists in large schools may a wish to achieve the ration of 40 items per student. The schools in this study (which are typical account to national statistics) show that elementary schools have more items per student but smaller collections than secondary schools. In this study, the average collection size for elementary schools was 8,372; 54 junior highs, 12,521 and 18,306 for high schools. research needs to be done to establish minimal collection sizes, not just for total collections but for collections to support units of instruction and courses of study. Perhaps size standards for curriculum blocks would be a direction to investigate

The 1975 guidelines did not specify guidelines building professional collections. Very few of the schools in this study had sizeable professional collections. In some districts, library media specialists noted that professional materials were at the district level rather than the school. In others, these collections were very small or non-existent. ovided evide effective ter ion managemen ollection rai g procedure i tensive trais n of a collection strength onal sample o

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ify guideline ery few of the ofessional ary media aterials were school. In mall or The second aspect of the study, the comparison of collections to nationally published lists, provided new insights into the composition of the recommended lists vs. actual collections of materials. Library media specialists generally build collections to support supplementary reading and subject oriented collections which serve social studies, literature and science. It is not surprising that school library collections and services only appeal to a part of the total curriculum and teaching staff in a school.

The study clearly pointed out that school library media specialists build different collections than national lists recommend. National lists contain emphasis collections which have developed over a period of time which need re-examination in light of current school curriculum. The orientation of national lists toward what publishers publish is as troubling as the narrow focus of the collections in schools.

If school collections are to support the total curriculum, library media specialists need to map their collections and create acquisition targets which match their curriculum--then channel their money into those Publishers of national lists need to re-assess areas. their lists regularly and adjust the scope to truly reflect the curriculum of the nation's schools. H. W. Wilson, for example, hasn't yet discovered that audiovisual media are as basic as books in an educational institution. Considering the current curriculums and the availability of computer technology, perhaps it is time to suggest that both H.W. Wilson and Brodart rethink the "raison d'etra" and the methodology of creating their publications. Perhaps core titles and emphasis collections could be made available on floppy disks on a subscription basis and/or on-line. Such a data base could be under continuous revision and could expand far beyond the current efforts toward core materials only. If printed books continue to go out of print as has happened in the past few years, the value of a printed list is questionable.

Perhaps the best advice to library media specialists from this research is to build collections in topical segments rather than just buying "things." Nationally published core lists may be useful in building a few basic materials in a topical area but to build strength and depth into a collection requires a different approach.

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PRINCIPALS' AND TEACHERS' ATTITUDES TOWARD KANSAS SCHOOL MEDIA LIBRARIES

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JOHN A. HORTIN

Principals' and Teachers' Attitudes Toward Kansas School Media Libraries

by

John A. Hortin

Kansas State University

The intent of this research was to discover (1) the attitudes of machers and principals toward rural school libraries, (2) how school rincipals and teachers compare in their attitudes and (3) what do bey expect in the way of services? I made a special effort to scertain the adequacy of microcomputer technology in Kansas rural schools.

'I identified four hundred rural and small schools in Kansas and sked them to participate in this research. The schools identified are involved with the Kansas State University Center for Rural shoation and Small Schools. All schools had an enrollment of less than 600 students. Of the four hundred schools in the sample, one hundred and eighty-two schools responded. I used no follow up letter and this may account for the moderate rate of questionnaries returned (5.5%).

The principals of each school received three copies of the twenty item questionnaire (see Appendix I). Each principal completed a copy and selected two teachers to fill out the other two copies. The three expise were returned by the principal. I collected and analyzed demographic data and attitudes toward school media library services and programs. I also analyzed frequencies for the demographic data and used a multivariant analysis of variance to compare principal and teacher groups. The questionnaire consisted of twenty items with the subject ranging from teachers' and students' attitudes about using the library to instructional development services. The higher the score of each item, the more positive the response of the principal or two teachers.

The principal was the contact person in this study and he or she designated the two teachers that were to respond to the questionnaire. This procedure was considered the most expedient and practical, but it would be noted that certain biases and influences affected the data found since the principal did the selecting of the two other respondents. Readers of this study should keep in mind the possible biases inherent in this procedure. A second limitation is that the attitudinal data collected does not necessarily reflect what conditions really exist in rural or small schools, but only attitudes and opinions about these conditions. The demographic data I collected did provide some description and information about budgets, volumes of library books, enrollment, staffing and education of the school media library personnel. A third limitation is the fact that there was only a moderate return of questionnaires (45.5%) from the respondents, and I can only wonder about the reasons. Follow up letters might have given a greater return percentage or phone calls to school districts Right have provided more data.

Results and Discussions

I summarized the demographic data for enrollment, number of books and budget in Tables 1, 2, and 3. Over half the schools that responded to the questionnaire have enrollments between 101 and 400 students (57.7%). Only 4.9% or nine schools have over four hundred students. The number of books in the collections vary greatly.

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Eleven schools had collections of 2000 or fewer books. Twenty percent had 6000 to 8000 books. Eleven other schools had over books. My recommendation is a minimum of 15,000 to 20,000 books most school media libraries to do an adequate job supporting curriculum. For rural or small schools I recommend some kind sharing or network system to reach the goal of a collection of books. Rural or small school budgets varied, with twenty school having a budget of under 1000 dollars and one school a 62,500 do budget. The largest number of schools (N=29) reported a budget between 2001 and 3000 dollars.

Eighty-four percent of the schools have a certified library The percentage of time a librarian spent at one site was 66.24, meaning the librarian spent one-third of his or her time either another school site serving another faculty or spent that time teaching or with other educational activities.

Another study from the Kansas State Department of Education showed that the number of schools served by one librarian was a follows:

In 11 districts one librarian serves 4 or more sites. In 36 districts one librarian serves 3 sites. In 106 districts one librarian serves 2 sites. In 70 districts two librarians serve 1 site. (Level, 1984)

Level (1984) said that if librarians are to provide curricula support and instructional development in each building, the libra staffing must be based on the number of teachers in each building and the number of sites served rather than on a per pupil basis, a is the current practice.

Some of the respondents (27.9%) did not know whether their librarian had a master's degree in the specialized field of libra media. Twenty-seven percent reported that their school media librarian held a master's degree in that specialized area, while 44.3% reported that the librarian did not hold a master's degree a any field.

There was a significant overall difference between the principal group and the teacher group with the approximate F=2.12 (df=20,434), p<.01. The principals generally had a higher positive attitude about the school media library than did the teachers, although both groups were positive. On two specific items of the twenty item questionnaire there was also a significant difference. The first significant item asked the "library staff's attitude toward teachers" and the teachers' (N=287) mean score was 4.58, while the principals' (N=168) mean score was 4.39 with F=6.6 (df=20,434), p<.01. The teachers felt that the library staff attitude toward teachers was better than the principals did. In the other item to show significance, the question asked about the success of library instruction: the principals (mean = 3.84) felt more positively that the school media librarians were doing a goot

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The three items or questions that dealt with microcomputer achology generally had lower mean scores for both principal and teacher groups than did the other items on the questionnaire (see nole 4). The principals were somewhat more positive than the teachers on these three items. One item that both principal and teacher groups agreed on was that teachers did about an average job mean = 3.33) keeping librarians abreast of trends in curriculum.

Conclusions

This research provided some demographic data on the diversity a library services, budget and staffing in the State of Kansas. mere was a significant difference between the principals' attitudes toward the school media center and that of the teachers. As a group, the principals were more positive (approximate F=2.28 [df=20,434], p<.01). Overall, most principals and teachers in mail or rural schools were fairly positive about their school adia libraries. Both groups were less positive about the adequacy of microcomputer technology. The demographic data showed that Hbrary staffing, budgets and collection size varied widely from school to school. Many librarians were working at one site only 56.2% of the time. In order for librarians to work closely with faculty and students in planning, selecting, producing, using and evaluating instructional materials, I believe librarians need to devote full time to one site. When this practice is impractical, some sort of networking or sharing of staff between districts may be necessary to accomplish better library staffing. Positive attitudes about library and media services are encouraging. However, from responses to the questionnaire, on-site visits and interviews with teachers and librarians I believe there is room for improvement. Local production of media and instructional planning and development are services that many librarians do not have the time to do or the necessary training to accomplish. Principals, teachers and librarians need to be informed about the potential of local production in the schools. Librarians need to know not only how to organize, catalog, and administer the school media collection, but also how to make instructional materials, work with faculty and students on learning experiences, integrate resources and services into the total school program, and share learning and teaching theories, methods and research with teachers and students.

I believe that the school media library should be the fulcrum of intellectual activity and learning for students and the catalyst for innovative learning experiences. A librarian who informs teachers about the many materials and services the library has to offer can achieve these goals and elicit a positive response toward the library. I believe librarians could do more to inform patrons (students, teachers, principals, and parents). Frequently a library needs more staffing and a budget increase to bring about a truly innovative and comprehensive media library that does more than just check out books. I believe librarians should be leaders in curriculum development, instructional development, local production and computer technology. First, I recommend further emphasis on attitudes about the school media library with an emphasis on student and teacher attitudes. Also, I recommend librarians work toward informing principals, teachers, parents students about the leadership role that librarians should play curriculum development, instructional development and local production. Third, librarians themselves may need to learn the inservice, conferences, retraining seminars and formal course about their role in local production, curriculum development instructional development.

Table 1

Demographic Data on Enrollment for Rural and Small Schools

Pupil	Number of	Cumulative	Percent
Size	Schools	Percent	of Total
$\begin{array}{r} 1 - 50 \\ 51 - 100 \\ 101 - 200 \\ 201 - 400 \\ 401 - 1615 \end{array}$	-32 36 59 46 9 182	27.6% 37.4% 69.8% 95.1% 100.0%	17.68 19.88 32.48 25.38 4.98

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Table 2

Number of Books in Rural and Small Schools in Kansas

Size of Book	Number of Schools (N=182)	Percentage
0000	11	6 049
800 - 2000	17	9.309
2001 = 3000	26	14.30%
3001 - 5000	29	15.92%
soo1 - 6000	24	13.20%
6001 - 8000	46	25.30%
8001 - 10,000	18	9.90%
over 10,001	11	6.04%
	182	100%

Table 3

Budget for School Media Libraries of Rural and Small Schools of Kansas*

Budget	Number of Schools	Percentage of Those Schools Who Reported Data
0 - 1000	20	16.20%
1001 - 2000	21	17.07%
2001 - 3000	29	23.50%
3001 - 4000	13	10.50%
4001 - 5000	14	11.38%
5001 - 6000	12	9.76%
6001 - 7000	. 6	4.87%
7001 - 9500	7	5.69%
62,500	$\frac{1}{N=123}$.813%

'59 schools did not report this data.

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Percent of Total 17.6% 19.8% 32.4% 25.3%

4.9%

Table 4

Mean Scores and Standard Deviations of Principals' (Nelse) and Teachers' (N=287) Attitudes About Microcomputers in the School Media Library

	Variable	Principals' Mean Score	Standard Deviation	Teachers' Mean Score	Standard
1.	Knowledge of current micro computer soft ware for subject areas	- - 3.46	1.64	3.40	1.9
2.	Library staff encourages teachers to use micro- computer technology	3.60	1.79	3.48	2.02
3.	Library staff helps student use microcom- puter softwar	s ne 3.59	1.84	3.42	2.04



	School District.
	Name of school:
	Principal:
	Teacher:
	Enroliment:
	Grades taught:
	Total number of volumes of library books:
	Budget: Library media budget (excluding textbooks and equipme for the current school year:
	(this attendance center only)
	Do you have a certified librarian?
	What is the percentage of time the librarian is assigned to the building as a librarian?
	How many volunteers do you use in the library?
	Does the librarian hold a master's degree in library science? Institution granting degree:
	Other degrees:
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This survey is being conducted under guidelines established by Kansas State University. you will help the survey administrators find answers to important questions; however, your print in this survey is strictly voluntary. You should omit any questions which you feel invade privacy or which are otherwise offensive to you. Confidentiality is guaranteed.

* Hortin, J. A. School media specialists and their roles as teachers and curriculum activists.

Additional copies of this survey available from the author: Dr. John A. Hortin, College of Education University, Manhattan, Kansas 66506. 419

Reference



TITLE: LONGITUDINAL CURRICULUM CHANGES IN INSTRUCTIONAL DESIGN AND EDUCATIONAL PSYCHOLOGY DOCTORAL PROGRAMS

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LONGITUDINAL CURRICULUM CHANGES

IN INSTRUCTIONAL DESIGN AND

EDUCATIONAL PSYCHOLOGY DOCTORAL PROGRAMS

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INTRODUCTION

Several writers have discussed the need for more research about instructional design, and some have identified areas particularly in need of research. One general area designated as being in need of further research is the training and education of instructional designers (Durzo, Diamond, & Doughty, 1979; Silber, 1981); several specific recommendations for modifying graduate education in instructional design have been proposed. At the same time, others have proposed changes in graduate education in educational psychology. One specific proposal which has been made is the integration of coursework in instructional design into graduate programs in educational psychology (Dick, 1978; Scandura et al., 1978). Thus, it appears that the status of graduate education in both instructional design and educational psychology is in a dynamic phase; a study examining changes in graduate education in the two fields would help to clarify how the two disciplines are changing relative to each other.

The usefulness and importance of individual components of graduate aducation in instructional design have been discussed. For example, ruided field experience for the instructional design student has been proposed to be an essential component of an instructional design curriculum (Bass & Duncan, 1981-82). Skills in self-evaluation of job performance are necessary for professionals delivering services, and the need for better training in self-evaluation skills has been discussed (Eldridge, 1982). More broadly, the general development of higher cognitive skills as exemplified by Piaget's stages of concrete operations and formal operations has been proposed as the goal of 1981). instructional design education (Silber, Thus, proposed components of an instructional design curriculum range from very specific to fairly broad and comprehensive.

Similarly, several persons have examined the role of particular components of graduate education in educational psychology. Specific content areas such as human development, learning, motivation, and research methodology and statistics are traditional components of graduate education in educational psychology (Anastasi, 1979; Sandura et al., 1978). However, other areas such as instructional design and program evaluation have been suggested as topics which should be incorporated into the educational psychology graduate curriculum (Albino, 1979; Dick, 1978; Scandura et al., 1978).

To date, however, the relationship which exists between instructional design programs and educational psychology programs at institutions which have doctoral programs in both areas has not been examined. This study was intended to clarify specific aspects of that relationship.

The primary purpose of this study was to investigate the relationships which exist between graduate education in educational Psychology and instructional design. First, the study assessed the extent to which instructional design topics are being studied in

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doctoral programs in educational psychology; second, the assessed the extent to which doctoral students in instruction media, and technology study educational psychology topics curriculum at institutions which have doctoral programs in The study also determined if specific curriculum topics disciplines had changed over time, using five years ago (19) year), currently (1983-84 school year), and projections for the in the future (1988-89) as the points in time. In this fashing possible to determine the extent to which the two programs inteterms of students studying topics in the other area.

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Programs which were examined in this study are psychology doctoral programs and instructional design doctoral at schools which have both programs in their graduate curricular respect to educational psychology programs, graduate program offer the doctorate in either "educational psychology" or educational psychology" were included in this study Psychological Association, 1981). Instructional design, technology programs were identified from a listing found <u>Educational Media Yearbook</u> (1983); from this point, these program be referred to as instructional design programs.

Two major questions about the interaction of graduate educate instructional design and educational psychology were answered study. First, what differences exist between educational psychology and instructional design programs in the number of doctoral as studying specific curriculum topics at each of the three points a which were examined? Second, can any trend in directionality over time; that is, has one area shifted more in the direction other area? Four measures of interrelationship between the two curriculum topics studied by doctoral students, recent dissertation research, faculty dissertation research, and between faculty in the two programs were used to answer questions. This paper will focus on findings from curriculum studied and faculty contacts; other data from this study can by elsewhere (House, 1985).

Additionally, the study provided a descriptive characteritate each type of graduate program. Information including how frespecific curriculum topics were studied, recent student dissedirections, faculty dissertations, and open-ended communresponding chairpersons were used to provide a brief character of instructional design and educational psychology graduate pro-These findings are also summarized elsewhere (House, 1985).

The results of this study may be of interest to several F First, higher-level administrators such as deans of colle education are provided with a more clear representation a relationship between doctoral programs in educational psycholog instructional design. Second, administrators of doctoral proginstructional design and educational psychology can be made suc the degree of interrelationship between the two areas, and be relationship is changing over time. Third, persons responsible 7: second, the ints in instruction isychology topic ioral programs is iculum topics we years ago (19) i projections for ime. In this fast he two programs to her area.

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interest to sever as deans of colar representation ducational psychfors of doctoral pogy can be made the two areas, and persons responbiring educational psychologists and/or instructional designers are provided with a more clear characterization of the types of experiences which graduates of these programs have been exposed to.

RELATED LITERATURE

Characteristics of Instructional Design Graduate Programs

within the structure of an ideal graduate program in instructional design, several specific areas of training would be represented and would have acquired the ability to exhibit certain graduates professional competencies. Among the specific areas to be included in an ideal program would be educational technology and media, instructional psychology, instructional development, and statistics and research methodology (Patridge & Tennyson, 1978-79). Additionally, it has been proposed that graduate students take courses outside of instructional development in order to observe how other disciplines view the learning process and conduct research (Bratton, 1981). Also, considerable discussion has focused upon professional competencies which graduates of instructional development programs should be able to perform (Task Force on ID Certification, 1981). Each of these areas will be examined in more detail.

A major component of the traditional doctoral degree curriculum is research (Spurr, 1970). In their assessment of competencies which would be included in an ideal program, Patridge and Tennyson (1978-79) found that research methodology would be a highly emphasized area; however, it has been noted that graduate students in instructional design are often not adequately trained to conduct research (Reiser, 1982). Consequently, some graduate programs are starting to provide practice experiences in research in the form of research practicum courses (Reiser, 1982).

Another integral portion of an instructional development curriculum is educational media and technology. There are two generally accepted definitions for educational technology (Romiszowski, 1981). The first definition refers to educational technology as the use of hardware or equipment in the educational process while the second definition focuses on the process of the scientific development of learning experiences through a knowledge of the psychology of learning. In their study of components of graduate programs in instructional design, Patridge and Tennyson (1978-79) surveyed course offerings in media such as visuals. computers, and audio and it would appear that the authors were employing Romiszowski's (1981) first definition of educational technology. Also, in his proposals to incorporate instructional design topics into the educational psychology curriculum, Dick (1978)discusses areas such as media selection and media production, indicating that he also employs a definition of educational technology as being primarily hardware or equipment.

Instructional psychology has also been identified as a major area of preparation in an instructional design graduate program (Patridge &
Tennyson, 1978-79). Instructional psychology is the applifindings from experimental learning psychology to various is a settings at all levels of education (Glaser, 1982). The learning psychology differs from instructional psychology is experimental study of learning is not necessarily approaches ultimate aim of being applied to instructional practices Hilgard, 1981); conversely, instructional psychology is condthe goal of improving instructional methods (Glaser).

A final consideration of graduate education in instruction is the development of professional competencies. A set all competencies has been proposed (Task Force on ID Certification This particular list focuses upon professional activities and to be correctly accomplished by instructional developer competencies have been proposed, including appropriate interand consulting skills (Bratton, 1979-80) and the ability to clients in order to quickly learn basic knowledge in unfamiliar areas (Bratton, 1981). Thus, a variety of behavioral and interskills are expected of the professional instructional developer

One method by which characteristics of present ID graduate procan be evaluated is by an assessment of the content of those pro-There has been at least one study which has assessed similarity differences between various graduate programs in instrudevelopment (Patridge & Tennyson, 1978-79). This project survey graduate programs in instructional design, documenting prograand characteristics, student characteristics, and faculty progra-Similarities and differences between masters and doctoral program examined. Additionally, representatives of each graduate program the order of emphasis placed upon a variety of student competences their programs; similar ratings were solicited for what excompetencies would be ranked in an ideal graduate program instructional design.

A major difference found between masters and doctoral prepa program goals. Most programs placed an emphasis on the teach instructional development and/or media production for masters may while emphasizing a more traditional study of research methodel an area of specialization in doctoral programs (Patridge & Ter With respect to faculty preparation, Patridge and Tennyson form most faculty were trained in one of three areas (instrudevelopment, instructional psychology, and visual technology). We were considerably more often trained in visuals than any other As well, more faculty were trained in measurement and evaluation media (with the exception of visuals).

Patridge and Tennyson found that many of the courses of graduate programs in instructional development fall within five areas: instructional psychology, measurement and evalinstructional development, educational technology, and managese administration. In their discussion of the redesign of the SP University instructional development graduate program, Dough? Durzo (1981) also show that many of the courses in the curricula

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ology to various 1 into the categories of instructional development, media, research and (Glaser, 1982). avaluation, and instructional psychology/learning. Additionally, they ional psychology ; siso report that field experiences such as internships and practicums acessarily approad are part of the curriculum. Patridge and Tennyson report that five of ictional practice the nine programs surveyed in their study offered internship psychology is co experiences on a credit basis for graduate students in instructional development.

Patridge and Tennyson noted a wide variation across institutions in petencies. A set the number of courses offered, with courses in instructional psychology on ID Certificate and visual technology offered considerably less often than courses in onal activities a instructional development. With respect to educational media, courses uctional develope in visuals were most often taught, followed by computer courses second; ing appropriate in however, there was considerable variation found across institutions in the number of courses taught in specific areas. Each program surveyed owledge in unfamily by Patridge and Tennyson also required courses outside the formal behavioral and in boundaries of their own program; courses in research methodology and structional develo statistics were most often found outside the instructional development graduate program. Finally, Patridge and Tennyson also found that there present ID gradue was a considerable disparity between the emphasis placed on research competencies and the number of research methods courses offered within the program. More courses in research methodology and statistics were required than were actually taught in instructional development graduate programs.

> In another study, Silber (1982) reported findings similar to those of Patridge and Tennyson. Silber evaluated several graduate programs development which were divisible into three in instructional classifications: A) MA programs, B) residential PhD programs, and C) commuter PhD programs. It was found that MA programs placed an emphasis on practical skills for job performance such as media production, project management, and evaluation skills, findings similar to those of Patridge and Tennyson. In fact, this study found that MA programs and residential PhD programs spent the same amount of time on design courses; the extra courses in the PhD program were represented by research and theory courses. Also, Silber found a difference in emphasis between commuter and residential PhD programs; residential PhD programs emphasized more research and theory coursework, while commuter PhD programs emphasized practical design courses. Lastly, residential PhD programs spent the most time on developing research and theory competencies in fields other than instructional development (such as motivation, perception, developmental psychology, learning psychology, and cybernetics), followed by commuter PhD programs next and MA programs last. Residential PhD programs spent approximately twice the amount of time on these areas as did MA programs.

Characteristics of Educational Psychology Graduate Programs

A recent examination of various aspects of the current status of educational psychology was conducted by Scandura et al. (1978). This study detailed major problem areas and disciplinary components of educational psychology, curriculum trends in educational psychology

training programs, and promising advances in educational payment an effort to clarify the major applied activities in which the psychologists conduct research, four major topics were identified Scandura et al.; these four major areas are: A) the identities educational goals (including needs analysis); B) analysis/deter what must be learned (task analysis); C) delivery/a of (designing instruction, instructional systems media and D) readiness/evaluation of delivery); instructional behavior and course effectiveness (developmental stages and no evaluation of instructional programs). With regard to graduate a in educational psychology, Scandura et al., suggest that them wide variation in the quality of training programs, although seems to be common core areas offered; these specific areas discussed later. Lastly, a number of promising advances in ed. psychology were discussed by Scandura et al. (1978). Areas cognitive information processing, particularly as it applied education, and artificial intelligence and models of compley performance and instruction are cited as the most promising to areas of the future for educational psychology.

On an applied level, several authors have discusses competencies which need to be exhibited by the educ psychologist. First, graduates of educational psychology should be able to interact successfully with professional and (Brenner, 1979; Maggs & White, 1982); this ability is partic important because many research projects arise from per encountered in educational practices in the schools (Brenner Thompson & Lindsay, 1982). Also, because academic opening educational psychologists are few, skills in testing, evaluate assessment, and school psychology are beneficial (Scandura et al

With respect to the graduate curriculum in educational process several authors have examined the major areas of training and major represented (Anastasi, 1979; Brammer, 1967; Scandura et al., 19 general terms, there appears to be a relative consensus as to be components of graduate training in educational psychology training in research design, statistics, and educational mean and test development is considered to be an integral # educational psychology (Albino, 1980; Anastasi, 1979); in and statistics courses are integral parts methodology educational psychology and experimental psychology graduate (Edwards, 1981). Additionally, training in the area of applied specif is important (Brammer, 1967; Dick, 1978). More toward the improvement educational psychology is oriented instructional methods through the utilization of psychological P (Charles, 1980). Last, training in human development is considered be an important part of an educational psychology curriculum (Ame Dick; Scandura et al.).

There have been, however, other proposals regarding the coman educational psychology curriculum. For example, Brammer indicates that educational psychologists should be active in ruthe findings of a number of disciplines, including psych

struction. media idiness/evaluation th regard to grade ..., suggest that plogy.

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in educational p has of training and Scandura et al.,] ve consensus as to cational psycholog nd educational a be an integral nastasi, 1979); e integral parts ychology graduate the area of applie 978). More spec toward the improv on of psychological ievelopment is const ology curriculum

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is in educational activities in the sociology, anthropology, and educational technology to the improvement activities in which of instructional methods; at least some training in basic human or topics were is sciences is necessary (Brammer, 1967). Also, some education in the are: A) the idem basic sciences, such as genetics, is necessary for conducting research sis); B) analysis basic sciences and intelligence and intelligence testing methods and sis); B) analysis/2 in areas such as intelligence and intelligence testing methods, and lysis); C) delive reading achievement and reading disability (Morton, 1974).

opmental stages and Integrating Graduate Instruction in the Two Programs

Because of the relative youth of instructional design as a ining programs, al discipline, individuals working as instructional designers reflect a ese specific are variety of training backgrounds (Briggs, 1982). Among the more mising advances in traditional disciplines in which instructional designers have been al. (1978). Are trained are psychology and educational psychology (Briggs, 1982). ticularly as it Because many persons who ultimately will function as instructional nd models of comdesigners will continue to come from educational psychology programs, as the most promisi Dick (1978) has proposed changes for graduate education in educational psychology to further enable graduate students to acquire instructional design skills.

has proposed the integration of specific courses and Dick ational psycholor experiences in instructional design into the framework of the y with professional traditional educational psychology graduate curriculum. For example, is ability is a students would be taught skills in needs assessment and instructional ojects arise from analysis, testing and evaluation, development of instructional he schools (Bren strategies, and evaluation of entry skills and behaviors in addition to foundations of learning, human development, and statistics. Many of these topics would generally be considered to be components of a graduate program in instructional design (Doughty & Durzo, 1981). Additionally, Dick proposed that educational psychology graduate students should have internship experiences in areas such as teacher education centers, instructional development centers, or medical education programs; the incorporation of field experiences into the graduate curriculum has been proposed to be a desirable experience (Bass & Duncan, 1981-82). Thus, Dick has proposed that the training of various instructional design topics be fully integrated into the educational psychology graduate curriculum; however, he presents no data indicating the extent to which instructional design courses and field experiences are currently being taught in educational psychology programs.

> Others have also proposed that instructional design should be incorporated into educational psychology programs (Anastasi, 1979). Anastasi indicates that instructional design can be considered as a component of the larger field of instructional psychology; the purpose of instructional design is to bridge the gap which exists between experimental learning psychology and curriculum development. The result of research in instructional psychology is improved educational technology, including programmed learning material, media usage, and computer-assisted instruction. In other words, Anastasi maintains that instructional design should already exist as a component of the curriculum in educational psychology while Dick feels that, because it

is currently absent in many programs, instructional design integrated into educational psychology graduate programs.

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In a discussion of the various roles performed by psychologists in the health sciences, Albino (1980) sur teaching particular skills to graduate students in psychology will enhance their performance in a health science Briefly, Albino indicates that additional training for psychology graduate students is necessary in the areas of com skills, program evaluation skills, test development and design, and applications of learning theories. It has previous noted that much of the foundation for training in program skills is available in psychology and educational psychology (Perloff, Perloff & Sussna, 1976; Wortman, Cordray & Reis, 19 respect to applications of learning theory, Albino emphasis experience in instructional design should be acquired educational psychology graduate student expecting to function health sciences setting; the ability to evaluate course struct suggest alternatives is important. Addition content and background in designing instruction for psychomotor and and Additionally, skills is important. a background in the instruction for psychomotor and affective skills is considering the large amount of time spent by health sciences m learning clinical skills. Lastly, Albino notes that edge psychology graduate programs provide little coursework or experie developing consultation skills. As mentioned by Bratton for 1981), interpersonal and consultation skills are also imported successful performance as an instructional developer. Patrite Tennyson note that many of the instructional development surveyed in their study placed an emphasis upon the acquisition ability to manage problems and interact with personnel.

METHODS

Design

Within educational research, descriptive research is an entool for determining the present status of a variety of educpractices. In fact, descriptive research methods are required to questions which deal with current educational conditions (me 1976), and can yield extremely useful results when properly me (Asher, 1976; Burton, 1979). One of the major types of descriresearch is the status study; status studies are intended to information about an existing set of conditions or practices is educational setting (Hopkins, 1976). Because the primary object this project was to investigate the relationships which exist is graduate education in educational psychology and instructional is the use of descriptive research methodology was appropriate.

Subjects

As has been previously mentioned, program administ

iuate programs.

performed by Albino (1980) : students in n a health scierc training for in the areas of a development and les. It has prev ing in program ational psycholog ordray & Reis, 1 ory, Albino empha d be acquired expecting to fuc uate course stru sportant. Additis psychomotor and background in skills is y health sciences notes that es oursework or expe ed by Bratton lls are also impos developer. Patri personnel.

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(chairpersons) of instructional design and technology programs at 22 institutions with doctoral programs in both areas were surveyed. surveyed. These institutions were:

Florida State University Indiana University Iowa State University Nichigan State University Sew York University Pennsylvania State University Purdue University Syracuse University Temple University University of Georgia University of Iowa

University of Kentucky University of Massachusetts University of Michigan University of Minnesota University of Oklahoma University of Oregon University of Pittsburgh University of Tennessee University of Texas University of Virginia Wayne State University

Instrument Development

A questionnaire was used to collect data on how frequently graduate students study specific topics in both educational psychology and instructional design, and how frequently those topics were studied at three points in time: currently studied (1983-84 school year), studied five years ago (1978-79 school year), and projected to be studied five years in the future (1988-89 school year).

This list of topics was developed by examining graduate catalog course descriptions of approximately one-third of the programs which developer. Fath ional development: on the acquisition personnel. This list of topics was developed by examining graduate catalog course descriptions of approximately one-third of the programs which expeared in instructional design and educational psychology textbooks. Individual topics were chosen over courses as the unit of measure because of the large differences often noted between course descriptions and actual course content. Approximately an equal number of topics from instructional design sources and educational psychology sources was identified.

> Respondents were asked to include open-ended comments on what trends were foreseen for their programs over the next five years. Information was solicited about the contact between faculty in instructional design and educational psychology and whether or not those faculty interactions were expected to increase, decrease, or remain constant over the next five years. Finally, information was solicited regarding faculty training (year and institution of doctoral degree) and recent program graduates (name and year of degree completion).

> The questionnaire was initially pilot-tested by mailing it to six departmental chairpersons, three instructional design and three ^{educational} psychology, who were not at institutions included in the study. Responses were received from three of these individuals (50%). All questionnaires were completed correctly and no major changes were made before the study was initiated.

Procedures

The questionnaire was mailed with a self-addressed postenvelope to chairpersons of the instructional design proeducational psychology programs. Approximately eight weeks initial mailing, non-respondents were telephoned and subseque a second questionnaire. At this point, chairpersons who sabbatical or unavailable for other reasons were identified questionnaires were sent to the acting chairperson. As question were received, the data were entered into a computer file for

Data Analysis

Responses on the section of the questionnaire deals, curriculum topics were coded using a four-point scale: none-1, most-3, all-4. Means were then calculated for each topic at the in time studied. Educational psychology programs were compariinstructional design programs on the extent to which students a various topics at three points in time. The comparisons were using t-tests for each topic at each of the three points in time

In order to objectively categorize topics as either instrudesign or educational psychology topics, factor analysis was is a statistical technique which alles analysis Factor experimenter to examine underlying dimensions for a particular (Kim & Mueller, 1978). One major use of factor analyse confirmatory; a smaller number of factors are identified which for the covariation in a given data set. The experimenter cm m the number of factors which will be formed. In this case, two is were used; one factor represented instructional design topic m second factor consisted of educational psychology topics. A rotation was used to simplify the factor structure. The infer derived from this procedure consists of each topic and an area factor loading for each of the two factors. A factor loading variable represents the correlation between that variable factor (Kleinbaum & Kupper, 1978). Thus, the higher positime loading indicates to which factor a given topic is attributed.

Topics were assigned to one of the two factors using the procedure. A topic was assigned to the factor for which then higher positive factor loading. After topics were classified as either instructional design or educational psychology topics us above procedure, topics which were noted to exhibit high growt analyzed to determine if either educational psychology propinstructional design programs showed a disproportionate number af growth topics from the other area (using means obtained us four-point scale described previously, curriculum topics exhibited an increase of .50 between figures for the 1978-735 year and projections for the 1988-89 school year). Chi-square as was used to test for significance. e

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questionnaire de design i for each topic at programs were com ent to which stude The comparisons e three points in the

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In this case, tw tional design topid hology topics. r structure. The is a topic and an ors. A factor lost in that variable the higher positi pic is attributed

factors using t actor for which the were classified psychology topics exhibit high gro onal psychology pr portionate number g means obtained urriculum topics res for the 1978-7 ear). Chi-square

Questionnaires were sent to 44 individuals; 22 chairpersons of tructional design educational psychology programs and 22 chairpersons of instructional imately eight week; design programs. However, the chairperson of the educational elephoned and subse psychology program at one university indicated that, contrary to t, chairpersons w original information, there was not an instructional design program at reasons were identic that institution. Consequently, a final sample size of 42 was used. hairperson. As qu An overall response rate of 27/42 (64.3%) was obtained. For) a computer file (instructional design chairpersons, 14 of 21 (66.7%) completed cuestionnaires of 21 (61.9%) educational psychology while 13 chairpersons completed questionnaires. One additional questionnaire was returned by an educational psychology chairperson who indicated that he was unable to understand the directions. One instructional chairperson did not complete the first section of the -point scale: none, questionnaire relating to student study of various curriculum topics, but did complete the other parts of the questionnaire. Also, the chairperson of one educational psychology program responded; however, he indicated that his program was being terminated due to a lack of graduate students and he was unable to complete the first section of the questionnaire. All other returned questionnaires were usable and substantially complete.

Program Comparisons

Of the two questions investigated in this study, the first three involved program comparisons and are presented in this section. First, changes in the extent to which curriculum topics are studied in each program have changed over time were examined. Second, an examination was made of the directionality of any changes.

The first question to be addressed in this section is the extent to which curriculum topics studied in each program have changed over time. Comparisons were made between programs for each curriculum topic at each of three points in time. A number of changes were noted in the number of students studying specific topics at each of the three points in time examined. These figures are presented in Table 1. The means presented in Table 1 were obtained using the four-point scale described earlier (none-1, some-2, most-3, all-4). Of the 72 curriculum topics examined in this study, 30 (42%) showed no significant differences between educational psychology and instructional design programs at any of the three points in time examined. For the remaining 41 topics, several interesting patterns were noted. For example, achievement motivation was reported to be studied by significantly more educational psychology students than instructional design students five years ago (Table 1). Subsequently, the number of educational psychology students studying achievement motivation remained constant while a large number of instructional design students began to study the topic and eliminated any significant differences between the two groups for the current school year or five years in the future. Similarly. significantly more educational psychology students studied adolescent development five years ago and during the current school year.

However, the number of educational psychology students adolescent development is reported to be decreasing while the instructional design students studying it is increasing, prosignificant difference between the two programs for the 1988-10 year.

Another interesting pattern was noted for computer instruction and interactive video. No differences were found students in educational psychology and instructional design for the 1978-79 school year for either topic. The ministructional design students reported to study these topics for the 1983-84 school year and were projected to increase topics 1988-89 school year. The number of educational psychology reported to study these topics also increased, although at must rates, producing significant differences between educational and instructional design programs for the 1983-84 and the school years.

A similar trend was noted for program evaluation and come skills. Although these topics were to be more frequently state each point in time by instructional design students, no sim difference was found between programs for either topic during 1978-79 school year. However, significantly more instructional students were reported to take each topic during both the W school year and projected for the 1988-89 school year.

topics studied by significantly larger number Many instructional design students at each of the three points in the related to media production: audio/slide production, re production, media center administration, media selection me photography production, telecommunications, transparency production and videotape/TV production. A second set of topics which were by significantly more instructional design students was related instructional delivery and evaluation. These topics include cure instruction, development, design of formative evalue individualized instruction, instructional evaluation, instruction objectives, instructional strategies, needs assessment, see instruction, summative evaluation, systems concepts, task analysis, and teaching methods.

In contrast, relatively few topics were studied by signifimore educational psychology students at each point in time. topics were generally related to human development: in development, self-concept determinants, and sex role development

In addition to the differences between educational psycholog instructional design programs discussed above, a number of similar were also found. Referring again to Table 1, it can be seen that of the major similarities found between the two programs was the of students studying statistics and measurement topics. For each chairpersons of both programs indicated that a substantial make students currently studied analysis of variance/covarian correlation, descriptive statistics, inferential statistics sychology stude lecreasing while t is increasing. grams for the 198

noted for comput ferences were for instructional der ar topic. The study these toping ted to increase a cational psychole ed, although at a tween educational 1983-84 and th

evaluation and co ore frequently n ign students, no m either topic of during both the :hool year.

ntly larger three points in t lide production, media selection : topics which were an students was n topics include a formative ev evaluation, instr is assessment, st concepts, tasia

e studied by sign point in time n development: ex role development

icational psychol a number of simi it can be seen of o programs was the t topics. For t a substantial p £ variance/covi inferential stat

standardized tests, and test reliability/validity. Similarly, research topics such as experimental research methodology and research design were indicated to be frequently studied by students in both programs. Topics which were indicated to be studied less often but at approximately equal levels by students in each program included factor analysis, naturalistic research methodology, nonparametric statistics, criterion-referenced testing, norm-referenced testing, and standardized tests. The only statistics topic for which a large difference between the two programs was found was multiple regression; significantly more educational psychology students study it than do instructional design students. Additionally, the respondents indicated that this difference would grow larger in the future. Educational psychology even chairpersons indicated that more of their students would study multiple regression in the future while instructional design chairpersons felt that the same number of their students would study this topic in the future. Finally, a measurement topic, latent trait theory, was studied by relatively few students in either program.

A second question addressed in this study was the issue of directionality of change. In order to determine whether instructional design is incorporating components of the educational psychology curriculum or if educational psychology is incorporating components of ly more instruction the instructional design curriculum, several factors were examined. These factors include curriculum topics, student dissertation research. faculty dissertation research, and contact between faculty in the two disciplines.

Considering curriculum topics, it will be recalled that one of the methods used to characterize instructional design and educational psychology programs was factor analysis. Two factors were used in the transparency p: factor analysis procedure. It will be recalled that topics were assigned to one of the two disciplines on the basis of the factor analysis procedure; curriculum topics were assigned to the factor for which they exhibited the highest positive factor loading. In general, computer assignment of the topics placed them in the factors as was expected. Each topic was then examined in order to note whether or not a disproportionate number of "instructional design" topics were exhibiting growth in educational psychology programs. Similarly, "educational psychology" topics were examined as to whether or not they were exhibiting growth in instructional design programs.

> "High growth" was defined as a gain of .50 or more for the mean score between the 1978-79 school year and projected figures for the 1988-89 school year (using the four-point scale previously described and presented in Table 1). Using this criteria for growth, 33% of the high growth topics in instructional design programs were topics which had been classified as "educational psychology" topics by the factor analysis procedure. In contrast, 75% of the high growth topics in educational psychology programs were "instructional design" topics, this being a significant difference (chi-squares=5.00, df=1, p<.05). When the criteria for defining a high growth topic was changed to a gain of .70 or more for the mean score between the 1978-79 school year and projected figures for the 1988-89 school year, 25% of the high

growth topics in instructional design programs were psychology" topics; 75% were "instructional design" (chi-square-3.20, df-1, p<.08). Although overall significant (probably due to smaller sample sizes due to more stringent criteria), the general trend of educational psychology progra a large proportion of high growth topics which are "in design" topics remained consistent.

A second measure of the extent to which educational preinstructional design programs may be merging was the type which occurs between faculty in the two programs. The faculty contacts at institutions where chairpersons in both responded (N-9) is presented in Table 3. The most frequent reported by the chairpersons which involve contact between fi the two programs were dissertation committees and faculty Activities which involve little contact include team-teaching collaborative rese joint program administration, and publication. Finally, chairpersons indicated the a11 interactions have either increased or remained constant over five years. The respondents were evenly divided, however, as h or not they anticipate those faculty interactions will irrn the next five years.

These findings suggest that the two disciplines are index closer to one another, with educational psychology incorporating more topics from instructional design programs

Despite the finding that topics from the instructional curriculum are being introduced into educational psychology p the results of this study suggest that a merging of the two p not occurred on the level of research activity. Student disc research was found to be conducted in areas specific a discipline.

The same trend was true for cooperative faculty a Chairpersons of both programs indicated that relatively fer engage in collaborative research or publishing with faculty other discipline.

With respect to other measures of contact between faculty two programs, high levels of joint faculty participation dissertation committees and comprehensive exam committees cooperation between the two disciplines. Additionally, all respondents felt that contact between faculty in these two in increased or remained constant over the past five years. They clear trend, however, as to whether or not those faculty introwould continue to increase over the next five years.

DISCUSSION

The primary purpose of this study was to investig

ign programs were instructional design. The study assessed the extent to ugh overall signific sychology and instructional design. The study assessed the extent to due to more due to more string which instructional design topics were studied in educational ional psychology prosphere doctoral programs; this study also assessed the extent to opics which are which doctoral students in educational technology study educational opics which are

psychology topics in their curriculum at institutions which have

3. The most freque lve contact between rsons

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cooperative faculty that relatively 5 blishing with facult

tact between facult nt faculty partic ve exam committees IS. Additionally, ilty in these two past five years. To those faculty is ive years.

doctoral programs in both areas. The study also determined if specific which educational curriculum topics in the two disciplines had changed over time, using rging was the profive years ago (1978-79 school year), currently (1983-84 school year), irging was the type and projections for five years in the future (1988-89) as the points in the two the two programs. Finally, types of interactions between faculty in the two chairpersons in b programs were examined.

It should be pointed out that the present study has several mmittees and facult limitations. One limitation was that the findings are not necessarily include team-teach generalizable to all instructional design and educational psychology collaborative : doctoral programs. Because specific types of programs which were at indicated institutions with programs in both areas were studied, the results may remained constant o not be generalizable. A second limitation of this study is that divided, however, a projections were used. Consequently, these figures are not as accurate interactions will is as would be the case with actual observations.

disciplines are in Relationships Between Programs

Two of the major questions examined on this study were: first, are instructional design and educational psychology programs in transition relative to one another and, second, what are the directions of those findings of this study suggest that educational The changes. psychology and instructional design are indeed changing relative to activity. Student & each other. It is also evident that those changes are occurring in an in areas specific uneven fashion. For example, many of the topics which were indicated to be rapidly growing in the educational psychology curriculum were instructional design topics, suggesting a merging of the disciplines. Conversely, however, relatively few of the high growth topics in instructional design graduate programs were educational psychology topics. These findings suggest that the two disciplines are indeed moving closer to one another, with educational psychology programs incorporating more topics from instructional design programs.

> Despite the finding that topics from the instructional design curriculum are being introduced into educational psychology programs, the results of this study suggest that a merging of the two areas has not occurred on the level of research activity. Chairpersons of both programs indicated that relatively few faculty in either program engage in collaborative research or publication with faculty from the other discipline.

With respect to other measures of contact between faculty in the two programs, high levels of joint faculty participation on dissertation committees and comprehensive exam committees suggests cooperation between the two disciplines. Additionally, all of the was to invest respondents felt that contact between faculty in the two areas had increased or remained constant over the past five years. There clear trend, however, as to whether or not those faculty inter would continue to increase over the next five years.

Because respondents provided unclear projections as to not these transitions might continue, it is possible that other might be involved in the transition process. For example curriculum changes might possibly be more influenced by instafactors rather than national trends. Thus, the two propacontinue to grow closer at some institutions while remain distinct from one another at other institutions.

Future Research

One topic for future research in this area might determining qualitative characteristics of student contact with subject area. For example, the present study assessed has students studied particular topics at some point in their comno measure was made of the extent of exposure to a given take obtaining data regarding the number of student contact hours is a area, a more accurate profile of major areas of curriculum within a type of program can be derived. Consequently, a study examines topics in greater detail would provide an assessment of extent to which topics are studied rather than an assessment many students are exposed to a given topic as was the case is study.

A second project that would provide additional information a study of specific topics in a graduate curriculum. Such a could be done using methods similar to this study. Rather sampling a large number of topics as was done in this study, i content area could be examined. For example, rather than idea computer-assisted instruction as one of many topics, the research focus on CAI as the only topic to be studied. This topic could divided into smaller topics such as artificial intelligence. systems, evaluation, simulations, and games. In this fashion, I be possible to identify programs which are providing doctoral with exposure to the most current topics. Open-ended responses provide insight into the reasons for program differences; in " example, possible reasons might include students with better of science backgrounds, hardware availability, or other reason project of this type would allow the researcher to study the smaller components of specific graduate programs in a detailed

Another future research project would consist of replicating study during the 1988-89 academic year. Responses given at the could be compared to the findings reported in this study. Open responses could be requested to investigate possible reasons for differences between projections in the current study and finding the future follow-up study. Such a follow-up study would allo investigator to determine whether the instructional design topics are being integrated into the educational psychology curricula st five years. ot those faculty ive years.

rojections as to s possible that of cess. For example a influenced by is hus, the two potutions while read tions.

this area might student contact via study assessed e point in their of re to a given to ent contact hours as of curriculue Consequently, a su vide an assessment er than an assessment as was the case

itional information riculum. Such 1) this study. is ie in this study. le, rather than ia ' topics, the resur . This topic could cial intelligence In this fashion, roviding doctoral Open-ended response differences; in ! udents with better y, or other ress searcher to study a rams in a detailed

sponses given at the this study. Of this study. Of the possible reasons at study and find w-up study would at tional design top psychology curricu lead to future dissertation research in those areas. Also, it would be possible to note if collaborative research and publication by faculty in the two programs were increasing.

Another approach to examining the trends noted in this study would be to conduct a future study using the Delphi technique. Briefly, the Delphi technique is a procedure used for forecasting trends. By distributing a series of questionnaires to experts is a particular field, responses can be modified by each individual after having evaluated the responses of the group for the previous round of questionnaires (Amidon, 1977). Opinions can be reviewed throughout the process and, by the final questionnaire, concensus and minority opinions can be developed. Such a procedure might be used to allow chairpersons of instructional design and educational psychology programs to amplify on what trends they anticipate for their programs. Opinions could be developed for the future of each discipline individually as well as for future interactions between the two disciplines.

Summary

The results of this study indicate that instructional design programs and educational psychology programs are in transition. However, these changes appear to be occurring at an instructional level. Topics from each program are being introduced into course content in the other discipline. Merging at the level of dissertation research and collaborative faculty research, however, has not taken place.

There was no clear indication as to whether or not these trends would continue. Future research can determine if the two programs will continue to move toward each other and, if that is the case, in what respects they might merge.

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(Eds.), Annual Table 1 Inc., 569-594 Comparisons Between Groups, Instructional Design (ID) and 1 skills of in Educational Psychology (EP), At Three Points In Time 1), 19-21. uctional System Academic ID SD Topic EP SD p Year Mean Mean urow, K., Stolur and future dira Educational Achievement 1978-79 1.89 .60 2.82 Psy .87 .0145 1983-84 2.30 Motivation .82 2.83 .83 NS 1988-89 2.75 .89 2.83 .83 NS s stages of in cellect model to 1978-79 1.55 Adolescent . 69 2.91 .70 .0002 structional Devel .94 1983-84 1.83 Development 2.67 .0270 .78 1988-89 2.00 .94 2.58 .90 NS ity training prog 1978-79 2.17 .83 2.27 .79 Adult NS itructional Develo Development 1983-84 2.54 .88 2.64 .81 NS 1988-89 2.92 .90 2.91 .70 NS structures: Affective 1978-79 2.20 .42 2.18 .75 NS Measurement 1983-84 2.80 .42 2.25 .75 NS 1988-89 3.10 .74 2.33 .89 .0419 Competencies essional. ANOVA/ANCOVA 1978-79 Jour 3.73 .90 3.64 .50 NS 1983-84 3.75 .87 3.75 .45 NS 1988-89 3.64 .92 3.75 .45 NS fessional develop he British Psyc Aptitude 1978-79 2.60 .97 2.82 .75 NS Tests 3.09 1983-84 .83 2.92 .79 NS 1988-89 3.30 .67 2.83 .94 NS . (1980). Train L. Sechrest (Ed. Attribution 1978-79 1.88 .83 2.09 .54 NS ng Program Evaluat Theory 2.33 1983-84 .50 2.75 .45 NS 1988-89 2.38 .52 2.75 .62 NS Audio/Slide 1978-79 3.31 .75 1.27 .47 .0001 Production 1983-84 3.08 .86 1.42 .51 .0001 1988-89 3.00 1.04 1.58 .67 .0007 Classroom 1978-79 1.90 .57 2.36 .50 NS Management 1983-84 2.00 .63 2.50 .52 NS 1988-89 2.00 .67 2.50 .52 NS Cognitive 1978-79 2.82 .75 3.36 .67 NS Development 1983-84 3.09 .83 3.67 .65 NS 1988-89 3.36 .81 3.67 .65 NS

Topic	Academic	ID	SD	EP	SD	P
	Year	Mean		Mean		1.1
				•••••		····
Computer-	1978-79	2.23	.93	1.82	.87	Ng
Assisted	1983-84	3.23	.60	2.42	.79	0075
Instruction	1988-89	3.92	.28	2.83	.83	.0002
Computer Data	1978-79	2.42	.79	2.64	.81	Ne
Analysis	1983-84	3.00	.58	3.50	. 52	0332
	1988-89	3.33	.78	3.75	.45	NS
Consultation	1978-79	2.33	1.15	1.82	.40	Ne
Skills	1983-84	2.92	.79	2.00	43	0010
	1988-89	3.25	.75	2.33	.65	.0043
Correlation	1978-79	3.60	. 52	3.55	52	Ne
	1983-84	3.55	69	3 75	45	Ne
	1988-89	3.64	.50	3.75	.45	NS
C	1070 70					199
creativity	19/8-/9	2.30	.95	2.27	.47	NS
	1983-84	2.2/	.90	2.33	.49	NS
	1988-89	2.64	.92	2.17	.72	NS
Criterion-	1978-79	3.45	.82	2.45	.69	.0057
Referenced	1983-84	3.50	.67	2.92	.79	NS
Testing	1988-89	3.58	.67	3.08	.90	NS
Curriculum	1978-79	3.15	.99	2.09	.70	.0068
Development	1983-84	3.15	.99	2.08	.67	.0045
	1988-89	3.25	.97	2.08	.67	.0023
Descriptive	1978-79	3.55	.82	3.73	.65	NS
Statistics	1983-84	3.42	.90	3.83	.39	NS
	1988-89	3.55	.82	3.83	.39	NS
Design Of	1978-79	3.85	.38	1.91	.54	.0001
Instruction	1983-84	4.00	.00	2.25	.62	.0001
	1988-89	4.00	.00	2.25	.62	.0001
Early School	1978-79	1.73	.65	2.18	40	NS
Experiences	1983-84	1.75	.45	2.25	62	0345
,	1988-89	1.64	.50	2.33	.49	.0030
Experimental	1978-79	3.50	.67	3 82	40	NS
Research	1983-84	3.75	62	3 83	30	NS
Methodology	1988-89	3 75	62	3 02	. 39	NC
AT					1 M	10.0

EP	SD		Trada.	Academie	TD	CD.						
ean		×.,	Topic	Year	Mean	50	Mean	SD	P			
.82	.87	NS	anleratory	1978-79	2 50	85	2 64	02	NC			
.42	.79	.0079	Exploracory	1983-84	2 82	.05	2.04	. 74	NG			
.83	.83	.0002	Data Analysis	1988-89	2.90	.99	3.08	.90	NS			
.64	.81	Ne		1070 70	0.00	1 00						
.50	.52	0333	Factor	19/0-/9	2.33	1.00	2.36	.67	NS			
75	45	.0333	Analysis	1983-84	2.50	.85	2.50	.80	NS			
	.45	NS		1988-89	2.80	.92	2.67	.89	NS			
.82	.40	NS	Film	1978-79	2.00	.89	1.18	.40	.0153			
00	.43	.0019	Production	1983-84	1.83	1.03	1.33	.49	NS			
33	.65	.0043		1988-89	1.82	1.17	1.25	.45	NS			
55	.52	NS	Formative	1978-79	3.73	.65	2.09	.70	.0001			
75	.45	NS	Evaluation	1983-84	3.67	.65	2.25	.75	0001			
75	.45	NS	14 (C.) (C.)	1988-89	3.73	.65	2.33	.78	.0001			
27	.47	NS	Graphics	1978-79	3.00	91	1 36	67	0001			
33	.49	NS	Production	1983-84	2 77	1 01	1 42	67	0001			
17	.72	NS		1988-89	2.64	1.03	1.42	.67	.0001			
45	60	0057	Te Mart Aug 1	1070 70					100000			
92	.09	.005/	Individual	19/8-/9	3.33	. /1	2.91	.83	NS			
0.8	. / 9	NS	Differences	1983-84	3.40	.70	3.08	.90	NS			
00	.90	NS		1988-89	3.44	.73	3.08	.90	NS			
09	.70	.0068	Individualized	1978-79	3.45	.69	2.27	.47	.0001			
28	.67	.0045	Instruction	1983-84	3.50	.67	2.50	.52	.0005			
28	. 67	.0023		1988-89	3.67	.65	2.58	.67	.0006			
73	.65	NS	Inferential	1978-79	3.50	.90	3.73	.65	NS			
33	.39	NS	Statistics	1983-84	3.69	.63	3.75	.62	NS			
33	. 39	NS		1988-89	3.58	.67	3.75	.62	NS			
11	.54	.0001	Information	1978-79	2 25	75	2 45	60	NC			
!5	.62	.0001	Processing	1983-84	2 93	.73	2.40	.05	No			
:5	.62	.0001	recourse	1988-89	3.00	.77	3.08	.79	NS			
8	.40	NS	Instructional	1078 70	2 50	67	2.26		0007			
5	.62	0345	Evaluation	1002 0/	3.38	.0/	2.30	.81	.0007			
3	40	0030	avaluation	1963-84	3.85	. 38	2.50	.80	.0001			
	.43	.0030		1988-89	3.83	. 39	2.75	.75	.0004			
2 .	.40	NS	Instructional	1978-79	4.00	.00	2.45	.82	.0001			
2	. 39	NS	Objectives	1983-84	4.00	.00	2.58	.90	.0004			
2	.29	NS		1988-89	4.00	.00	2.75	87	0001			

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Topic	Academic	ID	SD	EP	SD	D
	Year	Mean		Mean		*
Instructional	1978-79	3.64	.67	2.09	.54	0001
Strategies	1983-84	3.83	.39	2.25	.62	0001
	1988-89	3 91	30	2 50	67	.0001
	2700-07	5.72		2.50	.07	.0015
Instructional	1978-79	3.42	.90	2.09	.83	.0002
Theory	1983-84	3.62	.65	2.33	.78	.0002
	1988-89	3.55	.69	2.83	.94	NS
Interactive	1978-79	1.25	45	1 27	47	
Video	1983-84	2 00	43	1 50	50	0134
12000	1088.80	2 82	.40	2.00	. 52	.01/5
	1900-09	2.02	.00	2.00	./4	.0087
Intrinsic/	1978-79	2.45	1.04	2.64	.81	NS
Extrinsic	1983-84	2.67	1.07	3.00	.60	NS
Motivation	1988-89	2.92	1.08	2.92	.67	NS
Language	1978-79	1 73	00	2 45	60	
Development	1093 94	1 02	. 90	2.45	. 52	.0317
peveropment	1000 00	1.05	.03	2.58	.51	.0147
	1909-99	1.91	.83	2.58	.51	.0279
Latent Trait	1978-89	1.45	.69	1.64	.67	NS
Theory	1983-84	1.58	.67	1.92	.51	NS
	1988-89	1.64	.67	2.08	.51	NS
Media Conter	1079.70	2 50	00	1 00		
Administration	1092 04	2.30	. 90	1.00	.00	.0001
Adminiscration	1000 00	2.30	.0/	1.00	.00	.0001
	1988-99	2.33	.89	1.08	.29	.0004
Media	1978-79	3.69	.63	1.36	.50	.0001
Selection and	1983-84	3.69	.63	1.33	.49	.0001
Use	1988-89	3.73	.65	1.50	.52	.0001
Memory/	1978.79	2 92	1 08	2 01		ve
Forgetting	1083.84	2 17	1.00	2.91	.03	NO.
TorRecernig	1000 00	3.17	.03	3.1/	.83	NS
	1900-09	3.21	.90	3.17	.83	NS
Meta-analysis	1978-79	1.42	.51	1.91	.94	NS
0.04646.00466.0000000000000000000000000	1983-84	2.17	.58	2.17	.83	NS
	1988-89	2.27	.65	2.75	.75	NS
Multiple	1978-79	2 27	00	3 00	77	NC
Regression	1983-84	2 50		3.00		0464
	1988-80	2.50	. 90	3.23	.02	0107
	1300-03	4.77	4 1	1 0.7	51	01107

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EP	SD		and a	Anndanda	TD				
lear	n	P	Topic	Year	Mean	50	Mean	SD	P
	••••••								
.09	.54	.0001	a muralistic	1978-79	1 64	50	2 36	81	0100
.25	.62	.0001	Naturarto	1983-84	2 67	78	2 42	.01	.0177
. 50	.67	.0015	Hethodology	1988-89	2.91	.94	2.50	.90	NS
.09	.83	0000		1078 70	0.00	1			
.33	.78	.0002	Needs	19/8-/9	2.83	1.03	2.09	.30	.0328
.83	.94	. 0002	Assessment	1983-84	3.50	.67	2.00	.43	.0001
		NS		1988-89	3.75	.45	2.00	.43	.0001
.27	-47	NS	Nonparametric	1978-79	2.50	1.08	2.55	.82	NS
00	. 52	.0175	Statistics	1983-84	2.73	.90	2.83	1.03	NS
	.74	.0087		1988-89	2.91	.94	2.92	.90	NS
64	.81	NS	Norm-Referenced	1978-79	3.18	.87	2.82	.75	NS
00	.60	NS	Testing	1983-84	3.17	.83	3.00	.85	NS
32	.67	NS	0100	1988-89	3.18	.87	2.92	.79	NS
45	. 52	.0317	Peer	1978-79	1.50	.53	2.45	. 52	0005
58	. 51	.0147	Relationships	1983-84	2.00	.77	2.50	.52	NS
28	.51	. 0279		1988-89	2.10	.74	2.50	. 52	NS
64	.67	NS	Personality	1978-79	1 01	94	2 55	50	
92	.51	NS	Development	1983-84	1 02	. 94	2.55	.52	0100
38	.51	NS	pereropment	1988-89	2.08	1.08	2.67	.49	.0190 NS
00	.00	0001	Photosurahu	1070 70					
0	.00	0001	Procography	19/8-/9	2.85	.90	1.00	.00	.0001
8	.29	0001	rioduction	1983-84	2.69	. 95	1.08	.29	.0001
		0004		1988-89	2.67	1.07	1.17	.39	.0005
6 3	.50 .0	0001	Principles	1978-79	3.75	.45	3.36	.81	NS
ō	.49 .0	0001	of Learning	1983-84	3.92	.29	3.58	.67	NS
	.52 .0	001		1988-89	3.91	.30	3.67	.65	NS
	. 83	NS	Problem-	1978-79	2.91	.94	2.55	. 69	NS
8 8	.83 1	NS	Solving Skills	1983-84	3.18	.75	2.92	.67	NS
80 B	.83 1	NS		1988-89	3.30	.67	2.92	.67	NS
3	.94 1	IS	Program	1978-79	2.67	.98	2.09	54	NC
1	83 N	IS	Evaluation	1983-84	3.08	.79	2.50	52	0448
	75 N	S	8	1988-89	3.36	.67	2.75	.62	.0337
12	77 N	s	Programmed	1978-79	2 75	75	2 19	40	0375
1.0	62 .04	64	Instruction	1983-84	2 83	72	1 00	.40	.03/5
	51 .010	07	ALC NO VAVI	1988-89	2.55	1.04	1.92	.07	.0038
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Topic	Academic	ID	SD	EP	SD	
	Year	Mean		Mean		P
				•••••	····	·····
Research	1978-79	3.83	. 39	3.55	.69	Ne
Design	1983-84	3.92	. 29	3.75	.45	No
	1988-89	3.91	. 30	3.83	. 39	NS
Roles of	1978-79	2.42	1.08	3.18	87	No
Heredity/	1983-84	2.42	1.08	3.08	.07	NS
Environment	1988-89	2 45	1 13	3.08	. 50	NS
Environmenc	1900-09	2.45	1.15	3.08	.90	NS
Self-Concept	1978-79	1.73	.65	2.45	.52	.0088
Determinants	1983-84	1.73	.65	2.50	. 52	.0047
	1988-89	1.70	.67	2.50	. 52	.0052
Sequencing	1978-79	3.42	.67	1.91	.30	.0001
Instruction	1983-84	3.67	.65	1.92	29	0001
	1988-89	3.64	.67	1 92	20	0001
	1,00 07	5.54		1.52	.23	.0001
Sex Role	1978-79	1.42	.51	2.55	.69	.0002
Development	1983-84	1.58	.51	2.75	.62	.0001
	1988-89	1.73	.65	2.92	.79	.0008
Socio-Cultural	1978-79	2.18	87	2 55	69	NC
Factors	1983-84	2 27	90	2 75	62	Ne
	1988-89	2 30	82	2 92	70	NC
	1,00-07	2.50	.02	2.32	./5	10
Standardized	1978-79	2.92	.90	3.18	.87	NS
Tests	1983-84	2.83	1.03	3.33	.78	NS
	1988-89	3.00	1.00	3.33	.78	NS
Summative	1978-79	3.38	.77	2.64	92	0413
Evaluation	1983-84	3.62	.65	2 75	87	0093
	1988-89	3.83	. 58	2.92	.90	.0071
Swatana	1079 70	2 60	62	2 00		0001
Concents	1003 04	2.02	.05	2.00	.63	,0001
concepts	1903-04	3.92	. 28	2.17	. 39	.0001
	1988-89	4.00	.00	2.17	.58	.0001
Task/Content	1978-79	3.33	.78	1.82	.60	.0001
Analysis	1983-84	3.92	.29	2.08	.51	.0001
	1988-89	4.00	.00	2.33	.78	.0001
Teaching	1978-79	2.83	.94	2.00	.77	.0310
Methods	1983-84	3.08	.95	2.17		0187
27.7.7.7.7.7.7.7.7.7.7.7.7.	1988-89	3.25	97	2 42	.03	0306
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	SD	р	Topic	Academic Year	ID Mean	SD	EP Mean	SD	р	
2	****	****								
	.69	Ne		1978-79	2 67	78	1 09	. 30	0001	
	.45	Ne	Tele-	1003 04	2.07	. / 0	1.63	70	.0001	
	. 39	NS	communications	1988-89	3.17	. 58	1.42	1.06	.0001	
	12121									
	.87	NS	Test Item	1978-79	2.82	.87	2.73	.90	NS	
	.90	NS	Writing	1983-84	3.15	.80	2.75	.87	NS	
	.90	NS		1988-89	3.25	.75	2.75	.97	NS	
	. 52	. 0084	P. 45	1978-79	3 18	87	3 64	67	NS	
	. 52	0067	lest	1983-84	3 42	67	3 67	65	NC	
	. 52	.0052	Reliabilicy/	1988-89	3 64	.50	3 67	.65	NS	
	19495		varioncy	1,00.01	2.04		3.07		110	
	.30	.0001	Transparency	1978-79	3.15	.90	1.36	.92	.0001	
	.29	.0001	Production	1983-84	2.92	.86	1.33	.89	.0001	
	.29	.0001	ALC: NOT	1988-89	2.75	1.06	1.42	.90	.0031	
	.69	.0007	Verhal	1978-79	2 67	98	2.82	60	NS	
	. 62	.0001	Learning	1983-84	2 67	98	2 92	.79	NS	
	.79	0008	Dearning	1988-89	2.73	1.01	2.92	.79	NS	
	.69	NS	Widestans (TV)	1078.70	2 02	05	1 00	30	0001	
	. 62	NS	Videocape/IV	1083.84	2.72	.75	1 08	. 30	.0001	
	.79	NS	rroduction	1988-89	2.92	.70	1 25	. 29	0001	
	1213			1700-07	2.05	.05				
	. 87	NS	Visual	1978-79	2.83	.72	2.00	1.00	.0310	
3	. 78	NS	Learning	1983-84	2.75	.87	2.08	.90	NS	
	.78	NS	100	1988-89	2.92	.79	2.08	.90	.0250	
	92 .0	0413								
	87 .0	093								
•	90 .0	071								
	63 0	001								
ĵ	39 0	001								
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. 5	51 .00	001								
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7	7 .03	10								
8	3 .01	87								
7	9 .03	06								
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		•			-	
Contact Characteristic		13	ID		1	EP
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Collaborative research/						
publication	3	(33%)	2	(22%)
Comprehensive exam committees	5	(56%)	5	(56%)
Dissertation committees	9	C	L00%)	9	(100%)
Faculty committees	7	(78%)	7	(78%)
Joint faculty appointments	4	(44%)	2	(22%)
Joint program administration	2	(22%)	1	(11%)
Program located in same building	6	(67%)	3	(33%)
Team-teaching	2	(22%)	1	(11%)
Have these interactions increase or decreased in the past 5 years	4					
Increased	3	(33%)	4	(448)
No change	6	(67%)	5	(56%)
Decreased	0	(0%)	0	((\$0
Anticipate an increase in the next five years:						
Yes	4	(50%)	5	(56%)
No	4	(50%)	4	(448)
••••••••••	• • •	•••				

TITLE:

AUTHO

Table 2

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	1							
the Two Program sons Responding								
EP			÷					
2 (22%)								
5 (56%)	10001							
9 (100%)	BES-							
7 (78%)								
2 (22%)								
1 (118)								
3 (33%)	and the second							
1 (11%)								
4 (448)								
5 (56%)	UILE:	PERCEPTIAL /COR	NITI	FUTER D	ISPLAY	ONA		
0 (0%)				. more				
	AUTHOR:	DAUID H. JONASS	EN					
5 (56%)								
4 (448)								
	20							
-								

EFFECTS OF MICROCOMPUTER DISPLAY ON A PERCEPTUAL/COGNITIVE TASK

David H. Jonassen School of Education University of North Carolina at Greensboro Greensboro, North Carolina 27412-5881

Paper presented at the Annual Meeting of the Association for Educational Communications and Technolog Las Vegas, Nevada, January 19, 1986

INTRODUCTION

	Adaptive Courseware Designs
	I lower that computers will play an incresingly intergral
	Assuming the educational and training of individuals in
	role and non-school settings, more effective ways of
	school and their potential should be investigated.
	atilizing cherr potential should be investigated.
	courseware producers are beginning to transcend the
10.000	conceptual and instructional constraints imposed by the form
R DISPLAY	of most drill-and-practice and tutorial software. Future
IVE TASK	efforts should focus, at least in part, on exploiting the
	interactive and adaptive capabilities of computer assisted
	instruction rather than merely using the computer as a
	presentation device for text and graphics. These
	capabilities permit greater flexibility in courseware than
	merely providing remedial responses to multiple choice
	questions. Several levels of interactivity between the
	user and the computer are possible, as are multiple levels
n	and dimensions of possible adaptations by the courseware to
on	those interactions (Jonassen, 1985). A potentially
at Greensher	important adaptive, interactive courseware design diagnoses
27412-5881	learners' intellectual skills and/or cognitive styles prior
	to instruction and then adapts the instructional
	presentation to capitalize on the individual learner's
	processing strengths or to remediate the learner's skill
	weaknesses (Carrier & Jonassen, in press), Ross (1984)
	recommends "oreater emphasis on pretask assessments (eo.
Menting	of prior achievement, learner backgragund, etc.) as bases
tions of the	for adaptation" (n.47). Only through increasingly
19 1001 Techni	condicticated adaptive cequences will the computer benin to
., 1986	realize the tutorial notential of a Socratic dialogue
	realize the totorial potential of a bothatic dralogaet
10	Assessing Learner Differences
	Many measures of individual differences have evolved from
	individual, projective tests to take the form of
	non-projective, paper-and-pencil tests in order to improve
	the efficiency of the test while maintaino reliability and
	Validity. For instance, the consistive style, field
	acticulation has evolved from the Body Adjustment Test
	which paquined alabamate apparate to the Dod and France
	mitch required elaborate apparati, to the Rob and Prame

> Test, with less elaborate apparati, to the individual Paper-and-pencil Embedded Figures Test, and finally to the group administered Group Embedded Figures Test and Hidden Figures Test. The next step is to embed these latter tests into courseware as a means for diagnosing learners' processing preferences. Can we assume that these tests are adaptable to computer display without affecting performance? How will adaptation of these tests to computer display affect their validity and reliability? Will the limited resolution of computer generated graphic presentations affect the information processing requirements of the task?

> > 2

If instructional adaptations are to be predicated to computer tests of cognitive and perceptual tasks, be certain the computer testing requires the same and intellectual processes as the paper-and-pencil

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Purpose of the Study

The purpose of this study was to adapt the Hidden p scr Test to microcomputer display and to assess its alter pat form reliability when compared to the paper-and-penci or a The Hidden Figures Test (Ekstrom, French & Harmon, 19 bot Eh I a popular measure of the cognitive style, field AH articulation, otherwise known as field dependence/independence. It measures the ability of h de the subject to perceive and separate information from its the surrounding contextual field. Specifically, subjects required to locate one of five simple figures in seum tak EDS complex patterns (see Figure 1). Subjects who are an dif They are skilled at separating field independent. pal from their surrounding perceptual field, that is, then pas perception is indepedent of the perceptual field in wa two is embedded. Field independent subjects are not only the skilled at locating figures in patterns, but also in patterns, but pat solving and other cognitive tasks requiring learners in ter select salient cues from their surrounding contextual 511 as well as imposing their own structures on information d1 (Witkin et al, 1977). In short, they are more analytic 50 processors of all forms of information. These process SCI differences are reflected in their social interactions ani career choices, with field independents preferring on pa: interpersonal distances and fewer interpersonal relation th Field articulation has also been related to intelligent th hemispherical preference, deductive reasoning , and i se of other constructs. Since it is one of the most reli Th and certainly the most researched cognitive styles, 63 reflecting the most distinguishable processing different wa it it was selected to test the effects of microcomputer display. In a study virtually identical to this one recently discovered after collecting the data, the paper-and-pencil form of the test produced higher score though the alternate form reliability was significant. r=.57, p(.05 (Jacobs, Byrd, & High, 1985). Only 32% variance was explained, however, indicating a weak alternative form reliability. Despite my intention. U study may function as a replication of the earlier stee

METHOD

Instruments

The Hidden Figures Test, Form CF1, Revised, is from M of Factor Referenced Cognitive Tests (French, Ekstron Price, 1976). It consists of two parts, each with 10

tual tasks, complex patterns in which are embedded one of five simple predicated. es the same figures (see Figure 1). Part one, questions 1-16, was used r-and-pencil in its paper-and-pencil form. Part two, questions 17-32, as converted to computer display. It was programmed in

Applesoft BASIC for display on 12 inch, monochrome (green

le, field

nation from data, the s significan ing a weak intention, e earlier s

d, is from 1 nch, Ekstron each with 10

the Hidden screen) monitors with Apple IIe computers. The figures and ssess its al patterns were constructed in page 1 of Apple high resolution paper-and-pe. graphics. This provided a four line text window at the ch & Harmon bottom of the screen for giving directions. Resolution in le, field this mode is 280 horizontal pixels by 160 vertical pixels. All of the figures and patterns in the computer version were ne ability of identical in proportion nearly identical in size to those in nation from the paper-and-pencil version. The timing and scoring were ally, subjet the same. The instructions for how to perform the task were igures in structions in how to manipulate the screens. The primary it separating patterns visible to the subjects at any time. In the I, that is, patterns visible to the subjects at unres are displayed on ual field in paper-and-pencil version, the 16 figures are displayed on s are not on two pages, with 3 rows of patterns on each page. Four of those rows contained 3 patterns, and the last 2 contained 2 but also , but also patterns per row. Because of limited size of the computer ring learner; terminal, the three rows of figures could not be displayed ing contextual simultaneously. So, the five simple figures were always s on informat displayed at the top of the screen with a single row of the more displayed at the top of the screen with a single row of re more analy patterns (either 2 or 3) displayed in the middle of the These processoreen (see Figure 2). The rows appeared in the same order, al interactic arrangement, and proportion as they did in the preferring; paper-and-pencil test. Subjects could flip between each of personal reli the rows simply by pressing the right or left arrow keys at to intellig the bottom of the keyboard. The computer required 1.2 ioning, and seconds to clear the screen and form the new row of figures. the most re The numbers of the patterns were displayed directly beneath ive styles, each pattern. The other difference between the two versions essing diffe was in how the subjects recorded their answers. In the f microcomp, paper-and-pencil test, the letters A-E (corresponding to the to this one figures in the top row) were displayed beneath each pattern. The subjects were instructed to circle the letter ed higher so corresponding to the figure which they thought was embedded in the pattern. In the computer version, when subjects). Only 32% wanted to answer, they pressed the letter A (for answer). In the text window at the bottom of the screen, they were prompted: "In which pattern did you find a figure?" They were instructed to type a number between 1-16 followed by a return. Any other response but a number between 1-16 resulted in a remdial message instructing them to respond with a number between 1-16. They were next prompted: "Which figure did you find in pattern pattern number?" They were prompted to respond with a letter A-E and a return. They were then given confirmation of their response with the opportunity to alter their response, "Figure __ is in

Pattern ___. Correct (Y or N)?" A "y" typed in would the text window, except for the screen manipulation All other keys on the keyboard, except the numeral letter A-E, Y, and N were deactivated.

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Participants

The participants included 58 upper-level undergraduate graduate students in education and library science at southeastern university. They were predominately (female. The mean score for all subjects was 4.96, which equivalent to norms for this group established in othe investigations. So the participants in this student fairly normal with regard to the task measured by the All subjects had some prior experience with microcomputhough the level of experience varied.

Procedure

One group (n=38) was administered the print version me the test first, followed immediately by the computer version of t The other group (n=28) received the computer version . the in order to control for order effect. The tests were more administered in immediate succession. The only delays beci incurred were for changing rooms, ie. moving to and the due1 computer lab, which was less than 100 feet away. For the sion adminstration, the experimenter read the instructions same the subjects completed the sample test items. Any cum were answered prior to the beginning of the test. The COU per-Figures Test is a timed test. Subjects were given 12 minutes to complete each version of the test. exte

RESULTS

Pearson product momment correlations were calculated is paper-and-pencil and computer versions of the test. The was a significant relationship between the two versions \underline{r} =.484, \underline{p} <.05. The significance of this relationship is be tempered by the fact that the relationship accounted only 23.4% of the variance between the scores.

per In order to test for order effect, a two-way analysis num variance was calculated for the mean scores presented 900 Table 1 indicates that for the group which Table 1. dia received the paper version first, the mean scores on D wer tests were equivalent (M=4.71). However, for the group adc receiving the computer version first, their scores on COT computer version were significantly lower on the computer tes version (M=2.55) than on the paper version (M=5.28). res analysis of variance indicated no main effect for orde Der The paper first group performed better (" treatment. lea on the combined scores than the computer first group fac (M=3.875), however the difference was not significant.

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-way analysist res presented group which an scores on b for the group eir scores on t on the comput on (M=5.28). fect for order ied better (M=1 first group significant. was a significant main effect for version of the test, F=5.12, P(.81. Scores for the paper version (M=4.96) were higher than the scores for the computer version (M=3.63). The interaction was also significant, F=5.12, P(.85, indicating a significant order effect for the computer first group only. When the subjects received the print version first, they performed as well on the computer version. However, when they received the computer version first, their performance on the print version improved significantly.

DISCUSSION

There is evidence which indicates that by adapting perceptual and cognitive test, such as those for field dependence/independence, you lose both face and construct ualidity. Streibel (1981), in a series of experiments with the Embedded Figures Test, found that by increasing the size of the embedded figures by a factor of eight, the nature of the performance was altered. Field dependent subjects became more field independent, and field independent subjects became more field dependent. In this study, serious questions about the face validity of a computer version of the Hidden Figure Test were raised. While there was a significant correlation in the scores on both version of the same test, the analysis of variance indicated that they could not be judged alternate forms of the same test. The performance, as a function of order of testing, varied too extensively. This is especially important when we consider that in a computer managed instructional environment, where the computer would conduct the diagnostic testing, the computer version would replace the print version. The scores on the initial administration of the computer version were significantly lower than the initial administration of This lower score corroborates the paper-and-pencil version. the conclusions of Jacobs et al (1985) that the computer version is probably measuring other constructs such as computer anxiety, which is a function of prior computer experience. There was anecdotal evidence that the Perceptual constructs being measured were also different. number of subjects, especially those in the print-first group thought the computer version was easier, because the diagonal lines generated by the computer (2 pixels wide) were easier to distinguish and compare. Obviously, additional practice with performing perceptual tasks on the computer may well have reduced the effects of computer testing in this study. Additionally, the use of a higher resolution screen may have produced more equivalent Performances. This study should be replicated, adding at least one more level of resolution as a test for that factor. The use of computers to administer perceptual and



cognitive tests is clearly in the developmental station of additional work is necessary before we can apprint) forms of administration.

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Table 1									
Mean	Scores	by	Group	on	the	Hidden	Figures	Test	

Test

Order	Paper HFT	Computer HFT	
Paper-Computer	4.71	4.71	4.71
Computer-Paper	5.20	2.55	3.875
	4 94	3.43	



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Figure 2 Computer Version of HFT INTE:

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INTRODUCTION

is generally accepted that the exponential growth of cocomputers in education and the workplace has produced an procomputer in many people that is referred to as erse reaction in many people that is referred to as oputerphobia", ie. fear of computers. According to Jay mputerphobia from computer phobia:

ROCOMPUTERS:

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are resistant to talking or thinking about computers, may hostile and aggressive thoughts about computers, and tear and become anxious about computers.

other, more widely used term for computer phobia is computer gity. Computer anxiety results from fear or apprehension when ing computers or when faced with the prospect of using mouters. Such fears may be rational or irrational. Many reple have perfectly normal reasons for fearing computers have perfectly normal reasons for fearing computers have no set as fear of displacement, loss of control, no set learn to use them, fear of failure, fear of breaking the mouter, and (inevitably) unclear documentation. Such fears, he cuments, often produce the hostile reactions toward computers. rational fears, those without explanation, are the cause of mouterphobia, which in turn results in computer anxiety. urer and Simonson (1984) enumerate behaviors that are speciated with computer anxiety, such as:

avoidance of computers and the area in which they are located,

eting of the inegative remarks, and ions and Technologittempts to cut short the necessary use of computers. 19, 1985

> Exputer anxiety is generally regarded as an instance of state stricty. State anxiety is situational, that is, it results frectly from some stress-producing situation during a finite wried of time. Raub (1981) contends, however, that the state stricty associated with computer phobia will more likely result in people with higher trait anxiety. Trait anxiety is a more induring and permanent characteristic tendency to be anxious.

Secure anxiety tends to be gender specific, with many more when fearful of computers because socialization makes them less "Reptive to computers (Winkle & Matthews, 1982). Computer Nuity is an important issue which should stimulate affirmative With efforts (Bakon, et al, 1983).

While computer anxiety is a generally accepted phenomenon, its Mistence is often based on anecdotal data. We have no empirical Proof of its existence, which raises the possibility that it may be more constructed than real, based upon our expectations. Sociologically speaking, there is good reason to expect computer Maxiety. As we have all sat down to learn a new software package, we have felt the pangs of anxiety. Yet, there support for the pervasive effects that are often document the literature. The purpose of this study was to emprim document whether increased levels of state anxiety are in associated with the use of microcomputers, thereby produce anxiety-related behaviors enumerated by Maurer and Simona (1984). While they used the same instrument as this study results were used to validate a Computer Anxiety Inventor than to establish the existence of computer anxiety. In addition, they administered the anxiety measure in its print form. In order to assess whether state anxiety increases using microcomputers, the state anxiety measure in this state administered by the computer.

METHOD

Participants

116 undergraduate and graduate education and library science majors with an age range of 20 to 55, enrolled at a southern university.

Instruments

State-Trait Anxiety Inventory, Form Y (Spielberger, 1983) in inventory which assesses levels of anxiety states, such as tension, apprehension, worry, etc. Based upon the personal theory outlined by Spielberger (1972), the test is divided a two parts. Part 1 assess state anxiety, a transitory, moment state of anxiety. These personality states can become more stable over time. Trait anxiety, as measured by the STAL to a stable individual difference of anxiety proneness which result in elevated state anxiety in situations perceived by person as threatening. The trait portion was adminstered to participants in its print form. Half the participants also received the print form of the state portion of the test. state portion was converted to an auto-boot program for the IIe which presented each question individually with the life scale presented beneath each question (see Figure 1). After answering, subjects were asked to confirm their responses. enabled them to change their responses because of a change mind, Keyboarding error, etc. After the 20th question, an additional question was presented which asked the participul classify the level of their computer expereince (from "Never one" to "Use one all the time". The computer then wrote the participants' answers off to disc. A program was written to score the state tests and print out the results.

Procedure

The control group (58 students) received both portions of the test in a normal classroom environment. The experimental gra-(58 students) received the trait portion in class and then proceded to the computer lab for an introductory lesson in computer assisted instruction during which they completed the

mate portion

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This study increased a many educat anxiety. A increased e produce irr study. The could have stongest pr £(2)=12.18, variance. that. It a educational differences variance.

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RESULTS

er and Simon prans for the two groups (N=58 each), one completing the as this share wiety portion online and the other completing it in as this stud wate anxiety portion online and the other completing it in print tiety Investigate and compared statistically. No significant difference anxiety. the proups were found, t(114)=1.34, p).85. The state anxiety. In the groups were found, t(114)=1.34, p).05. The state ety increase wiety scores of the computer group (M=48.24) were substantially ety increases other than the print group (M=36.12), but within group variance ure in this s so high for the computer group that no statistical difference curred. The trait anxiety scores (M=36.59 and M=36.79) were rtually equivalent, t(114)=-8.13.

wei of Computer Experience

the end of the computer-administerd state anxiety inventory. library scim prticipants were asked to classify on a five-element semantic ed at a south afferential their level of experience with microcomputers. used upon their declared levels of experience, they were broken to five groups of unequal size with the most indicating a metrate level of experience and only three indicating a high berger, 1983 mel of experience. An analysis of variance of the state states, such a supery scores of these five groups indicated no significant on the person difference, E(4)=0.83, p>.05.

can become mon ally six members of the experimental group were males. Their d by the STAI, evel of state anxiety, predictably lower from the literature, promeness who were in fact slightly lower (M=46.12) than the females (m=48.36). ns perceived a he difference however was not significant, $\underline{t}(56) = -0.36, \underline{p}$.05. s adminstered here was no difference in trait anxiety scores either.

DISCUSSION

ly with the liv igure 1). After This study provides some statistically inconclusive evidence of hir responses. There are states when exposed to microcomputers. For se of a changer This educators, they are still novel enough to produce some this educators. An increase in state axiety should be mitigated by Mcreased exposure to microcomputers. Microcomputers do not the participe Produce irrational fear among educators, as evidenced by this then wrote the study. The setting (moving from the classroom to a computer lab) was written " fould have produced the marginal increase in state anxiety. The stongest predictor of state anxiety was still trait anxiety, (2)=12.18, p(.85, although it accounted for less than 18% of the

variance. The treatment factor added no significant amount to portions of b that. It appears that these results, like most produced by experimental f dicational research, are greatly affected by individual lass and then the second stated by the high level of within-group

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The computer equity issue was not supported by this study although the inequity in group size makes the analysis sup For this group of professional and pre-professional student anxiety toward computers should not be as great as among vastudents. Most of the large sex differences seem to occur junior high and high school.

The solution for computerphobia or computer anxiety is comliteracy (Lawton & Gerschner, 1982). Computer tension may be reduced by using a comparative organizer to relate comusing decisions to the more familar process of selecting a using a classroom film (Rottier, 1982). This metaphorical approach is the basis for developing elaborate "training way systems" described in the human factors literature.

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Figure 1

Sample Run of Computer Version, SAI

1. I FEEL CALM		
ENTER THE NUMBER THAT DESCRIBES HOW YOU FEEL ABOUT THE STATEMENT ABOVE AT THIS MOMENT. NOT AT ALL		
	New screen	. 38 885
ARE YOU SURE THAT YOU MEAN 1? (Y DR N)?		
	New screen	
2. I FEEL SECURE		
ENTER THE NUMBER THAT DESCRIBES HOW YOU FEEL ABOUT THE STATEMENT ABOVE AT THIS MOMENT. NOT AT ALL		
	New screen	HILE:
ARE YOU SURE THAT YOU MEAN 3? (Y OR N)?		AUTHORS:
	New screen	
3. I AM TENSE		- 1965
ENTER THE NUMBER THAT DESCRIPES HOW YOU FEEL ABOUT THE STATEMENT ABOVE AT THIS MOMENT. NOT AT ALL	131	

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ABSTRACT

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mis study compared the efficiency (time) and accuracy of list versus flow chart representations of the task of using indexes versus for document numbers in the U.S. Documents <u>Monthly</u> to search for document numbers in the U.S. Documents <u>Monthly</u> <u>stalog</u>. Participants independently used the algorithms and <u>stalog</u>. Participants independently used the algorithms and <u>stalog</u>. Participants independently used the algorithms and <u>stalog</u>. Both groups performed at a <u>stalog</u>. accuracy level. Both groups required virtually identical times to locate document numbers using each of the four indexes of the catalog, though the range of time and resultant variances were high. It appears that the form of representing algorithms has no effect on the algorithmic process during a varch task.

INTRODUCTION

Algorithms are often used in education to depict general procedures which describe a class of problems. Algorithmic procedures normally are distinguished from linear procedures, which are represented as sequential lists of discrete operations. Algorithms, on the other hand, represent decision rule procedures in which a set of rules is systematically employed to make decisions and take appropriate actions. Algorithms are designed so that they always produce the correct result, given any of a class of decision rule problems. They may serve as instructional media or as job performance aids, which indirectly instruct users. Numerous studies have uerified the effectiveness and efficiency of algorithms as instructional media (Landa, 1974; Scandura et al, 1971; Schmid et al, 1976).

while many people associate instructional algorithms with flow charts, Merrill (1988) illustrated four different representations for algorithms -- decision tree, decision table, flow chart and list representations. In this study we compared the efficiency and accuracy of two of the more popular representations, flow chart and list representations, for facilitating a search task. Very little research was availble to assist us in generating hypotheses. Coscarelli (1978) Reported that the form of representation (list us. flow chart Vs. prose) did not affect critical thinking ability or course grades, however, using flow chart algorithms, students reduced their completion times. Coscarelli (1978) believed that different representations for algorithms possessed different media codes, which should affect the recoding of information into mental operations. Recoding differences should result in performance differences. In a study employing limited Information processing tasks, flow charts were found to produce faster decision making than lists, with an equivalent level of accuracy (Holland & Rose, 1981). Evidence seems to indicate that flowchart representations of algorithms enables users to learn more efficiently. The questions that we addressed was, would these results generalize to a meaningful search task

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METHOD

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Participants

55 undergraduates and 5 adults at the Virginia Military Institute (26 male, 4 female).

Materials

Verbal Two sets (flow chart and list) of six algorithms were and field tested. Each set of algorithms depicted the Extende decision-rule procedure for using each of the indexes chart)= author, title, and keyword) and locating document num in the the Monthly Catalog, the primary accession tool to U.s. Government Documents in depository libraries. The first Accurat algorithm in each set presented decisions which led to a appropriate algorithm and index. Each of the next for 10W CT algorithms in each set directed the users through each a request indexes (see Figures 1 and 2 for examples of both types (n=2) ... algorithms for one index). The final algorithm showed procedu find the document number in the catalog. The algorithm consisted of an average of 3 decision steps and 5 action Time The flow chart versions used four common flow charting . Only m to loca (rectangle, diamond, oval, and circle) to represent action (M=5.24 decision, terminal, and connector steps respectively. N flow ch steps for the list representations used the same direction produc presented in a numbered list sequence, with decision comof var referencing different step numbers. Both sets of algorithm were presented on six 8 1/2" X 11" pages. less t

Procedure

indica Content validity was established by submitting the materi for review by the head documents librarian and a library science professor. Then, each set of algorithms was pill tested with naive users. No changes were found necessary The us participants in the study were unfamiliar with either th effect Monthly Catalog or the use of algorithms. They were rais locate assigned to treatment group (list and flow chart). Each experi first given an instruction sheet and practice exercise of the to use their respective type of algorithm. Next, all algori participants were presented individually with the set of list p algorithms and a set of four problems, each requiring 💷 concer of a different index in order to locate a citation and algori document number. That is, the search required each use appear one algorithm to determine the needed index, a second The ac index-specific algorithm to find the citation, and a the at lea locate the SUDOC number. Only the Monthly Catalogs for Hollan years 1988-1983 were used for searching, in order to 100 prior scope of the task. The order of the problems was rando are ge Each participant was individually timed as s/he worked the fl the algorithms in order to locate the document number to The gr 1-world setting

ong as they needed to locate it. They were told not to request assistance unless absolutely necessary. Following reatment, each participant completed the Extended Range Vocabulary Test from the Kit of Factor Referenced Cognitive Tests as a global measure of verbal ability.

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RESULTS

Verbal ability

algorithms wer There was no difference between groups on the first part of the thms depicted mextended Range Vocabulary test (M(list)=12.47 and M(flow h of the indexe chart)=12.93). We concluded that both groups were equivalent ting document of in their reading ability. ssion tool to h

braries. The f. Accuracy

ions which led Both groups completed the questions with 91.7% accuracy. The h of the next f flow chart group ($\underline{n}=9$) had a significantly greater number of sers through e_{12} requests for assistance than did the list representation group ples of both type (p=2), $X^{2}(1)=5.67$, p(.82. These requests related to the algorithm show procedure for locating the indexes or which index to locate. og. The algoris

steps and 5 act Time

non flow charting Only minute differences in the times required by participants) to represent to locate documents resulted (see Table 1). The list group is respectively. (M=5.24) completed their problems only slightly faster than the rd the same dire flow chart group (M=5.28). The range of times was very high, with decisions producing a large amount of variance in the data. The analysis Both sets of all of variance indicated a significant main effect. Post hoc analysis indicated the the title problem required significantly less time (M=4.39) than the other questions (M=5.42). The question by treatment interaction was not significant indicating no differntial effects of treatment.

CONCLUSIONS

The use of algorithms to introduce search procedures is effective insofar as most of the naive users were able to locate the information they sought independently. Also, the experience was positively received by all participants. Most of them reported positive attitudes toward the use of algorithms. Since the effectiveness of algorithms relative to list procedures has already been established, this study was concerned with alternative methods for representing the same algorithmic process. However, the form of representation appears to have little effect on the efficiency of the search. The accuracy of the search does not seem to be affected either, at least in terms of the proportion of citations located. Holland and Rose (1981) recommended practice with algorithms prior to performance because they (both list and flow chart) are generally unfamiliar forms of instruction. They found that the flow chart, after practice, elicits the best performance. The greater number of requests for assistance in this study by

ibmitting the main rian and a libra algorithms was a ere found necess iar with either ms. They were t flow chart). E ractice exercisi thm. Next, all ly with the set each requiring e a citation and required each u index, a second itation, and a thly Cataloos f , in order to oblems was rand as s/he worked

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the flow chart users was probably attributable to the of that form of instruction. So, with practice, the of the flow chart group in this study might have impro-Practice with any procedure is important. However, deemed likely that in an engineering-oriented, predommale school (such as the one in which the study was that some of the participants were familiar with flow The intent of this study was to investigate the use the algorithms for providing independent access to mater order to supplant the need for personnel to assist in process. While either form may be used with equivalent efficiency and resultant accuracy, the additional regulation users, would suggest the preferred use of list algorithms algorithm suggest the preferred use of list algorithms

However, the efficiency and resultant accuracy of the back different forms of algorithms in this study suggest that the technology of algorithmization that makes the process difference - not the form of its representation. The me codes are structural and therefore implicit in the algorithm process and not specific to its form of representation.

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tributable to the th practice, the might have imp ant. However, oriented, predo the study was miliar with flo Mean Location Times for Indexes tigate the use by Type of Algorithm Used access to mater nel to assist in d with equivale · additional rec Author Title Subject Keyword t trend among : of list algoriguist 4.11 4.97 6.05 accuracy of the slowchart 4.85 6.04 5.51 5.49 study suggest t t makes the proc sentation. The icit in the alg

Table 2

Table 1

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Results of Two-Way ANOVA

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		Sum of	Degrees of	Mean	F
son of prose r ictions. Tech Ru nter, American		Squares	Freedom	Squares	
	Type Search	29.01	3	9.67	1.16
and instruction logy Publication algorithms. M	Treatment .	3.05	1	3.05	0.365
	Type X Treat.	12.05	з	4.82	8.481
	Error	935.69	112		
l., & Luger, G. ncrete behavior	Total	979.81	119		

(1976). Using sroom text matr 312.

Figure 2

List Representation of Algorithm

- 1) Start here with the AUTHOR of a government document.
- Find the CUMULATIVE AUTHOR INDEX to the <u>Monthly Catalog</u>. The indexes, along with the <u>Monthly Catalog</u>, are located on Index
- Select the AUTHOR INDEX volume for the year your document van published. If you do not know the year, use your best guest
- Is your AUTHOR one or more persons? If yes, go to Step 5. In go to Step 6.
- Select one of your AUTHORS and look up the last name, followed the first name or initials. Go to Step 7.
- 6) Your AUTHOR must be a corporate or government agency. Lock up first major word in the corporate agency. Do not use <u>a</u>, <u>an</u>, <u>b</u>
- Did you find your AUTHOR? If no, you may have the wrong year back to Step 3 and select the year earlier or the year later. If yes, go to Step 8.
- There may be more than one title attributed to your AUTHOR. Me the one you want. Find the ENTRY NUMBER following the title.
- The ENTRY NUMBER looks like this: 83-16997. The first two due (83) indicate the year and volume number of the Monthly Catal

Write down your ENTRY NUMBER.

- 10) Find the volume of the <u>Monthly Catalog</u> for the year indicated your ENTRY NUMBER. ENTRIES are listed in numerical order. numbers contained in a volume are indicated on the spine.
- 11) Did you find your ENTRY? If no, you may have the wrong vale Look at the inclusive numbers listed on the spine to see if you fit. Go back to Step 10. If yes, go to Page 6.

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THE 1983-84 MARYLAND ITU UTILIZATION STUDY SUMMARY REPORT

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RUTHOR: PAUL E. JONES

THE 1983-84 MARYLAND ITV UTILIZATION STUDY SUMMARY REPORT

PAUL E. JONES DEPARTMENT OF INSTRUCTIONAL TECHNOLOGY TOWSON STATE UNIVERSITY TOWSON, MARYLAND 21204

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PRESENTED TO THE RESEARCH AND THEORY DIVISION, ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS AND TECHNOLOGI

LAS VEGAS, NEVADA January 21, 1986

ACKNOWLEDGEMENTS

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Finally, and most important, were the teachers, principals, school library media specialists and systems ITV coordinators who took the time and effort to complete the survey questionnaires. It was their professionalism and spirit of cooperation which made this research possible.

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BACKGROUND

In November of 1983, the Maryland State Department of Education (MSDE), Division of Instructional Television requested that we undertake a study to determine the press usage of instructional television within the public school of Maryland. One such study had been conducted by Johnson and Keller in 1981. Essentially, the proposed study would replicate and update the Johnson and Keller study. We were very pleased to conduct this study since, to a large extent the objectives of the study coincided with our own interest in the utilization of television in Maryland public schools In January of 1984, we prepared a proposal for the study which was subsequently approved by Maryland Instructional Television (MITV) and by the Council for Statewide Plannie of Educational Information Systems (CSPEIS). The study was conducted during the spring of 1984. It was essentially sample survey, utilizing mailed questionnaires. Data collection was completed for the project by late May in 19 for all Maryland school systems except one." Final data collection was completed by November 1984.

PURPOSE'

The study's purpose was to determine the present up of ITV in the public schools of Maryland. As with the Journ and Keller study, data-was collected relevant to four quests

- To what extent is ITV available in the Maryland public schools?
- To what extent are teachers, principals, library media specialists and system ITV coordinators committed to the area of ITV?
- To what extent is ITV actually used in Maryla study public schools?
- In general, what attitudes toward ITV are bell tesul by teachers, principals, library media special decid those and system ITV coordinators?

¹ One county (Montgomery) requested that data collection (2) principals and teachers be delayed until September 1984. ^[4] ease collection from these individuals was completed by late November 1984. ^[4]

ELATED STUDIES

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A comprehensive national study regarding the utilization of television in the public schools was sponsored by the corporation for Public Broadcasting (CPB) and the National center for Educational Statistics (NCES) in the 1976-1977 school year. The study was directed by Peter Dirr and Ron redone. The Dirr and Pedone study was representative of 12,000 school systems and 2,275,000 classrooms. The results indicated that instructional television was used by one out of every three teachers and that approximately fifteen milion students received a regular portion of their instruction ria television. While the results of this study were highly significant in terms of national usage, it provided limited benefits to assist in planning at the state level.

In order to provide more data specific to the utilimation of instructional television within Maryland, the Marvland State Department of Education, Division of Instrucrional Television, sponsored a statewide survey in 1981. The first Maryland ITV study was directed by Kerry Johnson and Paul Keller and was modeled after the Dirr and Pedone study. like the national study, the Johnson and Keller study collected survey data relevant to availability, commitment, ectual use, and attitudes toward ITV. The Maryland study utilized data collection questionnaires which were modificathe present g tions of the instruments used in the national study. Johnson and Keller found that utilization of ITV in Maryland closely to four quart followed national trends. For example, they found that ITV was widely available in Maryland and that 42.4% of teachers used ITV in 1981. Other findings indicated that ITV had become an accepted feature of instruction in Maryland public schools.

> The present study replicated the Johnson and Keller study in order to assess the current status of ITV utilization in the public schools of Maryland and to compare current usage with that of the 1980-81 school year. In order to obtain results which would be comparable with the 1981 study, it was decided to design questionnaires which would closely follow those of the 1981 study. Design of the instruments followed three principles. (1) they must closely match those used in the 1981 study in order to obtain useful comparable results; (2) they should include items to collect data relevant to current needs of MSDE; (3) they should be streamlined to ensure tase and accuracy of response. With those in mind, we first Getermined what additional information was needed by MSDE and by ourselves and then designed items to collect such data.

Second, we reworked the instruments to ensure ease of remain and to week out ambiguous item. Effort was directed town decreasing the time required to respond and toward improved accuracy of response. Since the 1981 study had not obtain usable data from school superintendents, it was decided the instrument which had been used in 1981 should be redesigned and sent to system ITV coordinators. It was felt the system coordinators would more likely be the ones with needed information and that they would be willing to particular in the study. The subsequent return rate among ITV coordinators (96%) proved these assumptions to be true.

Separate questionnaires were designed for teachers library media specialists, principals, and ITV coordinators The questionnaires were organized around the four major star questions: availability of ITV, commitment to ITV, actual of ITV, and attitudes toward ITV. The prototype questionnaires underwent informal field testing to identify problem items ease of response. After the initial field testing, it was decided to use professionally printed and color-coded question naires that would be attractive and easy to complete. The design of the questionnaires was greatly helped by the fact that the instruments used in the Johnson and Keller study was suitable to be updated and refined.

SAMPLE

The population of this study included all public schools in Maryland. We were interested in obtaining results which would ensure representation of all systems and proportional representation of elementary, middle, and high schools Consequently, we employed a variation of stratified random sampling which yielded a sample of 209 Maryland public school In each school selected, instruments were to be completed by the principal, the library media specialist, and five class teachers, the latter randomly selected by the principal. In addition, the ITV coordinator for each public school system received an instrument. The final sample selected was comprised of 24 ITV coordinators, 209 library media specialists and 1,045 teachers.

ADMINISTRATION

In February of 1984, a letter was sent to each of a superintendents in the state explaining the purpose of the study and requesting their cooperation. The collection of da began with the mailing of letters to each school principal of April 13, 1984. The principals' letters explained the purpos of the study and detailed procedures which were to be follow when the questionnaires were mailed. Questionniare packets a letters to the 209 principals were mailed during May 2-9, 196 Each packet sent to the principals contained a principal's respor ages r lated

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restionnaire, a questionnaire for the library media specialist, five questionnaires for classroom teachers. The packet included instructions for completing the questionnaires as well the procedure to be followed in randomly selecting the classteachers. ITV coordinators received questionnaires and letters of explanation the week of May 17, 1984.

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In order to increase the response rate of the study, a follow-up letter was sent June 5-7, 1984, to all schools which had not responded. A sample of the follow-up letter is included in Appendix I. Telephone follow-ups of those remaining, including ITV coordinators, were conducted from June 6 to 20, 1984.

THE DATA

Data for this study consists of responses of a sample of 618 classroom teachers, 149 library media specialists, 166 school principals and 23 system ITV coordinators to their respective questionnaires.

The results of the questionnaire mailings and collection were:

2		Questionnaires Sent	Questionnaires Returned	Questionnaires Returned (%)
i all public taining result	System ITV Coordinators	24	23	95.8
as and proper-	Principals	209	166	79.4
public school completed by	Library Media Specialists	209	149	71.3
d five classed rincipal. h chool system	Classroom Teachers	1045	618	59.1
ted was com- a specialist.	Total	1487	956	64.3

Analysis of the data consisted of categorization of responses by elementary, middle and high school levels. Percentages reponding in each question category by level were calculated for each survey item.

²The schedule for Montgomery County principals and teachers was: questionnaire packet mailed - September 10; first follow-up - September 18; telephone follow-up - November 5.

RESULTS

The purpose of the study was to determine the usage of ITV in Maryland public schools. Data were col relevant to four major indices of utilization: available of ITV, commitment to ITV, use of ITV, and attitudes to Data were collected from four categories of school person teachers, principals, school library media specialists system ITV coordinators.

AVAILABILITY OF ITV

The following results were obtained relevant to availability of ITV in Maryland public schools:

89.0 percent of teachers, 98.8 percent of school library media specialists, 93.6 percent of principals and percent of system ITV coordinators reported that ITV program ing was available in their schools. ITV was most frequent available via on-air direct broadcast. Next in frequence cassette-videotape, cable TV, and closed circuit TV. Less 5 percent of schools reported having or using videodisc m

Closely related to the availability of ITV is the coordinat ability of television sets for classroom use. 83.7 percent teachers reported that it was "easy" or "pretty easy" to be access to a TV set. Sets were reported to be in good real "always" or "most of the time" by 87.8 percent of teacher percent of school library media specialists and 91.9 percent principals. The quality of television reception was report be "good" or "fair" by 91.1 percent of teachers, and by 92 percent of principals.

Scheduling of ITV programs was reported to be the serious difficulty in using ITV. When asked about the depu of difficulty in obtaining a video recording (to overcome a scheduling problem), teachers responded as shown:

VIDEO RECORDING DIFFICULTIES

Easy	19.0
Pretty Easy	24.6
Sometimes Can't	9.9
Not Easy	8.0
Never Tried	26.0
No Facilities	11.9

When asked about the specific difficulties in un ITV, the group surveyed reported as shown:

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DIFFICULTIES IN USING ITV

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Program Scheduling	39.9
Set Availability	14.8
Advance Program Notice	9.5
Set Quality	8.7
Fnough Planning Time	6.9
Set Maintenance	3.9
Set in Class	3.3
Schedule/Guide Availability	2.8
Program Quality	2.2
Availability of Assistance	1.1
Others	6.9
	Program Scheduling Set Availability Advance Program Notice Set Quality Enough Planning Time Set Maintenance Set in Class Schedule/Guide Availability Program Quality Availability of Assistance Others

COMMENT TO ITY

nt of school ncipals and to The following results were obtained which were releat ITV progra unt to the question of the extent to which teachers, principals, ost frequentimool library media specialists and system ITV coordinators n frequency a are committed to the use of ITV. it TV. Less

videodisc equi One indication of commitment used in the questionnaire was whether or not schools had designated someone as the ITV of ITV is the mordinator. We found that principals and teachers disagreed 83.7 percent d y easy" to hm person responsible for ITV, the following results were obtained: in good repair of teachers,

BUILDING ITV COORDINATOR AVAILABLE

	Teachers	Principals
Full Time	20.4	31.4
Part Time	12.8	20.6
Informal	26.5	24.5
None	40.4	20.8

Of those schools which reported having an ITV coordin-Mr. teachers reported that the following services were provided:

ITV COORDINATOR SERVICES

Distributes Guides/Schedules	2.6
Works with Students	16.1
Provides Training/Consultation	19.4
Provides Newsletter	25.8
Calls Attention to Program	38.7
Provides Equipment Assistance	74.2

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Systems ITV coordinators were asked to report upon the Hrading or expansion of ITV facilities in their respective Fitens. Coordinators were asked what had been done during the Ht three years, as well as what was planned for the next three Mars. The following data were reported:

ITV FACILITIES UPGRADING

	Done in	Planned for	students
	Past 3 Years	Next 3 Years	school Lil
Increased the number of TV sets Added Video Equipment Expanded Videotape Libraries Added Master Antenna Added Production Equipment Added Videodisc Equipment	46.6 73.9 73.9 39.1 47.8 0.0	43.4 52.1 52.1 30.4 30.4 8.7	other Tea System Of Chairs/Su other Spe Farents

Students

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48.3

37.7

23.2 17.1 27.1

46.6

USE OF ITV

The study asked teachers to respond to several items order to determine how and to what extent ITV was used. Teach reported that they frequently view ITV as a whole class (74.9 percent), but that it is also very common (77.9 percent) to vie ITV with another class.

When asked how much time they spend watching ITV, 51 percent of all teachers reported watching at least 1/4 hour of ITV each week. 58.9 percent of elementary, 41.3 percent of mile and 43.4 percent of high school teachers reported watching at least 1/4 hours per week. Most teachers (87.6%) felt the manual School Li appropriate time for viewing ITV was between 1/2 hour and four Teachers hours per week. When teachers were asked about student outcome Subject S which they would attribute to ITV, the following results were obtained:

TEACHERS' REPORT OF OBSERVED ITV OUTCOMES

Expanded Knowledge :	
Expanded Vocabulary	
Students Follow-Up Ideas	
More Enthusiastic About School	
Use Library More	
Watch More ITV at Home	
Calming Effect	
Others	

When asked to which types of students ITV was most use ful, teachers reported that ITV was most useful to all student (79.0 percent) rather than for special abilities students.

ATTITUDES TOWARD ITV

Teachers, principals and school library media special ists were asked how they percieved the general attitudes of other groups toward ITV. The following results were obtained continue

Planned fo Next 3 Yes	students school Library Media Specialists	Favor 68.1 67.1 48.5	Neutral 31.7 32.1 50.3	Against 0.2 0.8 1.2
43.4 52.1 52.1 30.4 30.4	other leadince System Office Chairs/Subject Specialists ther Specialists Jarents	40.6 39.6 31.2 24.0	57.3 59.7 67.9 70.2	2.1 0.7 0.9 5.8
8.7	SCHOOL LIBRARY M	EDIA SPEC	IALISTS	
several item as used. Teach le class (74.) percent) to m	Indents Machers Mincipals Chairs/Subject Specialists Ther Specialists Teachers' Organizations Farents	Favor 68.1 66.9 61.9 52.2 46.4 43.0 25.9	Neutral 31.7 32.4 35.1 46.8 53.6 57.0 74.1	Against 0.2 0.7 3.0 1.0 0.0 0.0 0.0
ist 1/4 hour d	PRINC	IPALS		
<pre>} percent of the ed watching at) felt the mine ? hour and for student outcom ; results were COMES</pre>	School Library Media Specialists Teachers Subject Specialists Students Other Specialists Teachers' Organizations Farents	Favor 76.0 63.8 53.2 62 43.4 39.8 37.0	Neutral 23.9 36.2 46.8 37.5 55.8 60.2 60.7	Against 0.0 0.0 0.0 0.0 0.8 0.0 2.2
48.3 37.7	The three groups general being positive or neutral toward	ly view t the use o	he groups l f ITV.	isted as
45.3	CONCLUSIONS			
17.1 27.1 46.6	Based upon the results of clusions were made:	f this st	udy, the fo	llowing con-
J.9 TV was most use to all student s students.	1. ITV continues to be land public schools. While some availability occurred between print library media specialists and sys clear that programing is available schools. In addition, television teachers feel that it is relative classroom use.	widely av differenc ncipals, tems ITV e to more sets are ly easy t	ailable in es in perce teachers, s coordinator than 90 pe available o obtain a	all Mary- ption of chool s, it is ercent of all and most set for
were obtained	2. The most serious pro continues to be scheduling. Some	blem rela hope to	ted to avai improving t	lability his condi-

tion lies in the increase in the availability of video records ing equipment in individual schools.

 There is a commitment to ITV as indicated by the increase in ITV equipment and facilities during the past to years as well as plans for increases during the next three years.

4. The perception of attitudes toward ITV is genue positive. Teachers, principals, and school library media specialists perceive that significant groups within the educ tional environment are either neutral or positive toward the use of ITV.

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INTE

BUTH

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	TITLE:	DESCRIPTIVE STUDY OF NONCOMMERCIAL FM RADIO STATIONS AFFILIATED WITH COLLEGES AND UNIVERSITIES						
	AUTHORS:	MARY BETH LEIDMAN RICHARD J. LAMBERSKI						
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DESCRIPTIVE STUDY OF NONCOMMERCIAL FM RADIO STATIONS AFFILIATED WITH COLLEGES AND UNIVERSITIES

1986 AECT Annual Conference Las Vegas, Nevada Jan. 17, 1986 Research and Theory Division The Division of Telecommunications EM 1

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and

Dr. Richard J. Lamberski Associate Professor Department of Communications Media Indiana University of Pennsylvania 127 Stouffer Hall Indiana, Pennsylvania 15701 Office: 412-357-2495 Home: 412-465-5346 IO STATIONS SITIES

Abstract

FM radio in higher education has been an under appreciated resource for instrumatic development by sponsoring institutions. Radio, in general, has infered from the introduction of newer technologies. The current status of inference related the introduction of newer technologies. The current status of inference relation has been overlooked by most media researchers. This interval examines variables surrounding noncommercial radio stations affiliated with colleges and universities as they are in the early 1980's.

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DESCRIPTIVE STUDY OF NONCOMMERCIAL FM RADIO STATIONS AFFILIATED WITH COLLEGES AND UNIVERSITIES

Overview - Perspective

FM radio in higher education has long been the forgotten reso programmatic development by sponsoring institutions. Radio has sufficient the introduction of alternative technologies and the waivering of the support. The current status of these radio stations has been overla most media researchers, creating a substantial void in the available descriptive and comparative literature.

It is hard to believe, but radio was originally noncommercial educational. The first radio station is generally accepted as being to Pittsburgh, Pennsylvania, which started regular broadcasts in 1920. colleges and universities, especially in the midwest, rushed to join the radio bandwagon in the early days, and have continued to do so in the World War II era.

meration t The complexities involved with noncommercial radio operation have The or noted in the literature. Among these problems associated with educari to and t radio at colleges and universities commonly cited in past studies into started pub lack of adequate budgets and personnel (Aarnes, 1949; Halverson, 1941 bere are 6 Rashidpour, 1965; Note 1). re license

Any group of organization that has expanded as rapidly as has on After and university radio cannot have done so without some growing pairs. It was cond many such phenomena, the history of college and university radio reflection sold ident multitude of developments, relationships, and interdependencies. It is Tearbook. filled with many successes as well as failures. College and university information has never been stagnant, yet its path has rarely been smooth. It is criteria: therefore necessary and helpful to conduct periodic re-examinations of a either lice midress, w. organization. This project presents various aspects of, and observation miteria, · the operation of college and university radio broadcast facilities. tex sumber

The Study

The study the investigators wish to report, serves to establish framework for current and future documentation of FM radio affiliate institutions of higher education. The study examines the current state college- and university-affiliated noncommercial FM radio stations. research presents data in that describes the organizational attribute college- and university-affiliated stations as it applies to the follow areas:

- Basic description of institutions housing noncommercial radia 1. stations
- 2. Operating budgets

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Station operating hours

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whis way it is possible to develop a description of college and university moperations today.

Population

Because of the broadcasting's movement toward general deregulation, upled with the FCC edict banning 10 watt stations, it is somewhat difficult to arrive at an exact count of FM stations owned by colleges which are in coration today.

The organization which attempts to make accurate yearly compilations of ratio and television stations is Broadcasting Publications, Inc., which first warted publishing in the 1920s. Their Broadcasting Yearbook points out that there are 670 stations which are housed on a college or university campus or re licensed to one.

dly as has colle After consulting with several experts in the field of educational radio, owing pains. Us It was concluded that the best, most available and authoritative source which ty radio reflect would identify the wanted population most accurately was indeed Broadcasting dencies. It is Inrbook. Therefore, a total population was identified and derived from and university a information in the 1982 Broadcasting Yearbook that met the following enteria: (1) that it carried a noncommercial designation; (2) that it was caminations of 2 either licensed to a post high school organization or, according to its and observations Mdress, was housed on a college or university campus. Some met all alteria, others were licensed to a college or university but carried post Mx number addresses. The working universal population for this work was intermined at 670.

Limitations and Assumptions

to establish a o affiliated LIMITATIONS current statt stations. IM al attributes to the follow

mercial radio

- This study does not explore:
 - Station equipment
 - b. Salaries paid personnel
 - c. Physical size of station and physical plant

- Detailed lists of actual policies and procedures of interstations
- e. Specifics describing student personnel as it relates to major, year in college, year in college as compared via position, and time actually spent working at station
- f. The personnel section confines itself to examining group reflecting those involved and station groupings
- Due to the size and complexity of radio operations it is into to collect all data within the confines of a fairly concise questionnaire. To have increased the size of the question would have decreased the amount of responses.
- 3. There are actually two distinctive categories of college and university stations identifiable at the outset of this state, affiliates all meet certain specific minimum standards of operating times, budget, and operating power. They are considtogether. The non-NPR affiliates have no formal restrictions them as to budget, personnel, operating power, and broadcastin times. These stations are considered statistically in one crow and two subcategories: 10 watt stations (10WS) and stations operating power is greater than 10 watts (Gr10WS).

DISTRIBUTION OF THE INSTRUMENT

After a pilot study was conducted at the 1982 Broadcast Education Association Annual Convention and refinements were made, the survey was out in April, 1982 and seven weeks was allowed for responses.

The survey was sent to 670 college and university stations through the United States. Of the 670 sent out, 268 (40%) were returned. Of 243 (90.7%) were completed adequately. The information contained was into a Honeywell Level 66 Computer housed on the campus of Indiana law of Pennsylvania (IUP) for analyses utilizing the SPSS program which pudescriptive data as they related to mean, median, mode, and range si items and sections (see Leidman & Lamberski, 1986 for a detail methods presentation).

Findings and Conclusions

The all inclusive findings of the survey are too lengthy to fall within the confines of this particular discussion (see Leidman, 1985). However, some of the major areas of interest including financing, tech personnel, staffing operating hours, and programming are discussed here

All statistics and descriptions contained here have been derived in the 243 completed questionnaires. NPR responses equaled 51. They rep

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been derived fra 51. They repres of the population and 21% of the replies. Non-NPR stations particinumbered 192, or 28.65%, of the population, or 79% of the respondents. 192 non-NPR stations, 42 were 10 watt stations. They represent 6.27% the population, 17.28% of those replying, and 23% of the non-NPR stations the populating in this study. Non-NPR stations with power greater than 10 articipating in this study. Non-NPR stations with power greater than 10 autoents, and 78% of non-NPR stations participating in this study.

Both the 10 watt stations as well as those with power greater than 10 mits are included in the general category of non-NPR stations as well as the sponent parts.

In summary, for the purposes of this section, the following will equal an relative frequencies (percentages) of 100%:

N = 243--All stations

N = 51-NPR stations

N = 192-All non-NPR stations

N = 150--Non-NPR stations with power greater than 10 watts

N = 42--Non-NPR 10 watt stations

COLLEGE AND UNIVERSITY FINANCING--SUMMARY

This section examined the gross amount of money reported by the 219 stations responding to this section. It also considered the sources of station funding and the percentages derived from specific sources.

A limitation to this section concerned itself with how stations interpreted what "operating budget" involved. There is some question as to whether or not managers included such line items as student Federal Work itedy money, release time salary equivalent for professionals, and standing costs such as rent, electricity, etc.

The total amount reported by the college and university stations responding to the item regarding operating budgets was \$22,383,990. The rage was from \$600 to \$1.5 million with the average for NPR standing at \$345,228, for Gr10WS at \$42,462, and for 10WS at \$10,649.

Although stations tend to receive funding from any number of different mources, when examining this variable as a whole, indications are that less than 50% receive any substantial amount from any particular source with the exception of NPR and their receiving 50% of funding from general college funds.

Findings indicate that with the exceptions of donations and grants, college and university station groupings receive some of their financing from a combination of the following sources. These include: general college funds, funds administered by a particular school or department, student funds
(activity fees, etc.), and other sources such as underwriters. The category for endowment was included in the original list of possible sources only two schools received any funding in this way.

NPR-affiliated stations reported receiving smaller amounts of from schools, departments and student funds than do the non-NPR groups also true of

student funds. However, they do receive more of their funding free and donations. Only 8% of the non-NPR stations receive grant money receive donations. However, 74% and 85% of the NPR stations receive funds, respectively.

Almost 50% of the non-NPR stations derive an average of 77% of the funding from student-generated funds vs. only about 66% of the NPR are that do so.

While 83% of the NPR stations receive about 50% of their monies in general operating funds, 47% of the non-NPR facilities receive money way. However, the amount of this funding for those non-NPR stations a 67%.

While almost 27% of non-NPR stations report receiving 6% of their funding from funds administered by specific schools or departments, and of the NPR affiliates do so. These stations receive approximately are of their funding in this way.

Other sources of income such as underwriters were reported by M stations (36.5%). When breaking down recipients, one observes that M (74.5%) of the NPR stations receive "other" funding as compared with ((26.1%) of those who are not. Somewhat surprisingly, the 10 watt state reported the highest mean percentage in this category, however, only m watt stations total reported funding of this type. Also, the 10 watt stations showed a considerable number (23) receiving a majority (78%) of their funding from student funds.

It is important to note that most stations (approximately 85%) pafunding from at least two sources. None received funding from all some

STATION FUNDING-CONCLUSION

Although percentages can be deceiving, dollar amounts are real. Therefore, even though a 10 watt station might receive 100% of its open budget through underwriters, this amount might only be \$1,000. In the interest of greater participation, this study chose not to delve into a exact dollar amounts generated by particular sources. However, certais things are evident.

A higher percentage of NPR stations receive a greater amount of the money from general college funds. The non-NPR stations show a closer ful

relationship to relative the famat of backin extremts hold interpreted them the non-

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Although i s \$100,000 per setage budget stations receiv biget of some salability of

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TECHNICAL HEL

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re reported by K e observes that h as compared with a , the 10 watt stand y, however, only D Also, the 10 watt a majority (78%) =

oximately 85%) cc iding from all sor

autionship to school or department funds. That this is so would seem to phasize the fact that colleges and universities provide a substantial post of backing to high expense NPR operations. Furthermore, schools and sport on the purse strings for many of the other stations. This can interpreted to mean that closer academic and educational ties exist stysen the non-NPR stations and curriculum.

The actual range of operating budgets is in itself somewhat astounding. to even begin to compare a facility that subsists on \$600 per year with one has the resources of \$1.5 million can provide seems ludicrous. Yet both these facilities work under the same set of FCC guidelines.

Although it is understood that NPR stations must have a minimum budget s100,000 per year in order to remain affiliated, the fact that their marage budget is \$345,000 is indicative of the kind of support these stations receive. Comparing this with the average 10 watt station with a wdget of some \$10,000 cannot help but lead one to certain conclusions about wilability of resources, equipment, and personnel. NPR stations have all three.

It can be argued that institutions which heavily fund NPR stations do so eiving 6% of the set of a sense of mission related to community service. Yet, the 10 watt or departments, stations also supply such service, or at least try to do so.

> In the world of college and university radio there are stations with mater than 10 watts of power that have substantial operating budgets. The \$42,000 average reported by these stations carries with it availability of troadcasting resources. Yet, the mode and median of \$20,000 are probably pore accurate in this case. At least in terms of finances, it can be concluded that the larger non-NPR stations are viable.

Finally, it would appear that college and university stations do receive It least some money from a variety of different sources. They take it where It can be found. The level of commitment toward college and university ndio, based on interest and availability of funds, varies from institution to institution. The fact remains, however, that college and university stations do receive money.

ECHNICAL HELP--SUMMARY

ounts are real. e 100% of its open \$1,000. In the ot to delve into However, certal

ater amount of the s show a closer

Of 98%, or 239 stations reporting, 197 (45%) reported having full-time technicians vs. 132 (55%) which had some type of part-time technical help. Of NPR stations, 88% had full-time technicians as compared with 33% for the MG-NPR stations. Only 16.7 (7) 10 watt stations reported employing a full-time technician. Furthermore, 229 (96%) of all stations answered that they did have access to someone with a First Class FCC license.

TECHNICAL HELP--CONCLUSION

Once again, it appears that 10 watt stations are definitely on bottom of the college and university radio pile. Their lack of fully technical help is evident. This is just another indication of the reconfronting such operations. NPR stations are well established in the and Gr10Ws, although not having complete technical help, at least there is some attention being paid to this phase of operations.

ACTUAL STAFFING OF THE COLLEGE AND UNIVERSITY STATION

There were several areas of staffing analyzed by this research. ranged from staff totals and students involved in station operations students were paid, received academic credit, or were volunteers.

The gross number of individuals involved in the operations of the stations reporting totaled 11,886. Of these, 1,388 were associated in stations as compare with 10,498 for the non-NPR. Furthermore, the avera for the non-NPR station was much higher, 56 people vs. 29 for the NPL stations.

Stations definitively reporting student involvement (SRSI) numbered This measurement shows some 9,540 students involved. In NPR stations to were 767 vs. 8,772 in non-NPR stations. The percentages of student is ment are much higher in non-NPR stations than in NPR stations. Also, indications that 10 watt stations are the most dependent on student but apparent.

STAFFING CONCLUSION

Volunteerism seems to be a backbone of non-NPR stations. Most (at the people involved receive no remuneration. This is to be expected with an educational setting, yet the dependence of any organization on social level of young volunteers cannot help but have a marked effect on the my zation's performance.

College and university radio stations strive for a competitive a "professional" sound. However, indications are that realization of this is is made more difficult because of staffing patterns.

COLLEGE AND UNIVERSITY OPERATING HOURS --- SUMMARY

College and university stations generally broadcast for long been during the academic year. NPR stations, bound by contractual agreest a network average between 18 and 21 hours per day (hpd) year round. The findings bear this out. This is not the case with non-NPR college and

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PROGRAMMING-

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: (SRSI) numbered 1 NPR staticts be s of student in stions. Also, : on student hely

:ions. Most (80) > be expected will zation on such effect on the CP HOGRAMMING--SUMMARY

competitive lization of the

for long hours ctual agreement " year round. Th PR college and

disersity stations. Two hundred and forty-one stations reported on merating hours.

There is a change apparent in operating hours among non-NPR stations. alle they average 18 hours per day during weekdays when classes are in the mode reflects an actual increase of stations broadcasting around the clock on weekends, 40 stations for weekday operations versus 48 stations weekends. However, the actual average decreases by approximately 1 hpd.

Non-NPR stations show some tendency to close down in the summer months. systeen (9%) of the Gr10WS do so as compared with 48% (20) of the 10 watt rations. However, those remaining on the air average about 16 hpd.

During winter and spring recesses the non-NPR stations also close down at an even higher rate than they do in the summer. Thirty-eight percent of ge 10 watt stations cease operations and 33 (22%) of the Gr10WS do so. ovever, those continuing operating average close to 18 hpd.

THATING HOURS -- CONCLUSION

If broadcast hours can in some way be equated with level of commitment m community service and professionalism, it might be concluded that at least furing the months when school is in session all college and university stations show a high degree of both.

MPR operations are not an issue here. They operate 365 days per year. The consistency with which the non-NPR stations broadcast reflect an essential difference between them and the NPR group. Either through choice or necessity born of inadequacies of whatever sort many average college and miversity stations leave the airwaves when school closes. This fact can led one to the conclusion that such stations have yet to completely come of at in regard to realization of fully professional schedules.

College and university radio programming is not standardized. There is a wide range of programming types to be heard throughout the cross section of Merican college stations.

> Of 229 respondents, 179 (78%) reported that they did have a specific Wound or format. These covered the range of music from jazz to AOR to free form to fine arts.

> Unlike past studies, this one found that although classical music is Hill carried by many (167) college and university stations, jazz, with 170, has surpassed it in popularity. However, in terms of gross hours per week (hpw), indications are that rock supersedes both jazz and classical. Yet, the broadcasting of rock was reported by only 147 stations as compared with

classical and jazz. Indications are that those stations which do a devote a great deal of time to it. For the purposes of this summer types have been grouped together, although within the study rock such as Progressive, AOR, Heavy Metal, New Wave, Punk, Retrospecting Top 40 were examined. Very few (10) NPR stations broadcast any tech represents only 21% as compared with 78% of the non-NPR stations. station reported playing any heavy metal or punk rock.

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Other types of music on college and university airwaves include a country and western, bluegrass, Broadway, MOR, adult contemporary of religious, reggae, and urban contemporary. With the exceptions of contemporary and Christian religious, the other types of music average 10 hpw in each category throughout the station subgrouping types.

The MOR-adult contemporary statistics indicate that although comparatively few (49) play this music, those that do average between a least offi 28 hpd with an overall mean of 26 hpw. The 10 watt stations play the say are

Only one NPR station reported broadcasting any Christian religion music. Sixty-three of the non-NPR stations do so averaging 24 hps and range from 1 to 168 hpw. This indicates that wholly Christian relieve college and university stations exist. Format types reported support indication.

In regard to news-public affairs programming, 208 (93.7%) of all stations air such programming in varying amounts ranging from an avenue Thus hpw for 10 watt stations to 12 hpw for larger non-NPR stations to 30 m Jarz work affiliates. Included in this category are news, sports, public affain they, too talk.

music are Some type of specific news was reported as being broadcast by D This inte (80.6%) of the respondents. NPR stations were again first with an even much inst 22 hpw for 41 (87.2%) of their affiliates as compared with 6 hpw for the their sel (79%) for the non-NPR stations. The other subcategories of new-public to and wi affairs were similarly weighted.

PROGRAMMING--CONCLUSION

ALSWET CA It is evident from the findings of this study that substantial and within the realm of college and university program fare have taken plan That However, it would be irresponsible and inaccurate to draw universal resource: conclusions to an absolute nature. These findings may be judged to M cover the indicative rather than chiseled in marble.

It It would appear that college and university stations in their airing m programming are moving away from their traditional role as the bastica faciliti preservation of classical music. Programming is much more mainstreast backing so broadens the base of appeal, not only for the listener but also for difficul

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tions which do s of this summer the study rock as ink, Retrospective roadcast any tech -NPR stations. ck.

airwaves include t contemporary, 0 e exceptions of m es of music aven rouping types.

that although do average between stations play the

Christian religiou /eraging 24 hpw via / Christian religiou ; reported support

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3 broadcast by 13 first with an avenue d with 6 hpw for the ries of new-public

hat substantial du are have taken plus draw universal by be judged to M

ions in their le as the bastict more mainstreamed, ener but also for urplyed with the actual broadcasting. In the case of most non-NPR stations dis means that students, like most young adults, exhibit taste in music which reflects the times. For the early 1980s, the most popular genre of which heard on the air is some type of rock. This thought is easily main heard by turning the radio dial down its length as well as checking wat-selling record lists in <u>Billboard</u>, <u>Variety</u>, etc.

The rock element is undeniable. Several college and university stations are solely rock-oriented in content. This development represents a great thange from previous times. The trend will most likely continue but probably ever totally dominate the college and university radio scene. Current music all slways be available through commercial outlets. This may not be true for either jazz or classical.

The upsurgence of jazz may be judged as resulting from a search for the least offensive common denominator. Very few people are offended by jazz. Supy are devotees. But jazz commercial stations have yet to appear in any mumbers, therefore, jazz on noncommercial radio offers a real alternative.

Young adults prefer to listen and broadcast their own type of music, but just proves to be a palatable alternative for them as well. Classical music listeners generally find jazz appealing. Supporting this view is the fact that the classical music commercial station WGMS-FM, Washington, D.C., features jazz every Saturday evening. The program is very well-received by its listeners.

Thus, for the college and university station in quest of a compromise, jazz works. NPR stations continue to carry a lot of classical music but they, too, have jazz.

Those stations which air Christian-religious or Christian-contemporary music are, in all cases, connected with a religiously-based institution. This interdependence is not only absolute but it is also exclusionary. If such institutions continue to find that it is in their interest and that of their select listenership to broadcast this type of programming, they will do so and will remain a minority factor in the college radio picture.

The seeming lack of news-public affairs-oriented programming is #pparent. Does noncommercial college and university radio operate in the public interest? Whatever one's particular interpretation of same, the inswer cannot be final.

That sector of college and university radio which has the greatest resources produces the most public affairs-news programming. NPR stations cover the issues and looks at the world more than most.

It is easy to criticize non-NPR college and university stations for not airing more news and public affairs. It is also easy to accuse these facilities of not operating in the public interest. Yet, without adequate backing and resources, realization of this directed charge becomes very difficult, if not impossible.

College and university programming has undergone changes. Then continue to be many stations using a block programming technique to appeal to many audiences but there are also many which commit to to a specific format.

One basic question that remains is that concerning itself with mainstreaming noncommercial radio. Is it a good idea to have this me radio also appeal to the majority or should college and university me still cater to the minority audience of its traditional appeal? The has no single answer and this study would indicate that college radio has yet to decide in a unified fashion.

Directions

Midden mer While in the course of this study certain other related projects -Education could be of use to the field of college-and university-affiliated rates printed, became apparent.

Some are listed below:

1. To survey the 10 watt stations existing in 1983 and ascertain Asrnes, H. I many made the transition, joined cable systems, or ceased over operated altogether Congress

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- 2. To examine overall college operating budgets and learn what are Iroadcasting centage is appropriated to FM radio operations
- 3. A study to ascertain the following: Do college and university America: stations feel the need to compete with commercial stations? radio. they now program in this direction?

Certain other interesting trends also surfaced. One in particula with the basic character of noncommercial radio, specifically the another rock and roll of all types currently being broadcast.

Leidman, M.F. If the statistics of this study are truly indicative then they im kind of "loss of identity" for traditional college and university stall Furthermore, it would seem that such facilities are programming comptiwith commercial stations. It is possible that this will be the direct the future for all but those select few NPR stations. Rashidpour,

Another disturbing result of the programming reported by college university stations concerned the small amounts of news-public affairs programming produced. Granted that such programming is difficult to co and sustain at a high level. However, the entertainment-oriented radie was reported by most stations comprises only part of the mission origin set forth by the FCC when noncommercial radio was created.

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It seems that the issues surrounding college and university stations as mining grounds for future broadcasters and the predominance of rock on many mining cause a conflict of purpose. If an ultimate mission of a college ations cause a conflict of compete and train competitors for the world of informations, does it not seem that many are losing an excellent opportunity improve the caliber of offerings on the airwaves not only for the present is for the future as well. Yet there is no question that college- and inversity-affiliated radio is a viable, dynamic entity in the broadcasting intere today.

REFERENCE NOTES

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IILE: A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A CASE STUDY

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A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A DAME

1986 AECT Annual Conference Las Vegas, Nevada Jan. 20, 1986

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Abstract

The purpose of this undertaking was to examine the state of college- and invaffiliated noncommercial FM radio as it was today in the states. This was done by first examining the literature surrounding the states of noncommercial radio in order to develop a survey framework within

and of noncommercial radio in order to develop a survey framework within to work. The second and more immediate phase of this project involved and data concerning certain phases of college and university radio and as a result gather new and up-to-date information relative to an immanizations.

This research was national in scope. It was, therefore, necessary to a questionnaire and distribute it to all college and university nationwide which were identifiable through the 1982 <u>Broadcasting</u> In order to construct the seven-part questionnaire, an examination of information relative to noncommercial FM college and university radio was additional information was gathered by interviews with people involved in field. Before actually sending the questionnaire, it was examined and interview of research, and two noted broadcast educators. A pilot study was cited at the 1983 BEA convention with follow-up among the participants. Comments and criticisms of the instrument are presented in this paper with the major findings.

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A METHODOLOGY IN STUDYING NONCOMMERCIAL FM RADIO STATIONS -- A

Historical Content

Noncommercial FM educational radio is a huge animal that exists that does not really understand it.

All radio stations, or for that matter, any mass media operation an extremely complex set of interrelationships using technology, talen human relationships. In order for any broadcast station to function effectively, it develops its own superstructure. Yet, college and units stations must operate within a larger superstructure.

There is a constant need to update the data in this area and yet, m literature shows, this is not done regularly. The annual National Public -- Corporation for Public Broadcasting reports only deal with their on with the whole college and university radio scene, as do other organization such as the Broadcast Education Association.

Research has never had an important place in educational broadcass. Very little has been done on educational broadcast facilities. This fact examined by Avery (1978) who concluded that more research was needed to be by academicians and broadcast research should be stressed in undergraduit curriculum.

Twenty years ago, the National Association of Educational Broadcass conducted a thorough study of educational radio under the auspices of nu Foundation. Their published, The Hidden Medium, examined the then current of noncommerical radio.

At approximately the same time, Rashidpour (1965) surveyed education radio stations. Two problems emerged: lack of money and lack of person

Presently, there is a great deal of information available about color university noncommercial stations affiliated with NPR. However, there is dearth of material on nonaffiliates. It would be useful to make some attac help remedy this situation. Unfortunately, the Broadcast Education Association (BEA) only keeps accurate records of its own membership. Although excellent is not nearly complete (Caldwell & Niven, 1981).

Based on the aforementioned studies, it would appear that the area and with college- and university-affiliated FM noncommercial radio is one that always ripe for additional research. The field is always changing and enlarging. It is, in a word, dynamic.

Managing a college or university station is difficult. Most people involved have little or no formal background in management. New data for reference's purpose would also be helpful to aid in planning for the future

The Purpose

The purpose of this paper is to present a methodological approach and resultant findings revealing the current state of college- and university-affiliated noncommercial FM radio in the United States.

The following areas of college and university radio were studied! IN ANY at Basic description of the station as it pertains to enrollment of atistic 1.

institution housing the station, station operating power, licensee, age, of other FM stations in the area, organizational memberships of the station infanati unit affiliation; The

Station funding as it pertains to operating budget and percentage

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100	the funding;
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	personnel as it pertains to managers of college and university
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es. This fact	pere constructing the questionnaire, other area-related instruments,
as needed to be	cuding the NAEB instruments were reviewed. Interviews and discussions were
n undergraduate	the conducted with various professionals in educational radio and sociology to
	supering supering aire was developed and submitted to William McCavitt of
Hal Broadcaster	Injuersity of Pennsylvania and also to a noted educational broadcaster,
he then of the h	W. Kittross of Temple University, as well as Donald Lueder and Willard
then current	Armse of Vanderbilt University. Returned suggestions lead to a refining of the
ayed education	Instionnaire.
ack of personal	Apilot study of this survey took place at the 1982 Annual Meeting of the
ole about collen	Protest Education Association. Twenty college and university managers were
ever, there is a	right. Follow-up interviews took place and focused upon critism of the
make some atten	agginent in order to more fully refine the final questionnaire. A copy of the
Sucation Associat	The questionnaire has been attached to this paper.
though excelled	Intims increasing the probability of response and ultimately the confidence in
at the	walts. Mailing to all identified stations also avoided possible sampling
lio is one thit	mus brought about by arbitrary sampling procedures. Simply, this survey
anoing and	march is treated as a descriptive study meant to "discover the distribution
anging and	dentain traits or attributes" (Babbie, 1973, p. 58) of college FM radio. No
Most people	whe judgements are involved, only observations and summations.
New data for	The final questionnaire was printed and mailed to general managers of all
for the future.	connercial FM radio stations affiliated with colleges and universities in the
	will The security of a security the security of a security of all
	Connectical college and university stations as identified in Broadcasting
	Brbook (1982) (N=670).
anneasch und	A self-addressed, stamped envelope was included to encourage participation.
nd	"introductory letter stated the purpose of the survey and the promise of a
ates.	Wort upon completion of this project.
studied:	Iwo consent forms were also included. The first form granted permission to
	and all information provided within the narrative portion of the
nrollment of the	Missical menther consent form assured confidential use of material for
ensee, age, num	compilation purposes only.
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o percentage	The purpose of the questionnaire was to gather data on college- and
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university-affiliated FM radio operations as stated in the purpose, were used in descriptive data analyses. As indicated, questions for governed by the desired research questions and refined through extra internal peer review.

Internal and external validity of the questionnaire was controlled by extensive professional reviews and through a controlled pilot test Subsequent instrument revisions allowed for a strategy of open ended and supported by an elaborate system of data encoding.

The instrument included six basic areas which, after the data us to provide an accurate description of the college and university radius The questionnaire can be found in Appendix.

The term Faculty-Advisor-Manager (FAM) has been developed in order all possible jurisdictions. This person may or may not be a member of faculty. He or she may be a faculty advisor or a faculty manager or just a manager, or even a student manager. It was requested that the executive (FAM) of the station fill out the questionnaire.

Specific demographic questions profiling the FAM were included. We taken into consideration are age, sex, education, major fields of study in higher education, and academic status.

It was interesting to examine whether or not the FAM is tenured and or not this person is full time or nonacademic, etc. Other questions us those about length of time at institution and professional experience and broadcasting. When compiled, this information provides opportunities additional interpretation of the findings.

The guestionnaire contains items asking for information about the 1246 including enrollment, licensee, call letters, age of station, and power. Then a C also requests information about population of listening area and some mu 11521 information about FM radio in the station area. These are descriptive descr 1122 important in the operation of all mass media operations. A question to NPR affiliates is included in order to isolate and develop this subcategor 17D Additional information on news service, programming sources, and station membership, would allow the development of comprehensive, inclusive lists 0.0 memberships and programming sources. Identification of parent division e source for station accountability was also requested.

Two pages of the questionnaire dealt with programming. The resulting information was used for program content analyses and broadcast operations music offering list was developed after consultation with musicologists mu radio music directors. Questions also pertain to satellite reception-transmission capabilities.

The section on personnel examined such issues as number and classifier of employees at the stations. The sections also examined technical backup personnel as a separate entity.

The funding section provided financial data on station expenditures sources of the funding.

The last section of the questionnaire dealt with general policy and decision-making patterns and a statement of basic philosophy. Philosophy statements would be compiled and reported where consent allowed.

Data Analyses

The analyses of the data received from this survey were done at India University of Pennsylvania (IUP) under the guidance of Mark Staszkiewicz, director of Institutional Research.

For initial as well as follow-up data analyses, the Statistical Packa

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scial Science (SPSS) (Nie, 1975) was used. This package allowed ming into defined factor lists. Given the wide range of variability in and unequal cell N's, the SPSS package is very accomodating to

prive studies. In order to identify and focus upon certain trends and neans, median, modes, and ranges were computed and interpreted. ne analyses of the subgroups, as well as that of all stations, is included urge ranges exist. In a particular case, such as the FAM profile, this necessary due to the consistency and similarity of received data.

my major questions are, for the most part, discussed and then illustrated the confines of numerous tables. Although certain summations and

neive conclusions are reached in this study, the inclusion of summarized raw provides the reader an opportunity to agree or disagree with them. mis straight-forward multivariate analyses and explanations presented by section with accompanying tables provided the greatest efficiency in and improved the effectiveness of interpretation. A limitation to the method was the differing levels of frequency response. Where response

mited, interpretation would not be final but would be noted as tentative. also, in order to maintain the integrity in the reporting of the findings, Brequency of Response (FOR) was used for comparative purposes rather than N.

FOR or percentage of N was noted. The inclusion and exclusion of missing ers are treated on an item-by-item basis.

as the completed surveys were received, the data was coded and entered opportunities where into a Honeywell file program known as BEDIT. BEDIT is essentially a mting data entry program which, in this case, was tailored specifically to

) about the standard variable list. An SPSS "run" program was written which entered the meed data formated by BEDIT. The efficiency of managing data input and and some relationses was thus greatly enhanced. SPSS was also conducive to the development lescriptive on maxmiptive tables; these included items where the information was question to is militative rather than quanitative. Examples of these include Format Types, this subcategory liside Programming Sources, Person to Whom FAM Responsible, and others. Throughout the process of statistical analyses, an experienced research clusive lists of the Applied Research Laboratory, IUP, was also available for any int division of whid assistance. The professional support helped insure that data Iterpretation would be relevant and accurate.

Overview of Results

Discussion of the findings focused upon the major elements of the and classificate Modelogical framework in the areas of station: (1) demographics; (2) Ming; (3) organization and structure; (4) personnel; (5) operation; (6). Finning; and (7) philosophy or mission. For a more detailed accounting of

findings, see Leidman and Lamberski (1986). All findings have been derived from the 243 completed questionnaires. srepresented a 36.3 response rate (670 were mailed out). NPR responses maled 51; they represent 7.91% of the total population and 21% of the returned Miss. Non-NPR stations participating numbered 192, or 28.65%, of the total malation, or 79% of the respondents. Of the 192 non-NPR stations, 42 were 10 alt stations. They represent 6.27% of the population, 17.28% of those Wiving, and 23% of the non-NPR stations participating in this study. Non-NPR "Hions with power greater than 10 watts numbered 150, representing 22.38% of Population and 61.72% of the respondents.

Both the 10 watt stations, as well as those with power greater than 10 wits, are included in the general category of non-NPR stations and were given istical Package the Own subheadings as well. This subdivision allowed for examination of

Page 3

Page 4 of 7

trends among non-NPR stations as well as component parts.	C. HARRING
For purposes of this paper, the major findings will be highling	I. PROGRAMSTIN
	expe
Highlighted Findings	in a
we have all all a sound and data abbeined from sound in	h. Prog
The investigation examined data obtained from questionnaires territories territori territo	jazz
selected FM noncommercial stations. Initial analyses of demographic data	c. Data
indicated these stations could be clustered into three honcommercial	prog
These groups can be demographically defined as:	inco
1. National Public Radio (NPR) Attiliates;	affi
2. Carge Non-NPR Affiliates (10 watts on under)	CALER CAPIT.
onous has been ordered by the ECC to be phased	STATION PHI
All NPR stations are "Corporation for Public Broadcastics o	a. Surv
meaning they meet certain financial, facility and personnel requirement	conc
include:	b. Stat
1. Daily schedules of at least 18 hours of program in	and
365 days per year:	
2. A minimum of 5 full-time professional staff:	In summ
3. An adequate (two studio) physical plant: and	seconerical s
4. Budget of at least \$100,000 annually.	Ben onlograph
These criteria place NPR stations at a distinctively different level of	appradent upon
operations and planning than most other college and university FM stations	
NPR status not only identifies a station whose resources and commitment and	
superior to most FM noncommercial stations, but also administratively index	
continued support in order to maintain NPR affiliation.	There a
Given this identified demographic clustering, the following rate and	were is much t
summary of the major findings can be presented.	m difficult
	popran. In re
1. BUDGET	migned a ques
a. A majority of stations are expected to operate fully functional	muorses. Hou
broadcast operations on a small financial base.	bus built in t
D. Stations, in general, suffer from a consistant level of financia	reporcents wer
c. Sources of hudgetary support wary by democraphic aroun and	mitte tota. t
inconsistency over time.	1 Shi
d. NPR Stations have a superior budgetary base as compared to other	has acoduction
demooraphic oroups.	trouch mailing
e. Generally, stations suffer from inadequate commitment from same	
institutions.	2. De
	sulected sam
11. STATION ORGANIZATION AND STAFFING (exclusive of NPR affiliated stations	Aussion and
a. Stations have inadequate technical support.	A CONTRACTOR OF
b. Time allotted to professional station managers is generally	3. Gi
inadequate or split with other institutional responsibilities.	the to thos
Manager's time devoted to station operations appears consistent	and the second second
inadequate.	Him advisio
c. Most stations indicate a heavy dependence upon volunteer help	auninis
operate the station.	5 0-
d. There is a consistent expectation that the station will mainteen	P define too
"protessional sound" even given the reality of a mostly	Rticularia
Most stations have a lack of advants statt.	Se sonne 1
for student staff	Contraction of the
TOP Student Start.	6. 50
Piot	CONTRACT IN

will be highlin MING Format varies widely by demographic group and institutional expectations. At best, the noncommercial spectrum is inconsistent in an identifiable format. p. Programming covers the full gambit of sound, from classical to estionnaires ter jazz to rock, etc. demographic de c. Data reveals inconsistent operating times during "normal" oncommercial m programming periods. Particular concern was identified given the inconsistent operating time between session recesses for FM stations affilitated with academic institutions. 5; ts); and under). This a MATION PHILOSOPHIES o be phased out. s. Survey data indicates little consistent thought or adcasting Qualing conceptualization. nel requirements b. Station philosophy varies depending upon station market thrust and selected format. of programming a In summary, the findings point to vast yet specific differences for FM staff: camerical stations. These differences are clearly identifiable between the of demographically defined groups. Within group variablity is highly it; and undent upon the parent institution and NPR affiliation. erent level of rsity FM station and commitment at Recommendations nistratively mon There are positive and negative aspects of this instrument. Although following rank much to be said for some questions of an open-ended variety, it renders wdifficult the task of coding and entering such data into a computer mym. In retrospect, it probably would have been more efficient to have signed a questionnaire in which there would be an object list of alternative fully functional superses. However, this possibly would have distorted the results through a is built in by suggested answers printed on the guestionaire. As it was, the level of financial supportents were free to fill in the questionnarie with more exact answers as it and them. Other recommendations would include: IC Group and Shortening the questionnaire by listing alternatives or eliminating compared to other insproductive items. Or, having an initial mailing with a second follow hoph mailing thus spreading the requested information over time. itment from parent 2. Develop a follow-up procedure where, depending upon item responses, Rected sample of respondents would be contacted for in-depth telephone filiated stations Exission and elaboration. is generally 3. Given the identified three separate respondents, develop questions sponsibilities. What to those respective three areas which provide more in-depth explanation. pears consistentin 4. Develop an incentive system and/or check system to make sure the volunteer help to misr administrator fills out or verifies the reported data. ion will maintait? 5. Provide a list of terms either before the start of the questionnaire define terms within item stems or listed alternative responses. This is a mostly "ficularly important in collecting data on policies and procedures, and on or reward sist sonnel. 6. Convert some of the categorical, open-ended items to scaled indices. Page 5 Page 6 of 7 This would be particularly possible given the known pattern of response this study.

7. Visually improve the instrument through layout and design to increase respondent particiaption and motivation.

 B. Develop visual questionnaire responses. For example: a line would have aided in the collection of music type and hours broadcast. 9. Given the pattern of responses from the initial survey, diministration of the pattern of the survey of the survey. 	percial FM : resities in descripti
responded to depending upon primary responses.	Maculty-Adv
Bibliography	section Out
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<u>Hidden Medium.</u> Prepared for NER, a division of the National Associational Educational Broadcasters with the aid of a grant from the Ford Foundation. Washington, D.C.: NAEB, 1968. (Originally printed 1967)	56-60 61-65
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Leidman, M.B.,& Lamberski, R.J. <u>Descriptive study of noncommercial FM radio</u> stations affiliated with colleges and universities. A paper presentation at the Annual Conference of the Associaition for Educational Communications and Technology, LasVagas, Nevada, Jan.17, 1986.	0 1 Tenured? If no:
Nie, N.H. <u>Statistical package for the social sciences (2nd edition).</u> Chicago: McGraw-Hill, 1975.	(Please
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	Previousl Job you e
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APPENDIX n of responses Survey Instrument and design to cample: a time me purpose of this exercise is to gather data on noncomgreial FM radio stations affiliated with colleges and unibroadcast. mrsities in the United States. Results will be used in descriptive analysis of college radio in the 1980s. survey, develo items need be nculty-Advisor-Manager (FAM) Information (If more than FAM is employed, please have chief executive fill this sction out.) ine (check one) Education (circle highest received) ions curriculas Less than 30 BA, BS rth, 1973. MA, MS 31-35 MFA, MBA, ABD 36-40 83. PhD, EdD 41-45 ograms in Annual casting Educatio DA, JD 46-50 field 51-55 of most recent studies (last Association a 56-60 degree) m the Ford 61-65 Where was the highest degree ily printed 1967 earned? commercial FN ties of the entir Sex lerbilt Universib. mofessional years of involvement in higher education: 0 1 2 3 4 5 6 7 8 9 10 or more encial FM radio A paper Tenured? Yes No ition for Nevada, Jan.17, If no: Full-time Regular Tenure-track or edition). Part-time Non-academic (Please circle one of the above) Now long have you been with your institution?_____ Sow long have you been in the FAM position?_____ Revious to your present post, how many years have you Professionally worked in radio? Full-time Part-time Previously, what was the highest professional broadcasting Job you ever held? Page 7

	programming (
Demographic Information	Daily operati
	Academic Year
University or college? Overall enrollment?	Teekdays (Mon
Who is the station licensee?	mekends (Sa
Call letters	malidays whe
Year of first license	Judane (SII
Dial position	is not in
Licensed power	Check her - round and
Effective radiated power	sinter and S
Number of potential listeners in your area (community and university combined)	Teekdays
Description of community (rural, urban, suburban)	Teekends
Number of FM stations in your market	Eolidays (e:
Number of other college- or university-affiliated station	Summers
(not attached to your institution) in your market	Teekdays
Are you a National Public Radio affiliate?	Teekends
News affiliation (AP, UPI, Mutual, etc.)	Holidays (e
Programming affiliation (Texaco, Metropolitan, Longhorn, RKO, WFMT)List all applicable	Does your s
	If so, v
Station memberships (NAB, NFCB, IBS, etc.)	When do
To what academic unit (department or school) if any, is your station attached?	Does your : equipmen
II hone, please explain:	Does your : transmi
	That is th approve program
	Does the s format specify

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	programming (Please include as much detail a	us possibl	e)
	mily operating hours (example 8 a.m2 a.m.	.)(
1963	inademic Year		
Iment?	mekdays (Monday-Friday)		
	mekends (Saturday-Sunday)		
	Holidays when school is in session		
	Bolidays (such as Labor Day) when school is not in session)		
	Check here if the above is true all year - round and please go on to next section.		
	Winter and Spring Break		
(community ut	Teekdays		
urban)	Teekends		
	Holidays (example: Christmas Day)		
liated stations	Summers		
ur market	Teekdays		
104	Veekends		
	Bolidays (example: July 4th)		
an, Longhorn,	Does your station close for the summer?		
101	If so, when (approximately)		
	When do you resume operation?		
) if any,	Does your station have satellite reception equipment?	Yes	No
	Does your station have satellite transmission equipment?	Yes	No
	That is the title of the person(s) who approve specific programs or major programming changes?		
	Does the station have a distinctive format or "sound"? (Please specify if "yes.")	Yes	No
		1211274	

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10	Marsonnel
(M-F, 5-7)	 How many full-time, paid technicians does your station have?
	2. If none, who maintains equipment?
	 Who possesses an FCC 1st Class or General License and signs technical logs?
	 How many people (both non-student, professional and students) make up your total staff for the station?
	5. How many students work at your station per semester? Full-time: Part-time:
	6. How many (nonprofessional) students receive monetary compensation?
13.67 - 7124 - 7124	7. What positions?
120	8. How many students receive academic credit for working at the station?
	9. What position do they hold?
	10. Is it possible for a student to receive both credit and money for working at the station?
outside source	11. If yes, under what circumstances?
hours per *	12. Approximately how many students work in a purely unpaid voluntary capacity at the station?
	13. What positions are these?
	2012 T
_	

Funding

What is the station's operating budget?

From where do the operating monies come? (Please express in percentages)

Specific general college or university funds

General college funds as administered by academic department or school

Student funds (activity fees, etc.)

Endowment

Grants (monies received through specific grant applications)

Donations (telethons, raffles, etc.)

Other sources:

Policies and Procedures

- What is the title of the person who manages the rate station?
- 2. Is this person a paid professional? Yes No

RUT

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Percen

3. What percentage of the total contractual commitment of the manager's time is devoted to the radio statim (i.e., release time, load reduction)?

If students are integrally involved, what is the stachain of command?

- 4. To whom is the student leader directly responsible
- 5. To whom is the FAM directly accountable?
- Do written policies and procedures on station operate exist? Yes No
- Please make a statement reflecting the basic philoso



AUTHOR:

EFFECTS OF SELECTED FILMIC CODING ELEMENTS OF TU ON THE DEVELOPMENT OF THE EUCLIDEAN CONCEPTS OF HORIZONTALITY AND VERTICALITY IN ADOLESCENTS

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at is the state responsible? ation operate asic philosopassociated. BETH ELOISE LYNCH

Investi iments of te iments in ex ol student erticality we of the study c filmic coding meents. The inq umbol systems ind systems ca ity and vertic Effects of Selected Filmic Coding Elements **Attionale** Based (ettal attribu argues, "symbol s the wor better 1 nitive : person, differen the bet present communi To lea under specifi ters were use ous types of with which a coding elemen lantation the nate skills f elements that initially uns In dea in the area o bol systems s in space and mlit screen, present the E high school a Althou spatial syste found that ch girls were in Here unsucces mel, 1973; W1 Marris, Hanle on hills with (1978). Work 522

of TV on the Development of the Euclidean Concepts of Horizontality and Verticality in Adolescents

> Beth Eloise Lynch U.S.D. 305, Salina, Kansas University of Kansas

Investigation of the function and effects of selected filmic coding elements of television in learning and employment of those filmic coding elements in exploring the presence and development in adolescent high elements of spatial skill involving concepts of horizontality and enticality were the two major objectives of this study. The structure erticality combined approaches established by G. Salomon in the area of elements and L. Liben in her work with Piagetian spatial encepts.

The inquiry was concerned with the differential role of media's symbol systems in the acquisition of knowledge and in the way these symbol systems can function as cultivators of mental skills. The particular rea of knowledge pertained to the Euclidean space concepts of horizontality and verticality which involve the mental ability of spatial orientation.

ationale

Based on the general premise that the symbol system is the most essential attribute relating the two "systems" of media and cognitions, Salomon argues,

"symbol systems address themselves to different aspects of the world, and that some systems render specific aspects better than others ... Symbol systems vary as to the cognitive systems they address, and given a particular content, person, and task, the information they carry requires different amounts of mental recoding and elaboration. Thus the better the correspondence between the way information is presented, the less recoding is needed and the easier is the communication" (Salomon, 1979, p. 86).

To learn how media's symbol systems can be made to affect cognition under specific favorable conditions coding elements of media's symbol systens were used to activate, short-circuit or supplant processes for various types of learners. Activation stimulates or calls into action skills with which a learner has an initial acquaintance. In short-circuiting the coding elements provide ready-made results for the skill, while in supplantation the entire skill process is modeled. Coding elements that activate skills facilitate skill mastery in already skillful learners; coding elements that overtly model (supplant) skills facilitate skill-mastery in initially unskilled learners.

In dealing with learning tasks and cultivating mental skill mastery in the area of spatial relations film and television contain in their symtol systems specific codes to represent relatively unique transformations in space and time (e.g., slow motion, the zoom of a camera, rotations, split screen, and generated line cues). These coding elements were used to present the Euclidean space concepts of horizontality and verticality to high school adolescents.

Although Piaget and Inhelder (1956) maintained that a Euclidean spatial system is typically established by late childhood, other research found that children from nursery school through the eleventh grade (only girls were included from ninth to eleventh grade) and many college students were unsuccessful on horizontal water-level tasks (Thomas, Jamison and Hummel, 1973; Willemsen and Reynolds, 1973; Thomas and Jamison, 1975; and Harris, Hanley and Best, 1975). Verticality tasks (drawing trees and houses on hills with various degrees of incline) were introduced in Liben's study (1978). Working with seniors in high school, Liben found a sex-related

cality

its

difference to be present with both tasks of verticality and here Evidence indicated that imperfect performances by males and fear no significant difference in number or type of task errors, nor on field dependence/independence (EFT) and spatial orientation Zimmerman) measures. Performance on the Piagetian spatial tasks significantly correlated with performance on the EFT in both sec

This study attempted to ascertain whether the filmic code ments of split screen, slow motion, generated line cues, the zoon camera and rotation could aid in the development of the Euclidean concepts of horizontality and verticality and the skill mastery or orientation in adolescents.

Questions specifically addressed were

- Would the type of filmic coding elements used in present Euclidean spatial concepts significantly affect the mean of high school adolescents on a test based on those concernent
- For learners who have similar levels of understanding worker type of filmic coding element used in presenting Euclidean concepts significantly affect the mean score on a test of concepts given prior to and following the presentation;
- Would there be a significant difference in the mean score is school adolescent males and females on a test of Euclidean concepts following the viewing of a television tape using un filmic coding elements;
- Following the viewing of a television tape using selected m coding elements would there be a significant difference in the mean score of high school adolescent ninth-graders and high col adolescent twelth-graders on a test of Euclidean spatial concepts;
- 5. Would the viewing of television tapes using selected filmic elements to provide training on Euclidean spatial concepts of nificantly affect the mean score of high school adolescents Gilford-Zimmerman Aptitude Survey, Part V Spatial Orientation

Procedure

Two-hundred-forty randomly selected subjects for the study placed in four groups composed of fifteen male and fifteen female in man and senior addlescents. They were all from one four-year north-Kansas public high school of about 1025 students.

They were all pre-tested for mastery level of the concepts c izontality and verticality. The horizontal test involved drawing in water level of half filled cup outlines positioned at various degree tilt. The vertical concept required the subject to draw trees on bill with various degrees of slope and to draw bulbs hanging from wires in trailers parked on hills with various degrees of incline. The Group Embedded Figures Test (GEFT) and the Guilford-Zimmerman Aptitude Sem Part V Spatial Orientation were administered to all subjects before the ment. lity and horizon ales and females errors, nor prientation (enspatial tasks we in both sexes males. filmic codim ues, the zom the Euclidean me ill mastery d

d in presenting act the mean scent those concepts;

standing would be ing Euclidean suc on a test of the sentation;

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lected filmic com ial concepts sigadolescents of a al Orientation

the study were een female freshr-year north-cent

Results

concepts of horid drawing in the rious degrees of trees on hills from wires in . The Group lptitude Surverects before treir A repeated measures, 4x2x2x2 factoral design, employing two MANOVAs used. The factors were the two sexes, the two high school grade levels freshman and senior, high and low groups of EFT scores, four experimental roups and pre/post tests. There were three treatment groups and a control roup. The treatment conditions were those of activation, short-circuiting group. The treatment conditions were those of activation, short-circuiting d supplantation used by Salomon (1974b). The repeated measures were the sts of horizontality, verticality and Part V Spatial Orientation of the sulford-Zimmerman Aptitude Survey. The horizontal and vertical measures are used to reflect knowledge of those concepts and determine if any gain those concepts occurred following treatment. The Spatial Orientation is those concepts occurred following treatment. The Spatial Orientation the area of spatial relations occurred following treatment.

Tests and treatment were conducted on two consecutive days. On the first day all subjects were tested for knowledge of the concepts of horiiontality and verticality. The GEFT and Part V of the GZAS were also administered. On the second day each group viewed one of four television presentations. Three television tapes were used to present examples of the invarient horizontality of liquid and the verticality of objects (people, trees and houses). One of each of the three processes of activation, short-circuiting and supplantation was employed in one of the tapes. The control group viewed a television tape of nature scenes set to music. Iask booklets were used during the treatment portion. They were made up of outlines which corresponded to objects which appeared in the treatment tapes. At various places throughout the tapes the subjects were asked to perform a task which pertained to the concepts being demonstrated.

Using the SPSS^X language and operations, two MANOVAs were computed for the dependent variables of horizontality, verticality and spatial orientation. Means and standard deviations were computed for both pre and post test measures of horizontality, verticality andPart V of the GZAS for subjects in the supplantation, short-circuiting, activation and control groups. Phillais, Hotellings and Wilks multivaritate tests of significance were employed to determine if significant differences existed among the mean scores of the various groups. Univariate F-tests were carried out. All factors from four-way interactions to each individual factor of sex, grade level, treatment condition, and time of the first MANOVA and sex, EF scores, treatment condition, and pre and post test scores of the second MANOVA were examined. Graphs were drawn for all findings which revealed significant differences at the .05 or lower level of probability.

Findings for the study came from the examination of two MANOVAs. The first one was based on data for the variables of sex, grade level, treatment group, and time. The second MANOVA included the independent variables of sex, EF scores, treatment groups and time. These two MANOVAs were computed for each of the dependent variables of horizontality, verticality and spatial orientation.

In determining whether the type of filmic coding elements used in presenting Euclidean spatial concepts would affect the performance of high school adolescents on tests based on those concepts the results of the MANOVA based on the interaction between Treatment Group x Time on the horizontal measures produced non-significant multivariate f-tests (p<.198). However the univariate F-test for the pre and post test measures on the curved cup outline was of borderline significance (p<.057). A look at the graph of the pre and post test results of the four experiments revealed that the supplantation and short-circuit groups appear to the largest amount of change.

As for the vertical measures the multivariate F for Treat Time was significant (p<.043). The univariate F-tests revealed significance for the test with trees on hillsides was .253 but for hanging bulb test the level of significance was .031. On viewing m of the pre and posttest scores for the hanging bulb test it can be that the activation group achieved a change greater than twice the control group and that the short-circuit group increased their score four times that of the control group.

In addressing the question of the affect of filmic coding element in the presentation of Euclidean spatial concepts to learners of star levels of understanding the multivariate E for the interaction of In ment Group X EF scores X Time was non-significant (p<.687) on the al measures. Once again on the vertical measure the MANOVA using se Group X EF scores X Time provided a four-way interaction having a min variate F at the .017 level (Pillais, Hotellings and Wilks).

11 grou The univariate F-test was non-significant (p<100) for the dim on the drawing of trees on inclines but the univariate F for the diffe on the drawing of bulbs hanging in trailers parked on inclines was sin cant (p<.026). A look at the graphs of these findings for the bulb in ter test reveal a consistent pattern of higher results for EF2 (him group over those of the EF1 group. The level of performance by both m and EF2 is not as high for females as for males.

Treatment Group X Time interaction for the multivariate test man dy of t duced an F which was significant (p<.039). The univariate F-test for a the ligh bulb in trailer measure was significant at the .025 level. The various have bee treatment groups do not follow the same pateern for either the male of male or the two levels of EF. The short-circuit group shows the great herizont gain from pre to posttest scores for both male groups. For the feater Inatial activation appears to be the most effective for the EF 1 group, but the Guil lantation and short-circuit seem to be the most productive for the Ba of spati This would not follow the work or findings of Salomon. revealed group.

In checking on the role of sex in the performance of adolester a beam and females on measures of verticality the test scores show a signific multivariate F-test (p<.001). This substantiated the superior addieson poking IRTIOUS. male performance over adolescent females found in past studies (Liber,

performa As for the role of grade level on the effect of filmic coding in working with concepts of verticality the multivariate test (Pilland groups. occurred which deal with the average mean score for the two levels produced a freshman significant f (p<.157). The univariate F-test for the average mean we the test of verticality for the bulb in trailer test was .075. The me Increase the act of the MANOVA for the interaction of Time X Level revealed a significant group. univariate F (p<.040) for the mean scores on the bulb in trailer test the act graph of Level X Time pictures the greater increase made by seniors of the freshman on the vertical measure of the bulb in trailer.

The evidence of these two significant differences in sex and set sequent level for both the horizontal and vertical measures is most important Increas recall when interpertation of the other factors of the study are being group f viewed.

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ariate test prote F-test for the 1. The various er the male or the lows the greater or the females, group, but supp e for the EF 2 omon. of adolescent al ow a significat erior adolescent dies (Liber, p mic coding elect test (Pillais) produced a nonrage mean scort 075. The resi a significant railer test. y seniors over iler.

n sex and grad t important to dy are being r A four-way interaction revealed by the first MANOVA on the horizontmeasures produced a multivariate test of significance (Pillais) with a

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ificant F (p<.022) for Sex X Group X Level X Time. The univariate F non-significant for both the straight-sided cup outline (p<.067) and the curve-sided cup outline (p<.100).

Examination of the graphs of the four-way interaction show the mior males had higher retest mean scores in all groups, scoring above reshman males and both freshman and senior females. Senior females cored consistently above the freshman female mean scores on the retest essures and surpassed the freshman male performance in the short-circuit ed activation groups.

Senior girls narrowed the difference in the mean scores for males of females at the senior level in both the supplantation and activation moups. Freshman girls made gains on the repeated measures mean scores ner freshman boys in the short-circuit and activation groups, but the freshmen boys showed larger gains over the freshman girls in the supplanttion group. The freshman girls performed well below the senior boys in il groups.

As for the effect of the various treatments, the short-circuit and ectivation appeared most effective for senior boys. The freshman boys sowed their greatest gain in the supplantation group. All three treatments proved beneficial for senior girls with activation and supplantation supplying the greatest rate of gain. Freshman females appeared to benefit most from the short-circuit tape.

The existence of this four-way interaction points out the difficuldy of trying to understand the influence of the filmic coding elements in the light of the complexity of the sex and level related differences which have been noted.

Whether the use of filmic coding elements in providing training on brizontal and vertical tasks could have any effect on the skill mastery of spatial orientation was the final concern. Part V, Spatial Orientation, of the Guilford-Zimmerman Aptitude Survey was used to measure the mental ability of spatial orientation. Using sequential sums of squares, the first MANOVA revealed a four-way interaction of Sex X Group X Level X Time which produced a significant F at the .015 level.

These interactions were graphed holding various groups constant. In looking at the graphs of the senior and freshman levels of the males in the various treatment groups there is a similar pattern for the pre/posttest performance of senior males for the control, supplantation and activation groups. The short-circuit tape appears to have suppressed the change which occurred in the other three groups. The sequential sum of squares for the freshman males.revealed the short-circuit treatment provided the greatest increase from the pre to posttest GZAS test scores. The pre/post gain for the activation group was also at a steeper rate than that of the control group. The males performed at higher levels and showed greater gains in the activation group than in the other experimental groups.

For the females, the graphs of the various experimental groups' sequential sum of squares showed the short-circuit and supplantaion groups increased at the most rapid rate for the senior subjects. The activation group for senior females showed little change from pre to post means. Freshman females registered their greatest pre/post GESA score gain in the supplantation and activation groups. The short-circuit group little if any change in pre/post GZAS test scores for freshman, for

The F for the mean square of the interaction of Level X The significant at the .055 level. The senior' mean square was at a level than the freshman on both the pre and posttest administration GZAS.

Looking at the GZAS averages determined by use of sequential of squares it shows that sex has a significant F at the .004 level. look at the graph shows the males scoring significantly higher the The graph showing the senior and freshman performances on the GZAS significantly better scores by the seniors than the freshmen, Rather patterns of performance for sex and grade levels were established

Implications

From the significant findings for individual factors and the interactions it does appear that filmic coding elements do affect to ment of the Euclidean concept of horizontality and verticality and increase the mean scores on the Gilford-Zimmerman Aptitude Survey, Spatial Orientation.of high school freshman and senior adolescents.

Further investigation into the effects of selected filmic codin elements needs to be pursued keeping sex, grade level, concept understaing, treatment groups and time all as factors.

The shape of the container of the horizontal tasks does appear a have some effect on the mental processes of the subject, but results of the horizontal tasks did tend to form similar patterns and produce comsignificant findings.

For the vertical measures there were consistently different resp indicating different aspects were being involved. The question of file coding elements widh might aid in development of understanding of each those aspects of the concept of verticality would be open for investign

The presence and degree of development of the concepts of horizonality and verticality of freshman and senior adolescent subjects remains an area meeding further exploration. The work of Feldman (1980) might provide useful guidelines in studying the presence and development of the concepts.

Reduction of the difference in the mean score for various treater groups between males and females needs to be followed up to fill in a manual part of the total picture.

The flat pre/post mean scores produced by the low EF groups incleate the need to look into this aspect of the study. Male and female adolescents who have scored in the lower EF group should be studied to mathematical and particular selected coding elements are more beneficial than other in helping them to master the horizontal and vertical concepts.

The significant findings based on the use of the Guilford-Zimen Aptitude Survey to reveal development of the mental skills of spatial r ation in adolescents through the use of selected filmic coding elements would be of import to those involved in education and those who have a interest in occupations which employ spatial orientation skills. judgi

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TITLE: MEMPHIS STATE REGRESSION COMPUTER-MANAGED INSTRUCTION MODEL

RUTHORS: GARY R. MORRISON STEVEN M. ROSS

Memphis State Regression Model

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The advent of low cost microcomputer technology has aided the integration of computer assisted instruction (CAI) into the classroom. Typically, microcomputer software is planned as an attractive and adaptable alternative to learning from a textbook or programmed instruction book. Software created by instructional designers and sophisticated programmers has taken advantage of the microcomputer's graphics and sound capabilities, learner inputs, feedback, and record keeping abilities to produce attractive and versatile products.

Initially, the attributes of CAI suggested a medium capable of presenting instruction in a new manner. Recent research, however, has suggested that CAI may be no more effective than traditional textbooks once the novelty of the medium has disappeared (Kulik, Bangert, & Williams, 1983). Clark (1983) suggests a research strategy (and possible an instructional design strategy) that emphasizes the instructional methods as opposed to the individual medium.

Accordingly, our main assumption in this paper is that one of the computer's most powerful capabilities lies in adapting instruction to the learner. Adaptive methods typically found in the commercially available software use a weak form of adaptation that relegates instructional decisions such as speed, sequence, and difficulty to the learner. The learner control or internal control method is adaptive only to the extent the learners can make the necessary instructional management decisions (Johansen & Tennyson, 1983). In contrast to the learner control method is the program control method, often implemented in computer managed instruction (CMI), in which the designer controls the learning environment. Applications of CMI can range from simple branching based on the learner's response to decisions of the number or types of examples the learner needs, or when to exit the instruction. A principal criticism of the program-controlled method is the designer's ability to establish program control logic on criteria other than arbitrary and unvalidated rules (e.g., 80% correct; "3 misses in a row").

The purpose of this paper is to review three systematic adaptive instructional models used for computer-based curricular management. The types of adaptations included are (a) quantity of instructional support and incentives, (b) meaningfulness of problem-solving contexts, and (c) the density of narrative text. The first two models have been extensively examined in our prior research and evaluation studies. The third (context density) model is still in the developmental stage, and we will only report our preliminary findings in this paper.

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Memphis State Regression Model

Individualized learning strategies (e.g., Keller, 1978, Mar 1976) provide large amounts of instructional support, but typically rely on the subjective judgments of the learner is determine the amount of support required to achieve an objection Frequently, these strategies result in high achievers selecting too much support and low achievers selecting too little support Interest in this problem led to the development of the Marphin State Regression Model for systematically selecting the amount objectives (Hansen, Ross, & Rakow, 1977). The initial application of this model was directed at a self-instructional unit covering 10 algebraic rules taught in an introductory college statistics course. A flow diagram summarizing the steps of the model is shown in Figure 1.

Insert Figure 1 about here

Implementation. The following is an explanation of each component step of the model. Step one was the selection of pretask (entry behaviors) variables to use as predictors of learner performance on the task. This predictive process is the foundation of the adaptive model with the basic rule of "if predicted performance is low, increase instructional support; if high, decrease instructional instructional support." The second step was the development of a predictive equation for each lass (one per rule) from the results of a sample group. In the think step, the predicted scores were matched to instructional prescriptions specifying the number of examples the learner will require for each lesson. The prescriptions were incorporated in a computer program to generate a prescription for each learner Prior to the treatment, the instructional booklets were arranged for each learner according to the computer generated prescription for each lesson. The lessons were then presented to the learned and at the end of each lesson, a formative posttest was administered. Lesson posttest scores were used to make necessar refinements in the next lesson (i.e., adding or subtracting examples).

Evaluation of the model was performed in several studies. The first study (Hansen et al) consisted of five treatment gram One adaptive treatment received individual prescriptions general by the model. A second treatment, group-adaptive, received 4 prescription based on membership in a particular ability group Two other treatments received either low (2 examples per rule) m high (10 examples per rule) levels of instructional support for fifth group received instructional support that was varied nonadaptively. The results indicated the adaptive group perform

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veral studies treatment group riptions generated e, received a ability group ples per rule) a hal support. The was varied re group performed significantly better than each of the other treatments. Of particular significance was the difference between the adaptive group and the high instructional support group. It was hypothesized the disadvantage of the high support group was due to inefficient use of instructional time. A second study (Ross & Rakow, 1980) comparing individualized-adaptive prescriptions to group-adaptive prescriptions and non-adaptive instruction also found the individualized-adaptive strategy to be significantly better than the group-adaptive and non-adaptive strategies.

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Incentive Adaptations. An extension of the Memphis State Regression Model is the varying of incentives (Ross & Rakow, 1981). Incentives (normally 10 points per lesson) were divided so the lesson predicted to be most difficult was worth more points (e.g., 20 points) than the lesson predicted to be the least difficult (e.g., 0 points). The adaptive incentives strategy served to orient the students to make the most effective use of the materials. Significant learning gains were found for the adaptive incentive strategy over the standard incentive strategy (equal distribution of points).

The most powerful application of the model can be realized through a CAI system which updates the instructional prescriptions with each individual response or group of responses. These components create an "intelligent" system that varies the materials as learner's needs change during the course of instruction.

Context Models

A concern related to adapting how much is learned to individuals is to vary what is learned. The specific interest leading to the development of this latter model was the student's difficulty in solving math story problems (National Assessment of Education Progress, 1979). When the themes of the problems are abstract, unrealistic, or highly technical, the learner is faced with the difficult task of translating the meaning of the unfamiliar words and procedures, and then performing the necessary computations to arrive at the answer. The objective of this model was to adapt the problem contexts to the learner's interests to promote meaningful learning.

Implementation. The context model has been implemented in a PSI course (Ross, 1983) and on a CAI lesson (Anand, 1985). The first implementation involved the development of context examples related to the background of the learners, who were all educators, in a statistics course. Meaningful, educationally-related referents such as teachers, students, and homework were substituted for the abstract referents of "X", "Y", etc. (Ross, 1983). In other tests of the model, the context was personalized to the preferences and environment of the individual learners as obtained from questionnaire responses. This information was then stored as data in a computer program written in BASIC. Problem

"templates" were stored within the program which could incorporate the learner's data to personalize the context example, if a student's favorite food was pizza and he had turn friends, Billy, Joe, and Sam; the program would present a problem asking how he would divide the pizza between these friends and himself.

Results. In one study, Ross (1983) presented educators is PSI course with instruction including context examples related education (adaptive-education context). A second group received instruction with examples from medicine which substituted decises nurses, and patients for the referents. A third group received abstract examples using the referents of "X", "Y", "Event A" abstract examples using the referents of "X", "Y", "Event A" the results indicated that the adaptive-education context group performed significantly better than the non-adaptive medical context group and the abstract context group. Nurses were used is a second study to determine if the results were due to the examples presented in the educational context, or to the adaptive-context strategy. The nurse sample performed best with medical-related contexts. These results were consistent with first study indicating that relatedness of context to student background comprised the critical factor for learning.

In a third study, Anand (1985) investigated the personalization of the context as an adaptive strategy with tim and sixth-grade students in a math class. The first treatment consisted of abstract contexts using terms such as quantity, fluid, units and so on. The second treatment consisted of concrete context examples that used realistic hypothetical referents (e.g., Mrs. Smith, orange juice, etc.). The third treatment consisted of personalized context examples generated from the personal data collected prior to the instruction (e.g., best friends, favorite food, birthday, etc.). Results indicated that the personalized context group performed significantly better than one or both comparison groups on measures of conventional problem solving, transfer, formula recognition, and task attitudes.

Context Density Model

The third model, context density, focuses on systematic variations of <u>marrative text</u> as an adaptive strategy. Our interest in investigating this strategy is to tailor the content or text explanations to learner's needs, and to the attributes di the medium (specifically, computer versus print) to enhance comprehension and perception. Perception concerns the learner's attitude towards the instruction based on prior knowledge (Johansen & Tennyson, 1983).

The context density model builds on the support models previously described and other related studies (e.g., Rothen & Tennyson, 1978). The current model, however, differs from the Mempl

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e.g., Rothen i ffers from the support models which focus on the the more limited property of number of examples presented. Context density manifests itself in sentence or phrase length, degree of elaboration and redundancy, amount of contextual support, and linkages between major concepts. This model provides a means for restructuring the text by varying contextual density to meet individual needs without loss of comprehension as suggested by Johansen and Tennyson (1983). Ve. have hypothesized that learners with a high learning aptitude or prior subject matter experience may be able to learn more efficiently from a less dense narrative without loss of comprehension. Similarly, learners with lower aptitude or no prior background may require a more dense narrative as contextual support for the information to be learned. This hypothesis is consistent with current schemata theories (Anderson, 1984; Runelhart & Ortony, 1977) which suggest comprehension is facilitated by existing knowledge structures. Variations of context density as an adaptive strategy could possibly meet the varying needs of the learners.

A second area of interest with the context density model is the interaction with presentation mode--computer versus print. This interest in optimal use of instructional methodologies, not the delivery of the instruction, is consistent with Clark's (1983) proposal for research with the media. Are there possible interactions with the different context densities (i.e., high and low) and presentation mode due to delivery system constraints or attributes that will enhance or hinder comprehension? For example, what are the effects of the reduction of the CRT screen presentation to only 24 lines by 40 or 80 columns, or the lack of traditional cueing mechanisms such as bold and italic text, and underlining? Is there an expectation on the part of the learner to "see" less information on the CRT screen and more on a printed page, thus requiring more effort on the learner's part to comprehend the message presented on the CRT screen?

Implementation. In our initial study, two forms of instruction were developed using a section from a self-instruction statistics book developed by one of the authors. The low density version was developed according to a systematic algorithm for deleting extraneous and repetitious material in the high density text (original version). The stimulus material consisted of textbook and computer versions of the low and high density presentations. The computer version, written in Apple Superpilot, allowed the student to refer back to previous screens by pressing the B key.

Our pilot study consisted of print and computer presentation modes with either high density narrative, low density narrative, or learner control of narrative density. After collecting data on 35 subjects (approximately 6 per treatment), there appears to be a trend for learners in the computer mode to take more time in both the high- and low-density treatments. There is also a tendency for the subjects in the computer mode of the learner controlled treatment to select the high density narrative more

often than subjects in the print mode. It appears that learning in the computer mode have less confidence when learning from information presented via a CRT screen.

Future investigations will use context density as an adaptal strategy to present high or low density narrative according to predicted learner needs generated with the multiple regression model used in the instructional support model. Applying the general rule for the support model, context density will be increased as the predicted score decreases; and context density will be decreased as the predicted score increases. Planned extensions include the refinement of the model to include varian degrees of context density instead of the two discrete levels in used.

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Figure 1. Memphis State regression model

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Tillman J. Ragan Professor, Educational Technology The University of Oklahoma Norman, OK 73019

Paper Delivered to the

Association for Educational Communications and Technology

Annual Meeting

Las Vegas, Nevada

January 18, 1986

Introduction

There should be no doubt in any of our minds that the company cite a c a useful medium of instruction and that it is potentially an une powerful medium. We would also all agree, I think, that our know enters d of what to do with the computer in instruction is less than pair When w I do not believe that there exists a body of prescriptive knowledges such which tells us how to make best use of the computer's unique iner--th · instructional medium characteristics when designing instruction a succes will be delivered by a computer. I will go further and assert ming cr don't even know much at all about instructional design that take , regard advantage of what a computer can do best. This paper will expl tall we avenue for new research and development in instruction: use of ittea wh: insights from the study of teaching for development of intellige ms while instructional software. mare .

Computers, Teachers, and Other Media

I believe that a computer is more like a person than it is a compuother machines with regard to its instructional medium attribute is we "With the exception of the teacher, no other delivery system equiparts the the computer in its potential to accommodate the needs of the individual learner." (Carrier, 1985, p. 155) Although it is unput an instructional medium attributes analysis of human it is possible to do so, as I did in 1982, albeit somewhat in cheek. (Ragan, 1982) When a human is used in the role of an instrument, we call that instrument a "teacher." This humans is so time-honored and commonplace that we do not even these units called "teachers" as instructional instruments at ther thinking of these "teachers" as one major means of of instruction and everything else being either instruments" or "aids" to a teacher.

mere are many attributes of a human which may help make him or a good instructional device, and there are also many attributes make a teacher less than ideal. For example, humans are nously poor at being able to do something on one day in exactly one way they were able to do it a year or even a day previously. Nack of repeatability makes teacher delivery so unreliable that at times difficult to understand how the use of "teachers" could have be as popular as they are in schools, disregarding their and other drawbacks.

the reason why the use of "teachers" is mandatory in not only als but also training settings can be boiled down, I believe, to remormously powerful information processing abilities. Although

perfect by any means (humans, for example, have a severely limited city for temporary information storage), humans have an incredible sility in their ability to do what they call "interact" based on rmation processing. Consider this: a human can receive what a fast says or writes in natural language (this is called "listening" "reading"), process that information (with humans, they call that taking"), and can ask a question or provide some other stimulus is based upon what the student said or wrote.

Like the human, a computer's primary enviable attribute in muction is information processing ability. Were it not for that, imputer would be a poor alternative for a text book with regard to ability, a poor alternative to 35mm slides or an overhead projector a regard to graphic display, and a poor alternative to film and

that the compared to providing animation. Although there are ways to ntially an unappendix of their sperformance in all of these areas, we don't use that our knowled a second their fabulous display capabilities. We use less than period the try to use a computer in a manner like that which older trys unique g instruction r and assert to sign that take per will explain tion: use of t of intellige the which can be provided with equal effectiveness through other trys while, at the same time, topics abound within our curriculum

th are veritable killers--learning tasks which only the most staged students fully master, leaving the remainder of the s--which in many cases is the majority--with limited success or

on than it is in the confusion. It is these topics, the killers, that remind us ium attributes is computers are supposed to be wonderful instructional instruments. Ty system equilibre as we conceive of computer-delivery of instruction which is ther and further from that which may be delivered by text, video, ugh it is under regrammed instruction, we find ourselves as instructional

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If it is true, as I am saying, that we get further and the from the center of our base of knowledge and tools in instruct design when we attempt to design instructional software which effective use of the computer's unique attributes, what field knowledge, if anything, might we find ourselves getting closer closer to? Recall that earlier we noted an instructional med resembled computers in that its strength lay in ability to proinformation--the use of humans or "teachers." There is a field study related to that one approach to the delivery of instruct that field is called "the study of teaching."

The Study of Teaching and the Study of Instruction

could var The study of teaching is considerably separate from the nu books so instruction. A good general term for what most of our research to his pi instructional technology relates to is "the study of instruction do this 1 But the research and theory interests of a teacher-educator or cot a ch. professor of Elementary Education or of Teaching Methods in a has gone area such as mathematics, language arts, reading, or social store of page ! will most likely be in the area and traditions of the study of missed s teaching (not the study of instruction). Your colleague whom who page 50. umbrella professional organization is not AECT but is ASCD Let's go (Association for Supervision an Curriculum Development) and when dehumani has a difficult time understanding what it is that you actually a that is will probably have a primary background and interest in teaching 2073 research. By the same token, it is fair to say, I believe, that have an equally difficult time understanding what that colleague ects the

muter scie My conclusion from the above this: if the ways in which me effectively conduct instruction are different and in certain was presented in structional better than other media, and if teachers and computers share the In study critical capabilities of intelligent information processing, the mitions of things may be predicted:

lings from 1. that the study of instruction, being devoted in the to instruction delivered by non-intelligent instruments, would me funcing our include research and theory regarding what to do with an intellig fiware, bot Action I instructional instrument, and

2. that the study of teaching, being devoted in the suprates of t cibted to I instruction delivered by intelligent entities (humans), should in Inn Digra research and theory regarding what to do with an intelligent Hisity of instructional instrument, the computer. umpt a ful

Artificial Intelligence and Instructional Design

looking My interest in the current topic did not begin with artifice intelligence (AI), but I have realized over the past year that concern with teaching research in the context of instructional de study of for CAI, would lead quite naturally into contributions toward de The peo of intelligent instructional software. Although I see little tefore wh recognition of it in our literature as of yet, AI methods and techniques have already been developed which have enormous potert diner, Ph in instruction, (Schank, 1984) and there is good reason to belie shine, that education, specifically the delivery of instruction, will a dia the s of the most important uses of AI in the near future. "Automated, "Asized a

rom anything

urther and for s in instruct ftware which , what field atting closer ictional tedis pility to proere is a field , of instruct

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individual instructors are one of the most interesting significant possible applications of AI." (Schank, 1984, Although the potentials appear to be enormous, and a number have noted to me their interest in the area, it does not that anyone knows much about design of what any it does not that anyone knows much about design of what I will call ingent instructional software" or "IIS." Not only do we tional technologists know little about IIS design, our urparts in computer science appear equally unready. For example, schank, whose work in artificial intelligence at Yale University in The Cognitive Computer (Schank, 1984), appears as about instruction as anyone could possibly be in his discussions of artificial intelligence in instruction. For example,

if today's teachers were watching each child carefully, they could vary the complexity and amount of the examples in the e from the sed books so that each child could maintain interest according our research to his progress. If workbooks were smart enough they could of instruction to this by themselves. But workbooks don't know whether or -educator or not a child is doing the exercises correctly, or how far he ethods in a to has gone. A workbook isn't able to stop him in the middle or social state of page 54, exercise D, problem 13, and say, No, you've the study of missed something, let's go back to that tricky problem on league whose pr made 50. Nor can it say Great! You've got the hang of it. Let's go on to something else. Think of how alienating and ment) and who we dehumanizing the grade-school textbooks and the instruction you actually that is coordinated with them really are. (Schank, 1984, p. st in teaching 287) believe, that

that colleague gets the impression that if left to their own devices, the /s in which the mater science/AI community will do little more than re-discover in certain ways tranned instruction, not going quite as far as re-discovery of ters share the structional design. tocessing, the In studying instructional strategies in CAI and in thinking about stions of the design of IIS, I became convinced that research

levoted in the study of teaching could be of enormous utility in ents, would re funcing our knowledge and tools for design of instructional th an intelligence, both conventional and intelligent. Based upon this

mittion I therefore set out to survey the research and theory in ted in the same area of the study of teaching. (Footnote: in this effort I am ns), should in abted to Prof. John F. Wedman, University of Northern Iowa, and to in Digranes, doctoral student in educational technology at the telligent

Dersity of Oklahoma for their suggestions and ideas.) Rather than a full summary of the literature in the study of teaching--an Resible task in this setting in any event -- I would like to present you the highlights of what I found, recalling if you will that I with artifican a looking for help in the design of instructional software.

t year that 4

structional de study of Teaching in a Nutshell ons toward design

The people's names I found most cited and recommended, and see little "Hfore whose writing I concentrated on in my survey were: thods and David formous potest filmer, Philip Hosford, Christopher Clark, Robert Yinger, Barak ison to believe Mashine, N.L. Gage, and Madeline Hunter. Topics and key ideas tion, will be Min the study of teaching which I found most repeated and "Automated, Masized as major areas of interest were: teacher effectiveness,

teacher thinking, and models of teaching. Of all the materied, I would recommend as a single most helpful source, be We Know About Teaching, Edited by Philip Hosford and public the ASCD. (Hosford, 1984)

The following areas were used as primary organizing top. Berliner in his discussion of the status of teaching research (Berliner, 1984):

- A. Pre-instructional factors
 - 1. Content decisions
 - 2. Time allocation decisions
 - 3. Policy decisions
 - 4. Grouping decisions
 - 5. Decisions about activity structures
- B. During-instruction factors
 - 1. Engaged time
 - 2. Time management
 - 3. Monitoring success rate
 - 4. Academic learning time
 - 5. Monitoring
 - 6. Structuring
 - 7. Questioning
- C. Climate factors
 - 1. Communicating academic expectations for achievener
 - Developing a safe, orderly and academically-focuse environment for work
 - Sensible management of deviancy
 - Developing cooperative learning environments

D. Post-instructional factors

- 1. Tests
- 2. Grades
- 3. Feedback

The content of most of the topics is descriptive in nature example, with regard to content decisions, the research indicate the factor exists; in other words, that teachers do in fact main content decisions from time to time. The research does not spen how teachers make content decisions or how best content decision should be made.

Berliner's summary emphasized for many topics that there a great amount of variability among teachers. This was the prima finding summarized for time allocation decisions, for policy decisions, and for activity structures.

For the remainder of the topics, the primary findings note be characterized by "performance of this function is correlated student learning" or by "teachers who do this more than most teachers have students who achieve more than average." For example, studare cited which indicate that there is a strong relationship bet success rate (how often the learner is successful on things like exercises, problems, and so forth) and achievement. Rather that the utility of instructional instruments such as programmed instruction in this regard, the a typical conclusion for teaching

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is drawn: "It appears that the classroom in which the teacher repidly about, monitoring students and raising the number of interactions with students, is the class where students do (Berliner, 1984, p. 62) "A substantive interaction between a and student takes place when the teacher checks to see if the is doing things correctly, asks questions, gives the student feedback, and so on." (p. 62-63) Both tutorial CAI and instruction do this sort of thing routinely. In one sense, turn this area into a design recommendation, albeit not too stive one: "CAI software should be designed so that it checks ist work for accuracy, that it asks questions, and that it provide on the other hand, a question presents itself for which we have a ready answer: what difference does it make to have a to these things? If it is the case that a human is d, what are the critical variables? Are there particular miors that only humans can produce (at present)? If so, an expert protocol analysis of teacher monitoring behaviors would appear if we are going to get into AI in instruction. Or is the ical factor not what the teacher does but what the teacher is: a in. If that is the case, in what regard does the student's wiedge that the teacher is a person make a difference? In another review, Hosford (1984) summarizes the "science" of ming to be found in five factors:

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T - time on task (sufficient amount)

- E expectations (projection of high expectations for learning)
- M monitoring student progress
- P problems assigned (individual work which can be done individually)
- 0 organization (manage class so well that discipline is not a problem)

The "art of education" is seen in teacher's fostering and accerization of what Hosford calls the "silent curriculum"--four id areas, three of which are ignored by a school's manifest ve in nature. miculum, but associated with greatness in teaching:

arch indicates 1. desire for learning in fact make improved self-concept loes not spent 3. respect for others cent decision 4. skill in the use of the 3 R's

that there is Cers who can impart in students a desire for learning, who is the primary "tibute to improvements in their students' self-concepts, who show r policy

"supect for others and teach their students to do so, and who are ndings note melves highly skilled in the basics and improve their students' correlated levenent in the basics are what Hosford would characterize as being han most tere in art" teachers. Teachers who are good with regard to behaviors xample, stole the "science" domain he would characterize as "high science." tionship bet teaching would be both high art and high science. things like Are Hosford's factors the sorts of things we can employ in design things like the Hosford's factors the sorts of things we can employ in design Rather than the lintelligent instructional software? Although Hosford's factors are Ite broad, perhaps they--even the "art of education" factors--are for teaching "as in which we can begin some productive work. If, for example,

one were to perform a protocol analysis of teaching, where tions start? It seems only reasonable that if we want to develop resident for intelligent instructional software, that we should begin focusing investigations on the areas within which the most and which are considered most important by the people whose the research into the phenomena which we wish to model.

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In another review, Bauman (1984) cites nine factors of the effectiveness, reminiscent of those we have already seen:

- 1. clear goals and objectives
- 2. allocated time
- 3. academic engaged time
- success rates
- 5. management
 - 6. monitoring
 - 7. direct instruction (the provision of)
 - instructional organization
- 9. classroom atmosphere

Similarly, Rosenshine (1983) provides six functions, from a critice to studies of teacher effectiveness, which describe what effective in theory teachers do:

- review and checking previous day's work
 presenting new content/skills
 initial student practice (and checking
- initial student practice (and checking for understanding)
 feedback and correctives (and re-teaching if necess performe
- 5. student independent practice
- 6. weekly and monthly reviews

Clark and Yinger (1977) reviewed research on teacher thinks ability This work, quite different from the work on teacher effectiveness of for p be relevant to requirements and specifications for intelligent of like instructional software. One major question addressed by the resonances on teacher thinking is that of interactive decision-making. It for the been assumed that teachers do a great deal of decision-making moded alc feet, as it were, in the classroom. The research indicates that is, we m do, but not much. Teachers consider alternative strategies only teachir things are going poorly. In other words, teachers apparently is woing, v make efforts to optimize learning. Student participation and frather involvement are the primary cues used by the teacher, and, in fill also we teachers rarely change their strategy.

Another facet of the teacher thinking research reviewed by and Yinger is the content of teachers' "interactive thoughts." 294) Teachers apparently think about present, past, and future while interacting with students. Teacher thoughts about the pres are primarily about student behavior and their own affective stru Teacher thoughts about the past are concentrate on reflection on events within the present lesson, retrieval of factual information such as personal information about particular students, curricular content, principles of teaching, and beliefs about children (lear characteristics). Finally, teacher thoughts about the future are primarily on tactics to be used next in the current lesson, predictions or visualizations of directions the lesson might take hing, where t to develop should begin the most people whose del. factors of rady seen:

f)

research on teacher thinking may be a good place to begin research information processing requirements and structures intermining information structional software.

Ily, I would like to present a key point or two from an study rather than a review. The study, Yinger (1980), was subject study of teacher planning. The aspect of the study found of most interest was the investigator's report of the subject study interest. These "teaching routines" were is used to establish and regulate activities and to simplify

Four types of routines emerged: 1. activity routines, 2. retional routines, 3. management routines, and 4. executive routines. These teacher routines appear to have, at a ficial level at least, a close correspondence to general-level ter system activity descriptions.

resions from Teaching Research

then I began my survey of teaching research, I had hoped that I gind prescriptively oriented theories and models of what unctions, from tive teachers do and how they do it, similar to instructional what effective theories and models but with reference to teachers rather than isls or systems. I hoped, particularly, to find analyses of the er of interaction, questioning, and feedback. I did not find what Jork d for. Although I do not claim my survey of teaching research ins to be an in-depth review itself, I think this survey fairly ng the nature and quality of the mainstream of recent research on ing. Perhaps another survey of the research on teaching should ching if necess acformed, this one not focusing on the recent research but on inquseful information in what appear to be areas of most etial: interaction, guestioning, and feedback.

I have noted earlier, while discussing various reviews, that the teacher think multiply exists of using some of the work reviewed as a beginning er effectivenes, nor protocol analysis for development of expert systems. I r intelligent dlike to expand that idea and suggest that instructional seed by the rematchers may wish to begin to study teaching themselves. This new on-making. It has for teaching would build upon the existing literature but would ision-making on the along new directions. In other words, if what we need isn't indicates that the may have to do it ourselves. We will have to study teachers strategies only teaching to establish protocols for our "automated teachers." In apparently do bling, we will not only need to begin where the current work leaves ipation and lither than painfully rediscover the wheels of teaching research) ter, and, in far the we may find the skills and perspective of seasoned teaching archers to be invaluable.

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EVALUATING MEDIA SUPPORT SERVICES: AN ETHNOGRAPHIC APPROACH

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EVALUATING MEDIA SUPPORT SERVICES:

AN ETHNOGRAPHIC APPROACH

By

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Paper Presentation Research and Theory Division Association for Educational Communications and Technology Annual Meeting Las Vegas, Nevada January, 1986 553 An examination of the evaluation of media services in a school of nursing utilizing qualitative research methodology is presented. Since athnographic methodology differes significantly from research approaches more commonly used in education, it is important to identify and understand the differences in this alternative approach. This study considers these differences and provides an application of this methodology in the evaluation of media support services within a school of nursing. Pertinent evaluation and ethnographic literature are reviewed to provide a theoretical basis for this discussion.

ABSTRACT

A one year prototypical study employing ethnographic methodology was undertaken to evaluate media services within a school of nursing. Objectives were established in the areas of needs assessment and evaluation of the condition and context of media services. Data was collected through interviews with and attendance at faculty committee reetings, informal observation and interaction with nursing faculty, students and administrators, observation of the process of media support services, collection of media utilization data and the establishment and maintenance of contact with university level media personnel, both formal and informal.

Media and instructional support needs were identified and classified in four areas. These categories were: (1) Organization, (2) Administration, (3) Service, and (4) Production.

Recommendations are specified on the basis of examined conditions relative to the four categories of need. Plans for action and future development direction emerged from the analysis of qualitative data.

INTRODUCTION

Evaluation of media support services is both assumed and systematically planned for in the on going process of media services management (Erickson, 1968). Moreover, A.E.C.T. (1982) suggests that in addition to quantitative factors, qualitative considerations may be necessary to effectively evaluate specific programs of media support. Therefore, the purpose of this study is to identify qualitative research methodologies which are suitable for evaluation of media support services. Furthermore, an ethnographic approach is then applied to the evaluation process of media services in a school of nursing.

REVIEW OF THE LITERATURE

Three areas of consideration emerge from a review of the evaluation and media support/educational technology literature. The three areas are: (1) Issues of research, (2) Considerations related to the naturalistic paradigm, and (3) Ethnographic methodologies. Issues of research

hnology

include considerations of paradigmatic differences, questions at methodology and the resolution of apparent differences.

Paradigmatic differences have been addressed by Guba (1981). Guba and lincoln (1981) and Guba and Lincoln (1982), relative to defining naturalistic inquiry. Essentially for research purposes paradigms may be viewed as patterns for discovering knowledge. Therefore, different paradigms rest on different philosophical foundations with varying sets of assumptions relative to the result phenomena in question (Donmoyer, 1985;Guba and Lincoln, 1982). due to differences in world view, varying paradigmatic approaches in fact, produced a heated debate both philosophically and operation Most notably has been the discourse between "rationalistic" and "naturalistic" means of inquiry (Howe, 1985).

Philosophical stances have lead to perceived differences in a ology. Methodological differences, according to Guba (1981) have be viewed in terms of quantitative versus qualitative preferences. In ever, Guba (1981) further suggests that methodology concerns are analyzed when viewed in relation to the trustworthiness of the rem which those methods yield. Hence, when viewed in relation to aspen of trustworthiness (ie.: truth value, applicability, consistency as neutrality), questions of validity, reliability and objectivity im a "rationalistic" perspective, may in fact find a commonality of agreement when defined in terms of credibility, dependability and confirmability, from the "naturalistic" perspective.

Moreover, Cook and Reichardt (1979) suggest that a resolution the "rationalistic"/"naturalistic" debate, on at least the methodia level, is the use of both qualitative and quantitative methods when appropriate. Hence, Guba (1981) and Guba and Lincoln (1982) propose the triangulation of methodology through the collection of data in both perspectives.

The second major area of consideration relative to the literate review, is that of analyzing aspects of the naturalistic paradig analysis may be viewed in terms of the two areas of philosophical assumptions and methodology considerations. There are five areas philosophical assumption relative to the naturalistic paradigm (Game Guba and Lincoln, 1982). First, Guba (1981) suggests that there and multiple realities which may in fact, be studied holistically. the researcher and object or "respondant" have an interactive relief with each influencing the other. Third, generalizations are not pr due to the fact that knowledge is bound both by time and context. since actions are best explained in terms of the interaction of man factors, methods of assessing phenomena are most appropriately deter mined by the notion of "best fit," relative to a contextual/holist approach. Fifth, the research endeavor (inquiry) is value bound. five areas of philosophic assumption impact methodological application for the practicing evaluation researcher.

Methodological considerations would include a wide variety of a gathering techniques. Guba and Lincoln (1982) suggest a number of techniques, such as interviewing, observation, record analysis and non-verbal cueing behaviors. Moreover, Patton (1980) and Van Maare 3

nces, question ferences. sed by Guba (19) 1982), relative r research purpo ering knowledge at philosophici

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red differences in to Guba (1981) in tive preferences. logy concerns and rthiness of the m in relation to an lity, consistency in and objectivity in a commonality of dependability and tive.

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a wide variety of sgest a number of ecord analysis and .980) and Van Maard both address a number of related issues dealing with the application of and collection of data by qualitative methodologies. While quantitative methods as identified by Campbell and Stanley (1963) may also be included in the research design in order to triangulate findings (Cook and Reichardt, 1979). Finally, methods may in fact be determined by the unfolding of the study according to Guba and Lincoln (1982).

Based on the fore going considerations, the utilization of ethnographic methodological approaches appear to be not only useful, but also highly appropriate to the evaluation of media support services, from a qualitative perspective. Wilson (1977) and Fetterman (1984) suggest specific considerations for the use of ethnographic techniques in evaluation research. Accordingly, Shrock (1985) notes that the results of naturalistic studies tend to be process oriented, holistic and personally/politically sensitive.

Therefore, the study reported herein, is that of a one year prototypical study employing ethnographic research methodology from a naturalistic perspective, in order to evaluate media services and to determine areas of need for further development in support for a school of nursing.

METHOD - THE ETHNOGRAPHIC APPROACH

The methodology section of the study includes delineation of the context/institutional setting, as well as data collection activities and data analysis. The delineation of the institutional setting and contextual considerations provide for a higher degree of transferability of results by providing descriptive data which may be compared with other settings and contexts (Guba, 1981). Therefore, this study took place at a four year private university, within its school of nursing. The school of nursing offers a four year baccalaureate program in mursing accredited by the National League for Nursing. Nursing students receive instruction on campus, while gaining related clinical experience at various local health care facilities. An intensive program of individualized auto-tutorial instruction with clinical simulation laboratory experiences predominates the junior and senior levels. Several graduate programs leading to a Master of Science degree in Mursing (M.S.N.) are also offered, as is a course of studies leading to a Doctorate in Nursing Education. Undergraduate enrollment is approximately six hundred with graduate students numbering approximately wo hundred and twenty. Combined undergraduate and graduate faculty total approximately fifty five (FTE).

Media support is provided through a specialized nursing media support group for students' individualized instruction, clinical simulation laboratory experiences and several small classrooms within the school of nursing's building space. Classroom support outside of the nursing building is provided through a campus wide centralise media center. The nursing media support area maintains a collect of nursing related software materials, instructional kits and a hardware. These materials are housed in a small closet area and are checked out by students and faculty for use in smallgroup wine rooms located throughout the nursing building space. Instructional kits for clinical simulation laboratory use are checked out and in the laboratories, located in another part of the nursing build Staffing consists of one full time supervisor (R.N. with no form media training), two part time work-study students and a laborator instructional activities utilizing this service.

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Guba (1981) suggests that by collecting "thick" descriptive to a higher probability for transfering results to other contexts and achieved due to the comparison "fit" of contextual description. fore, issues of external validity and generalizability are address from a naturalistic perspective through the utilization of methods which are appropriate for determining a high degree of transferable

Data collection activities included a wide variety of ethnome and naturalistic methods, as well as, quantitative measures. Special activities included: observation of faculty meetings and committee meetings; structured interviews with faculty, students and adminiinformal observation of instructional activities, both in terms of faculty and student involvement and interaction; examination of faculty administration generated documents; informal conversations with her students and administrators; observation of the process of media services; collection of media utilization and evaluation data; and interviews and informal conversations with university level media support staff and administrators.

Observation of faculty meetings and committee meetings provide data for log entries. Log entries included any activities, discuss or disclosure relative to media support, as well as, reactions, and and other social interaction. These data were cross checked with a generated by the various committees and respective administrators. This activity provided a level of credibility relative to findings 1981).

Structured interviews with faculty, students and administration were conducted. The use of standardized open-ended interviewing in (Patton, 1980, p. 202) provided a reduction in bias due to the state ardization of questioning for each of the different groups interview

Informal observation of instructional activities yielded into responses from both faculty and students in natural contexts and more

Examination of faculty and administration generated documents as references for cross checking observationaldata (Guba, 1981). Primarily, these documents consisted of committee minutes, memo's, annual reports and task force reports to accrediting agencies.

Informal conversations with faculty, students and administrate provided additional data which reinforced observational and intervadata (Patton, 1980, p.198). pus wide centralise maintains a collect tional kits and a ll closet area and e in smallgroup wide space. Instruction a checked out and a f the nursing build (R.N. with no formal ents and a laborator responsible for

thick" descriptive in other contexts ar ual description. ability are addressed lization of methods gree of transferation variety of ethnom ive measures. Specia etings and committee tudents and administ s, both in terms of ; examination of Le nversations with fac process of media so valuation data; and h ersity level media

tee meetings provide activities, discum l as, reactions, que cross checked with m ive administrators. elative to findings

ts and administrator aded interviewing to bias due to the starrent groups interview vities yielded interview vities yielded interview iral contexts and we generated documents we ata (Guba, 1981). He minutes, memo's, itting agencies. Itting agencies. Itting administrator vational and interview Observation of the media support process provided log entries which lead to an understanding of logistical problems and processes. Collection of utilization and evaluation data provided for the

triangulation of data from a quantitative perspective (Guba, 1981). This process assisted in the cross checking of data and interpretations stablished by the qualitative methodologies.

Formal interviews and informal conversations with university level media personnel tended to clarify need areas identified by faculty, students and administrators in the school of nursing. Moreover, this activity provided for peer debriefing experiences for the researcher.

Member checks were provided through the process of combined observation and interviewing of the various population groups involved in the study. This wember feedback provided for the possibility of higher levels of credibility (Guba, 1981).

Data analysis emerged from and in conjunction with the data collection. Specific themes relative to needs and development direction for media support services were identified. As related themes emerged, they were checked in terms of source origination and multiple response. As various population group and techniques identified related themes, the themes were then defined in terms of media support need and related direction development. For example, when organizational concerns were expressed by the three groups of faculty, students and administration, the cross checking of these references lead to the emergence of organizational meed areas.

RESULTS

Based on the data gained from the variety of methods utilized, a conceptual structure of media support service need categories emerged. Moreover, recommendations specified on the basis of the examined conditions provided a structure for strategy development relative to the need categories.

The conceptual structure of identified needs consisted of four ateas. The four categories relative to media support are: (1) Organization, (2) Administration, (3) Service, and (4) Production. Organizational considerations included better organization of distribution of hardware/software materials to faculty and students; structured individualized learning areas; identification of lab practice areas; and establishment of comprehensive indices and inventories for collection boldings.

Administration concerns included staffing, funding and supervisory considerations. Specifically, questions of necessary staffing levels for media/lab support, budgeting process development, oversight of student simulation experience, responsibility for lab supplies and collection maintenance were identified. Service needs included areas in which media support service would be able to support faculty in the instructional process through the utilization of instructional design, development and evaluation principles and practices. Specific service needs incluthe following: faculty orientation to the possibilities for main utilization within the instructional process; identification of media users and opinion leaders; continued development of the ban software collections; and faculty consultation for instructional design, development and evaluation.

Production needs included specific applications of technolog to the instructional process in order to further achieve a broadbased learning environment through the production of materials designed to meet specific learner needs. Specific production needs included: utilization of basic graphics production for medis designed video programming applications to instructional tasks, delivery me and testing strategies; application of computer technology to competency based instructional strategies; and development of gram level instructional materials.

Recommendations were then developed on the basis of the prese contextual condition of media support service need categories. Organizational procedures for the effecient and effective function media distribution were developed. Administrative recommendations were specified in terms of staffing, budget, supervision, procein specification and collection maintenance. Role function of media service staff was identified. Service recommendations were devalues in terms of instructional support perspective including areas of inservice training, identification of media users/opinion leaders, and consultation for future development endeavors. Production recommendations emerged directly from data yielded from the quality methodology.

Staffing considerations evolved from the specification of and recommendations. Moreover, cooperative ventures were identified no to university level library and media support departments. Chamic of communication were identified and formalized.

DISCUSSION

The present one year study sought to identify qualitative methods which would be suitable for the evaluation of media service within specific contexts. Moreover, an ethnographic approach we then applied to the evaluation process of media services in a sche of nursing. Categories of media support need then emerged from the activities of data collection and analysis. These need categories provided a basis for developing a structure of recommended developed

The process of evaluation is on going, due to the evolution nature of media support bound in space/time contexts. Therefore, this study merely serves as a prototype for an on going evaluation methodology process within the school of nursing. Needs must conto be identified, strategies implemented and evaluation undertake upport service mal process levelopment and vice needs inclulities for mile tification of ment of the bars instructional

ns of technolog chieve a broad of materials production media n for media dealer sks, delivery mo echnology to elopment of grades

sis of the press categories. fective function recommendations vision, procedum nction of media ions were develope uding areas of opinion leaders, Production from the qualitation

ification of super ere identified rule rtments. Chandle

qualitative of media services ic approach was rvices in a school emerged from the need categories mmended development the evolutionally s. Therefore, oing evaluation Needs must continue tion undertaken. One must not, in this process lose sight of the central goal of instruction. Therefore, future directions will be shaped by emerging needs and the strategies implemented to meet those needs provided by the continual process of evaluation.

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THE EFFECT OF LOGO ON YOUNG CHILDREN

R: LLOYD P. RIEBER

THE EFFECT OF LOGO ON YOUNG CHILDREN

Lloyd P. Rieber The Pennsylvania State University

Presented at the Annual Meeting of the Association for Educational Communications and Technology, Las Vegas, January, 1986

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Abstract

In the Spring of 1983, twenty-five second grade students from a public mentary school in New Mexico had their regular curriculum supplemented with the experience of LOGO computer programming. This experiment studied meffectiveness of LOGO's turtle graphics in providing the subjects with a model of systematic thought which could be applied and measured in an adapted regetian problem solving activity. The study also investigated LOGO's mectiveness in teaching certain fundamental geometric concepts to children were supposedly not developmentally ready for such material. The matment consisted of each child receiving approximately one hour of Terrapin inso programming on the Apple microcomputer each week for three months. mestructure of the programming experience was based on a guided discovery moreach. The children were allowed much freedom in their programming mices, yet they were motivated to pursue formal stage thought patterns using trarefully planned positive reinforcement technique. Data from the exerimental group were compared to another second grade classroom in the sme district which did not receive any LOGO experiences. The experimental The showed statistically significant results in both the problem solving masure and geometric pencil and paper test. The control group showed no ignificant change in either case.

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Introduction

The introduction of the LOGO programming language to mainstream education in the late 1970's and early 1980's received much attention and initial praise. Even though not much was known empirically about the use LOGO with children (Watt, 1982), it was nonetheless brought into many classrooms across the country with rushed excitement. Many educators tar the responsibility of utilizing the growing microcomputer medium turned this innovative concept with the hope of providing children with a suitable profitable educational experience. In lieu of the research and field-test on many educators took the word of a small group of scientists and theorists the Massachusetts Institute of Technology (MIT) that children's exposure to LOGO could possibly yield favorable results in thinking and mathematical ability. Furthermore, it was contended that these results would be best achieved given a revolutionary break from the traditional, and often admonished, teacher dominated classroom and proceed to a highly child centered environment (Papert, 1980). This educational bandwagon was fully encouraged by the public's insistence that education begin to prepare its we for the already present computer age. These factors, among others, have contributed to LOGO's somewhat ubiquitous reputation as being possibly most significant educational software of the decade (Lough, 1983).

Confirming evidence of LOGO's ultimate educational value was expected from some of the early LOGO projects such as the Brookline, Massachusetts project and the Lamplighter project in Dallas. Unfortunately, these projects did not provide educators with convincing evidence of LOGO's potential and provide educators.

to mainstream h attention and y about the use of ht into many any educators fan medium turned b with a suitable me and field-test day ts and theorists tren's exposure to mathematical would be best and often highly child idwagon was further to prepare its your g others, have eing possibly the 1, 1983). value was expected >, Massachusetts ly, these projects i's potential and the

mument for and against LOGO continued. Recently, however, the findings from anal large LOGO projects, such as the Bank Street College Project in New and the University of Israel Project, have cast rather dark clouds over the info landscape. These studies attempted to present LOGO to children in the entext of free or open discovery learning as advocated by Seymour Papert. men's principal developer. In these studies, LOGO failed to show any imificant contribution to the children's problem solving or mathematical eills (Pea, undated; Leron, 1985). In another study completed at the inversity of Edinburgh, Scotland, LOGO was presented in a more traditional and eructured way. LOGO was substituted for the regular mathematics curriculum ind was taught in a structured, teacher directed way. Here again, LOGO did not movide a superior learning environment over non-LOGO instructional methods: dudents in the LOGO group did not perform significantly better on math mevement tests than non-LOGO math students (Howe, O'Shea & Plane, 1979). hese results, and in particular, the results from the Bank Street College of Bucation "raise serious doubts about the claims made for the cognitive metits of learning to program, particularly in LOGO" (Pea, undated, p. 30-31). nese results have prompted many educators to call for a halt in the use of D60 and LOGO-like experiences in the classroom (Tetenbaum & Mulkeen, 1984). itse studies support a contention that LOGO has failed to deliver what it had rumised.

In response to these criticisms, Papert has emphasized that LOGO never romised anything. Instead, he supports the view that LOGO is part of a sultural influence. Considering LOGO by itself, without associated cultural actors, is devoid of meaning (Papert, 1985). This is why, according to Papert, tis fruitless to try to control for the "LOGO variable" in experimental type "search.

Papert's criticism, although perhaps valid to a certain extent, less concerned educator in a type of "damned if you do and damned if you do situation. Educators who try to understand Papert's perspective and atter aspire to the potential of LOGO find themselves confronted with unimpress curriculum supervisers demanding supportive data whereas researchers and accused of contaminating a good idea with their experimentation technol Ultimately, educators will need to have an objective measure of the possinfluences of LOGO and LOGO-like experiences on their students in order justify continuing or abandoning the cause. These decisions will need to based, at least in part, on information gathered through experimental researchers <u>Purpose</u>

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The purpose of this paper is to present and discuss a relatively record to be study involving the experiences of young children who used LOGO over a tree nea month period. The purposes of the study were two-fold. First, it has been ASDEC claimed that people who engage in LOGO programming, or other similar theor languages for that matter, are apt to better develop problem solving abilities VIEW (Papert, 1980) due to the nature of the programming tasks. Programming View: LOGO, it is contended, supports a systematic structure of procedural problem are p to be solving where large problems are broken down into smaller, more managed some "chunks". This study sought to investigate whether or not young children in llouo the experience of LOGO programming, would acquire more problem solving skills and be able to demonstrate those skills in other problem solving Sple contexts.

The second problem investigated and discussed here concerns the potential of learners to gain incidental mathematical insight and ability from through their LOGO programming experiences. These skills are termed lisbo incidental because they are not taught directly by the teacher, but are acq.¹⁴ age o

a relatively recent ed LOGO over a time First, it has been other similar em solving abilities 5. Programming with procedural problem ir, more managealies young children, give problem solving blem solving by-product of the total programming experience. The rationale behind this based upon the structure of LOGO itself. The language of LOGO is a language mathematics is communicated between the learner and a small emetic animal called the "turtle". The learner, in his/her physical world, the turtle in its, share many important traits. The two most important its that they share are position and heading making the turtle body syntonic in the child (Papert, 1980). In addition, since the child is able to identify in the turtle through these physical associations, Papert contends that the old and the turtle begin to share a type of cognitive bond. This bond, or ego entonic relationship, allows the child to project his/herself according to the

Perspective of the turtle. It is through these means that the child is believed to be able to gain mathematic insight not readily attainable through traditional means. This belief becomes even more interesting when the learners are expecially young, as in the second grade. According to the child development theories of Piaget, the preoperational or concrete operational child does not when the world as being filled with rigid and fixed shapes. Rather, the child when the world with a more topological perspective where lines and angles are permitted to bend and flex (Copeland, 1979). Therefore, the second problem to be discussed here is whether or not young children are able to assimilate and though their cognitive development dictates a more topological viewpoint.

Methods

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Subjects in the experimental group consisted of 25 second grade children from a regular, public school classroom. The experimental group consisted of 15 boys and 10 girls with ages ranging from seven to nine years with a mean int age of 8.08 years. The control group also consisted of an intact, second grade

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classroom. This group was from a different school in the same school The control group consisted of 22 children: 11 boys and 11 girls whose also ranged from seven to nine years with a mean age of 7.82 years rationale for using a control group was based upon the need to control for maturation effects of the experimental group (Campbell & Stanley, 1961) experimental and control groups were selected based in part upon the willingness of their teachers to participate and other more restraining typically found in field-based research which prevented random assign subjects to the treatment groups.

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LOGO env

Materials

The treatment given to the experimental group was the experience of exocates programming a microcomputer in the computer language of LOGO. Each set such free received approximately one hour of LOGO programming each week using the AS state, SUC Terrapin version of LOGO on the four available Apple II+ microcomputers in conputer' four microcomputers were also used by the rest of the school's population m into a Since this study was conducted within the confines of a public elementar in the jar school it was therefore subject to all of the limitations inherent in this to stapes on of setting. Although this guasi-experimental design makes proper control lamed or experimental variables more difficult, there are some merits to be consider clivity c For example, the LOGO learning environment created here is probably not and mooleval different from those to be found in schools all across the country and that De child results can probably be more easily generalized to current classrooms. 1 bexed The LOGO Learning Environment

Initially, the LOGO experience presented to the experimental group and planned to conform to Papert's "free discovery" or humanistic style philosof where the teacher acts as a facilitator rather than a fact giver. In this type setting, a teacher who is well acquainted with the programming or "nuts and

he same school of 11 girls whose who 7.82 years. The eed to control for & Stanley, 1963 part upon the ore restraining for random assignment

5 the experience of LOGO. Each subject ich week using the microcomputers. The shool's population bublic elementary inherent in this type as proper control of rits to be considered is probably not much country and thus the classrooms.

rimental group was stic style philosoph giver. In this type of nming or "nuts and aspects of LOGO acts as a facilitator giving the child advice, informative eck, technical assistance and other "on-task" information whereas the role is to take an individual learning path with the responsibility of enting ideas as well as the bulk of the creativity. Shortly after the entinent began, however, it became very obvious that the subjects would are much more time than the three months allotted to even begin to attain programming level thought necessary for any significant differences to be excled. For this reason, it was necessary to develop a way to motivate the expects to progress in a quickened, yet consistent, way. So instead of lowing the children to explore with the turtle with total freedom, as Papert mocates, a different approach was used which still provided the children with and freedom.

A series of activity cards was prepared. On each card was a simple sape, such as a square. If the child successfully recreated the shape on the amputer's monitor, then a "chance slip" was rewarded. This chance slip was at into a jar which was later used to draw for prizes. The more chance slips able jar at the time of the drawing, the better the chance to win a prize. The sapes on the cards were then made increasingly more complex. The skills laned on one card might be prerequisite on another. (Copies of selected attivity cards can be found in Appendix 1.) This building block method of skill levelopment along with the reward system proved to be extremely successful. The children were not forced to complete the activity cards, just merely taxed. Many times a chance slip was awarded if the child would try to alter something in their design according to the instructor's directions. This was and to help the child achieve a concept which otherwise would have been "issed. This "guided discovery" technique has worked well in this and in other U60 environments occurring in typical school situations.

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After the child successfully completed several activity cards which is experimed ifficulty, the child would be encouraged to combine these shapes to make experime larger figure. Any figure created by the child which was composed of the proceed of the proceed shapes was also awarded a chance slip. This encouraged the children classical Precord successful programming code in a notebook. The code for several individuals shapes was often used with little modification when joined together to convidually the macro design.

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Evaluation of LOGO in classroom or other settings has been controled among LOGO's promoters and critics. Although LOGO enthusiasts tend to nec the notion of testing in any LOGO microworld, the problem of objective evaluation remains. Justifying the inclusion of any major curriculum component requires accounting for supposed educational gains in clear, objective terms. LOGO's effectiveness and potential learning and instruction benefits appear to be centered in two areas: problem solving and mathematic These two areas closely resemble the distinction between crystallized and fluid intelligence as described by Catell (1971). An objective of this study to examine a possible evaluation procedure of LOGO which considers these facets of intelligence.

There were two dependent measures used in this study. The first wat measure of problem solving ability in two parts and the second was a paper of

tivity cards with se shapes to make composed of activity aged the children to code for several several ned together to one

Although the two oth were in the same oth or in terms of erials apart from the rict objectives

as been controversia siasts tend to reject of objective curriculum ains in clear, sing and instruction og and mathematics crystallized and ve of this study we considers these two

dy. The first was a cond was a paper and experimental and control groups in a pretest/posttest design.

The problem solving measure is a quantitatively derived form of two classical Piagetian activities used originally as examples of problem solving in inviduals at the stage of formal operations. This measure was presented invidually to each subject in each treatment group in two parts. One part involved a combinatorial task and the other a permutation task. These tasks are chosen as a possible solution to the conflict of evaluating problem solving due their historical use as relative indices of formal thought in plaget's Theory of Intellectual Development (Copeland, 1979). These tasks are then supplied with a scoring technique which would allow them to be intistically analyzed.

In the combinatorial activity, the child was shown six piles of different plored markers. The task was to arrange the markers in as many combinations of pairs as possible. It was strongly emphasized by the researcher to the subjects that no repeated combinations could be permitted. All discovered combinations of the possible 15 were scored one point each. However, one point was subtracted for each combination repeated by the child. Fifteen plints was the highest score possible with the lowest possible score being tero.

Each subject was instructed to complete the task involving permutations ha similar fashion. The child was shown four piles of different shapes: squares, triangles, stars, and circles. The task here was to remove one shape from each pile and then arrange the four shapes in a different way from all revious trials. Again, it was emphasized to the child that all of the arangements must be found with no repeats permitted. The scoring technique here was identical to the combinatorial activity: repeated arrangements were subtracted from the total sum of identified permutations with 24 being b

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Each subject's raw score for this measure was the sum of the combinatorial and permutation tasks.

The measure of geometric concepts was administered in a group sense to each of the treatment groups with measurement tools such as rulers and protractors provided. The test consisted of four pages (see Appendix II) one consisted of an angle recognition activity where the child was instrume to select the proper angle from a group of four. Page two also dealt with the concept of the angle. The subjects were given an angle and one ray of anone angle. The subjects were instructed to draw the second ray in such a way we the angle formed would match the given angle identically. Additionally me given rays were offset somewhat from the given angles so that the children consider the task from a different perspective. Page three dealt with the measurement of line segments. One line segment was given with the child being told to draw another line of exactly equal length. The starting point in the child's line was given and offset in such a way as to require the child to demonstrate conservation of length. The fourth page also dealt with the concept of the angle. Here the child was instructed to imagine rotating figure a certain number of degrees left or right and then to point to the direction in which it would be facing. This task resembles more closely me activity actually involved in LOGO programming. Whereas the first three geometry test pages attempted to measure far transfer of LOGO's mathematic model, the fourth page was designed to measure one near transfer component

Analysis of the Data

Problem Solving

An analysis of the experimental and control groups' pretest means, 12

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ed in a group set such as rulers and e Appendix II) hild was instants also dealt with b d one ray of another iy in such a way by Additionally, the that the childhay e dealt with the in with the child e starting point fr quire the child to Jealt with the gine rotating age point to the more closely the he first three

-OGO's mathematic ansfer component 11.27 respectively, on the problem solving measures using an independent \underline{t} show that the two groups means were statistically similar, $\underline{t}(45) =$ 1588, \underline{p} <01 in problem solving ability at the onset of the study. (See table 1 the groups' descriptive statistics.)

The experimental and control group's posttest means were 17.6 and 1059, respectively. The analysis of these means using an independent <u>t</u> test cowed a highly significant difference, $\underline{t}(45) = 4.87$, $\underline{p}<.01$. Therefore, the null pothesis can be rejected and the conclusion drawn that these means are extistically different.

An additional analysis comparing the pretest and posttest means of each roup using dependent <u>t</u> tests also support the above conclusion (although this shot the preferred statistical technique). An analysis of the experimental's metest and posttest means show a highly significant difference, <u>t(</u>24) = 4.9, w01, whereas an analysis of the control group's pretest and posttest means stow no significant difference, <u>t(</u>21) = -.5718, <u>p</u><.01.

Insert Table 1 About Here

Emetric Mathematical Ability

As in problem solving measure, the experimental and control groups were termined to be at similar levels of geometric mathematical ability at the tart of the study as determined by an analysis of their pretest means, 11.4 and 11.73 respectively. An analysis of these data using an independent <u>t</u> test show bsignificant difference, $\underline{t}(45) = .4024$, $\underline{p} < .01$.

retest means, 1152

The experimental and control group's posttest means were 14.8 and 12.5,

respectively. A comparison of these means using an independent 1 test a moderately significant difference, t(45) = 1.78, p<1.

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The additional analysis of the experimental group's pretest and point means using the dependent <u>t</u> test show a significant difference, $\underline{t}(24) = \underline{1}$ <u>p</u><.01, whereas the control group showed no such difference, $\underline{t}(21) = .9281$, <u>p</u><.01.

General Discussion

The findings of this study tend to support the hypotheses and general meriment educational philosophy of LOGO's developer, Seymour Papert, in two important Institute o ways. First, the group of children who used LOGO in this study performed (983) All better on the problem solving measures than the group of children who recre stributes no such LOGO programming exposure. This is consistent with Papert's rensidered conjecture that successful programming interactions encourage the operience development and exercise of problem solving strategies. These results one AltI evidence that these strategies might be able to transfer beyond the content problem s activities computer experiences. These results in the area of problem solving are instiis import contrast to many of the findings reported by the Bank Street College could eva researchers and the University of Israel researchers. Second, the LOGO Attempti programming group appeared to gain mathematical insight to certain geometry **Brasure** tasks merely by their LOGO programming experience, whereas the non-LOGO light and group did not change significantly during the three months in which the stul mly the took place. These geometry aptitude findings presented here appear to Mults : contradict the findings from the University of Edinburgh work. Furthermone model to these results were obtained in a very young group of children and were the lamers result of direct computer programming interactions, i.e. no supportive Toblem non-computer instruction was provided.

One difference between previous studies and the one presented here

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's pretest and an rerence, t(24)=1 nce, t(21) = 900

theses and general ert, in two important study performed with Papert's :ourage the

These results give eet College cond, the LOGO : to certain geometry "eas the non-LOGO 3 in which the stud ere appear to vork. Furthermore, ren and were the o supportive

might help to explain the inconsistencies concerns the learning moment in which the LOGO programming took place. This study presented not in a "guided discovery" environment where although the teacher played an mortant role in the learning paths taken by the students, there was still an mous amount of freedom for the students to experiment with the LOGO erroworlds. This possible explanation is supported by findings of another inco study in which a guided discovery environment was also encouraged. The rimental group in this study, conducted at the California Polytechnic etitute of California, also showed significant mathematical gains (Cron, (43) Although it was not the intention of this research to examine the children who news attributes of successful LOGO learning environments, this insight should be insidered by current teachers in the planning of computer education speriences which will involve LOGO.

Although the experimental group showed a significant increase in their beyond the content arolem solving ability as measured by the combinatorial and permutation em solving are new stivities, one question which must be asked is whether or not this difference simportant. It would be a naive conclusion to state that any single measure and evaluate something as complex as the construct of problem solving. Attempting to evalute problem solving or systematic thought using a single Resure is analogous to holding a highly detailed object in front of a bright ight and then studying its shadow on the wall; the shadow gives the observer my the faintest notion of the object's complexity. Therefore, since these "Suits show much promise for LOGO's ability to present a problem solving model to learners, much more research is needed. These results show that learners who use LOGO appropriately and regularly appear to gain incidental Toolem solving aptitude, that is, the problem solving ability gained is the result of the programming experience, not as the result of direct teaching. presented here

Other studies have shown that there are more efficient ways than LOGO is increase problem solving in children (Dalton, 1985). Yet, since this increase problem solving ability is in addition to other assumed benefits, learning efficiency does not play as important a role.

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Another important issue is given the fact that LOGO programming e fact increase systematic thought, is this effect desirable? LOGO appears an obvious answer to what Piagetians term the "American question", when asks if it is possible to intentionally hurry children through their developmental stages. Papert has speculated that if computers and programming eventually become part of the cultural fabric, that one consequence might be that children's cognitive development might be here especially between the concrete and formal operational stages (Papert 1987 Regardless of the answer to this "question", one should consider David Ekon (1981) interpretation of childhood where "... it is important to see children as a stage of life, not just as the anteroom of life" (p. 199). Each stage some be given equal value in the development of the being, rather than merely interpreting cognitive development as a "race" to be won. The responsibility research is to investigate these speculations in order to provide objective ways in which to make appropriate decisions, whether instructional or societal, on the behalf of the individual.

Implications for Future Research

In contrast to Papert's criticisms of experimental research involving LOGO as a treatment variable, several recommendations for future research to be made. The first concerns the possible treatment interactions involving the learning environment in which LOGO is presented to children. Considering the results presented here as well as the findings from the Bank Street Coller of Education, the University of Israel, and the University of Edinburgh, it is

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ys than LOGO to ince this increase efits, learning

LOGO appears take LOGO appears take Juestion", which in their ters and that one might be hastened ges (Papert, 1980) sider David Elkinfh t to see childhood Each stage should than merely he responsibility of avide objective uctional or

iearch involving future researchan actions involving dren. Considering Bank Street College Edinburgh, it is

Indied that LOGO'S success is heavily dependent upon the learning context. Insitearning context would include the physical elements such as the number computers and the time on task, but most importantly the basic method of interaction such as free discovery, guided discovery, or highly structured. Intere research should center on the effects that these different LOGO learning intexts have on the child's cognitive growth. Certainly, future research should also consider the individual learner characteristics and the role that mese differences play in determining the proper LOGO environments.

It has been pointed out that there presently exists a unique opportunity for computer education research (Lepper, 1985). As computers begin to become apart of our daily lives, it will be difficult to find subjects who have not had prior computer experiences. Without such subjects, finding an appropriate control population will not be possible. This fleeting computer "research window" could be viewed as similar to the history of research in educational television. The obvious conclusion is that researchers need to act upon this research opportunity before it disappears.

This study has raised several questions concerning the learning effects of LOGO on young learners. It is hoped that further research will continue to clarify situations where using LOGO is appropriate as well as inapropriate. Host importantly, more research appears warranted and needed in this realm of computer education.

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Table 1. Descriptive Statistics of Treatment Groups

	Experimental	Control
Number of Subjects	25	22
Problem Solving		
PRETEST MEAN	11.52	11.27
(SD)	(5.92)	(4.55)
POSTTEST MEAN	17.6	10.59
(SD)	(5.11)	(4.45)
Geometry Test		
PRETEST MEAN	11.4	11.73
(SD)	(2.57)	(3.01)
POSTTEST MEAN	14.8	12.5
(SD)	(4.88)	(3.56)

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TITLE:

INTERACTIVE CABLE TELEVISION: AN EVALUATION STUDY

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Interactive Cable Television: An Evaluation Study

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Background

Educators are taking advantage of new opportunities to expand or improve education through cable television and microwave technology. Telecommunications can extend the classroom and learning potential for hundreds of students. Teleconferencing, one use of telecommunications, has become viable for education, training, and business meetings both in education and business and industry. Teleconferencing is a dynamic, live, interactive process which allows students in different locations to communicate and participate in an interactive educational experience (Olgren and Parker, 1983). Interactive television is one form of instructional television which has proved to be an effective and popular medium of instruction, more so than the ITV programs first introduced in the 1950's (Bloom, 1984).

There are many critics who "believe that education is the only major American industry which does not yet make intensive use of modern technologies to reduce its costs and to increase the scope of its services" (Curtis and Biedenbach, 1979, p. 3). Several interactive television projects around the country have begun to utilize technology in an innovative yet practical way to increase the overall effectiveness and availability of educational opportunities in their communities.

A project begun in Illinois in August, 1983 is an attempt to utilize new and emerging technologies to increase the effectiveness of the educational process. This project, the Carroll Instructional Television Consortium, was the first cooperative educational program of its kind in Illinois, and was born of the common need of four small rural high schools to offer a full range of academic opportunity to their students. The Consortium utilizes a cable television network already serving the four districts. The system permits simultaneous video and audio communication between any or all of the four high schools. The two-way television consortium represents a technologically acceptable method for sharing instructional resources, better utilizing faculty expertise and more fully serving the academic needs of students.

The project goals of the Carroll Instructional Television Consortium are:

- To increase the total number of course offerings available to students enrolled in the participating districts.
- To provide fully qualified, experienced, and effective faculty to teach advanced level course work in mathematics, science and foreign languages.
- To motivate and challenge talented and gifted students through association with comparable students from other districts.

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- To promote high levels of student achievement as measured mastery of advanced level course work.
- To increase the efficiency of teacher instructional time is traditionally low enrollment advanced level curricular offers.

Based initially on these goals, project evaluation was design a five year process. The research has broadened some to incluse factors of the environment, and to be as complete as possible.

Project evaluation of this scope has many inherent problem subjectivity of observation, the lack of control of population or teaching methods, the gaps in communication or cooperation all the researchers from utilizing experimental research procedures could add more data to comparative studies literature. Instead design of this research was based on naturalistic research press outcomes will be non-statistical but rich data about the school ment and the project's success. This study employs a naturalistic paradigm to investigate a technologically innovative project size way interactive television as a vehicle to enhance curriculum.

Although this is a fairly recent technology, some studies have reported on utilization of interactive television instruction. Inactive television has been successfully integrated into education systems and is a cost-effective means of augmenting the quality at education available to students, especially in rural areas. This instructional technology increases the spectrum of courses available small school districts and offers an alternative solution to comment tion of the school districts (Holt, 1985). It is a means to devi an educational system that "substantially expands and increases here school curriculum" (School Tech News, 1985). Microwave and cable transmission of two-way video provide students from surrounding sc districts with the opportunity to enroll in courses which otherwise would have been available to only one school due to a shortage of specialized instructors. Advanced levels of foreign languages, Kar and mathematics are high school courses typically offered. Sharing subject matter experts eliminates the need for students to be train ported to a central location, or for the instructor to travel to the the sites (Schramm, 1977). Interactive television (ITV) is also a ically feasible because the expenses incurred are shared cooperative by the school districts involved in the program, and many of them expenses are non-recurring (Pate, 1985). It is most economical to connect the videoconferencing system with an existing cable televinetwork (Howe, 1984).

Courses taught by ITV have been well received by participants evidenced by annually increasing enrollment in the courses and a increase in the number of course offerings to accommodate this me (Jones, 1985). Two-way television has been used extensively in sci districts throughout the country, and with a high degree of success (Jones, 1985). Microwaves for Learning in Iowa, Communicasting for Educational Purposes in Minnesota and the Irvine project in Califor are a few examples cited by Jones. No significant difference in the scores resulted when a College Learning course was taught either in person or by interactive two way television (Johnson, O'Connor at Ressing regardi studyin attitud

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/ participants, a courses and an odate this need insively in school tree of success nunicasting for ect in California. Ifference in test ught either in-O'Connor an Rossing, 1984). Survey results also revealed no negative attitudes regarding the instructional strategy utilized. Graduate students studying supervision via interactive two-way television had positive attitudes about the mode of instruction and learned equally as well as the control group (Johnson, O'Connor, Rossing, 1984).

Though the technology utilization has been studied only recently, these studies revealed a high degree of interest in both the effectiveness of interactive systems and in participants' attitudes towards learning from such systems. Project reports from Trempealeau County Wisconsin and from Texas A & M (Johnson, O'Connor, and Rossing, 1983) show preliminary success. The Carroll I.T.V. Consortium modeled itself in part after the Trempealeau County project. Evaluation reports from Wisconsin were available in the design of the research for this project.

Objectives of the Study

This paper explains the research being conducted to evaluate the project, and the results evident from data collected to date. This study was designed to determine:

- 1. Is an interactive television system effective?
- Is the teaching/learning process affected by use of interactive television?
- Is the interactive television system accepted by the teachers, the students, and administrators?
- 4. Are the project goals successfully met?

Method

A case study was designed to intensively study the status and interaction of the participants and this project. Data is being collected using several different techniques:

- Student cognitive growth is measured by pre- and post-tests in their subject matter.
- Students are surveyed four times during the year to evaluate technical aspects of the system.
- Teachers are observed throughout the year, approximately 75 hours in total.
- 4. Administrators involved in the innovation are interviewed about their decision-making process and their satisfaction with the project.

The case study methodology includes many separate data collection techniques, as listed. Hore specifically, evaluation and data collection includes:

- A comparison of 1984-85 course offerings with 1983-84 course offerings in each participating district by the district administrator and researcher.
- Periodic assessments of teacher effectiveness by district administrators and the researcher.
- A survey of student opinions about teacher effectiveness controls by the researcher during each quarter of the academic year.
- A survey of student attitudes and satisfaction conducted by the researcher during the fourth quarter of the academic year.
- A survey of teacher opinions about student motivation and degree challenge conducted by the researcher during the fourth quarter the academic year.
- Teacher-made tests covering learner objectives identified in two outlines utilized for entry and exit level assessments of states mastery of course content.
- 7. Analyses of student achievement scores made by the researchers assess: 1) student growth, and 2) comparison of achievement scores for students located at originating site with those located at remote sites, and with those not in TV classes where available
- A comparison made by district administrators of enrollments is televised classes with enrollments in the same classes taught is individual district during the previous two years.

Thus, the data collection has been triangulated to include prepost-tests, student/teacher surveys, and observation and interview throughout the project. Guba (1981) suggests that triangulation on improve dependability and transferability of data collected in ministic inquiry. The trustworthiness of observation and interview dat can be enhanced by the collection of survey and cognitive growth dat and by the comparison of results gathered by all three methods. For explanation of each data source is available (Robinson, 1985).

Results

This study has been designed to evaluate and assess the use of interactive cable television as an alternative method of delivering courses. Once study objectives were established it was then necting to attempt to determine if those objectives were being met. The reported here are based on the second year of this five year projectives

The first objective was to determine if a two-way interactive television system would be effective. Previous studies have been a on interactive television, but many of those studies examined syste that were one-way video, and two-way audio. This study has examine interactive system that is two-way audio, and two-way video.

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interactive s have been door kamined system y has examined m video. In order to accurately assess the effectiveness of this interactive systems pre- and post-tests were administered. The pre-test was administered to assess entry level skills and abilities of students. The post-test provided data which indicated how well students learned course saterial. These tests were given to students in all classes taught over the system. Additionally, if a class being taught over the system was also being taught in the traditional manner in one or more of the schools, the same test was given to students in those classes as well. The courses offered over the system were math IV, shorthand, Spanish I and II, and chemistry. Preliminary results have shown that among students taking courses over the system, those students in distant schools are scoring as well as students in home schools (where the course originates). Since many of the classes are small (some have as few as 4 students), comparative statistical analysis is not as valid at this time as it will be at the end of the five year study.

For 1984-1985, a comparison of mean post-test scores has been completed. The post-test score for students in the home school for 5panish II was 171.3 while the mean post-test score for students in that class at the remote school was 193.33. The chemistry class produced similar results: the mean post-test score for the home school students was 33.5; for the remote school students it was 36.43. These two classes demonstrate that students in the remote classes scored a bit better. On the other had, home school students in the' Math IV class scored somewhat better than students in the remote schools. Post test mean scores for students in the home school were 91, while mean posttest scores for student in one remote school were 75, and in another remote school were 66.88.

Just as significant is the fact that students enrolled in courses over the interactive system perform almost as well as students enrolled in the same class taught in the traditional setting. One example of this is the Spanish I class. Students in the interactive Spanish I class had mean post-test scores of 206, while students in the traditional Spanish I class had mean post-test scores of 231.

The second study objective was to determine if the teaching/ learning process is affected by the use of interactive television. While it is true the term "teaching/learning process" can sometimes be an ambiguous concept, for the purposes of this study it has been defined as any activity associated with the teaching process (i.e. lecturing, class discussion) and any activity associated with the learning process (i.e. class participation, teacher accessibility, interaction with classmates, etc.). Based on the responses to questions on a survey administered four times each year (see Appendix) students reacted positively to the system. Their responses indicate a high degree of satisfaction with these courses.

The students do not feel the technology interfered with the teaching/learning process. 93% report the video reception as good to excellent; 87% indicate they can hear the instructor and students in other locations without any problem; 75.9% thought the talkback feature did not interfere with their ability to communicate with students in other locations; 78.7% report no problems with having access to the instructor after regular class hours; 89.8% report no problems with
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Discussion

Since the 1940's, educators have looked to technology to revolutionize the education process. However, education has been slow to adopt technology, and that technology has not brought about the sweeping changes once anticipated. Even though millions of dollars have been spent, the results have been disappointing (Prange, 1973).

Interactive television instruction projects such as the Carroll Instructional Television Consortium are an example of the successful use of technology for education. They are not, however, a panacea. There are inherent problems which are possibly unsolvable, but which do not regate the positive effects.

For example, not all students will find learning via technology to be conducive to their learning style. Not all students in interactive television classrooms feel comfortable learning from a "distant" teacher, nor do they feel that they get an opportunity to know classmates in other schools. While teachers have developed techniques to encourage participation, and have provided opportunities for students to get better acquainted in person, these are only partial solutions. Interactive television systems can not eliminate the problems of geographic distance.

In addition, the technology itself is not perfect. Any time technology is involved, the learning process can be interrupted. There will always be problems with atmospheric and external interference. In this project, the cable system can be rendered inoperative by snow, interference from C.B. radio or other low band audio broadcasts, or by cable or power outages. While a two minute breakdown in audio contact may not sound like a technical problem, it certainly has proven to be for the teachers trying to encourage participation between distant schools.

The strengths of this study are its longitudinal design and its triangulated data collection. Instruments utilized are similar to other studies on interactive television projects (Holt, 1985; Johnson, et. al, 1984). To date, after 2 1/2 years of data collection, results have tended to indicate that the two way interactive system can be used successfully in the educational process. Johnson, et. al. (1984) and Brad Winchell of the East Central Minnesota Educational Cooperative have found similar results (School Tech News, 1985).

The data from this study has also revealed a fairly high level of satisfaction with the system, and positive student attitudes. These results are similar to those reported by Johnson and by Denton, et. al., (1985). In its evaluation of the project, the study objectives have been similar to other projects, and have reported similar results. While interactive cable television instruction is still a fair new technology, the research is beginning to indicate that system be effective, cost efficient, and viable alternatives to live interaction. The benefits, problems, and drawbacks need continued research before a definitive statement can be made about this technological solution to an educational problem.

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1984, March-April o share resources	CARROLL INSTRUCTIONAL TELEVISION CONSORTIUM Student Survey 1985 - 1986
lifornia: Sega	school Did you take a TV course last year?
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	<pre>sure rate the following questions on a scale of 1 - 5 (1 = poor,</pre>
	Is the reception of the picture good enough for following the lecture, copying materials, and taking notes? (1-5) . Can you hear the instructor, and the students in the other schools? (1-5)
	To you feel that the talkback feature allowed you to participate as effectively in this class as in regular classes?
	Do you feel as comfortable learning from the TV teacher is you do from a teacher in a regular class? (1-5)
	is the teacher accessible to you outside of regular class time? (1-5)
	Please describe when and how the teacher is accessible to you.
	Do you feel you have an opportunity to get to know your classmates from the other schools as well as you get to (1-5)

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- 9. Have you been receiving hand-outs and other materials from the teacher in time for assignments?
- 10. Do you feel the material presented in this class has been as easy to follow as material presented in regular classes?

11. How well do you like the TV class?

12. In general, how well do you like school?

Are there any additional comments you would like to make?

TITLE: WHAT YOUR PROFESSOR NEVER TOLD YOU ABOUT THE MUNDANE PRACTICE OF INSTRUCTIONAL DESIGN

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Allison Rossett Professor of Educational Technology San Diego State University San Diego, CA 92182-0311

Introduction

Graduate education provides students with access to our proud and varied theoretical underpinnings. There is communications theory, mean research; information systems; motivation theory and behavioral and cognitive psychology. At the university we enjoy Merrill and Reigeluth Gagne and Briggs; Markle and Tiemann; Fleming and Levie; Cronbach and Snow. But in the field, when a training professional is asked what reference he or she wants to take to the moon, it's Robert Mager and.... the bible. We kidding, that's what a major national survey found.

This presentation briefly reviews some hallowed research and theor traditions, ones I too have shared with generations of students. Then we will look at what is actually happening in the field. My experience in corporations, agencies and schools and a recent national survey suggests the the real world practice of instructional design bares only a kissing cousin resemblance to the chapters of Dick and Carey.

Textbook Instructional Design

The literature offers no end of suggestions for the systematic and effective development of instructional products and services. This is just a brief and partially attributed listing:

 There are scores of models, with endless arrays of boxes and arrows. U ABOUT AL DESIGN

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research and theory students. Then we My experience in I survey suggests that I y a kissing cousin

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Most proponents of the models share belief in needs assessment;
 aruculating behaviorally stated objectives; using objectives to determine trategies/media and evaluation criteria; and actually carrying out some torm of assessment to determine if the product or service solved the initiating problem.

• Most of the models differ in allegiance to behaviorist or cognitivist perspectives, with some writers going so far as to sound a death knell for instructional development if we refuse to throw off our behaviorist shackles. Now,1981; Sprague, 1981, etc.)

 Presumably, the particular theoretical underpinnings make a significant difference in the practice of instructional development.

 The details of instructional design (for example, the development or dassification of objectives a la Mager or Gagne) matter.

• Writers and researchers in instructional development and educational technology herald the dawn of an era of CBT and interactive video/videodisc. (Refer to issues of <u>Educational Technology</u> or <u>The Journal</u> of <u>Technological Horizons in Education</u>.)

 Our literature and conferences suggest great interest in authoring systems and languages which enable subject matter experts and classroom teachers to design CBT without being programmers themselves.

Graduate education is a valuable undertaking.

The Practice of Instructional Design

I have taught instructional design for nearly a decade. I've taught it to graduate students at the University **and** to course developers and training specialists in settings as diverse as telephone companies, banks, 7-11 training centers, and the United Way. I've had hundreds of discussions with instructional designers and their managers about what they do do, what they are expected to do, and what they wish they knew how to do. TRAINING magazine's October 1985 census issue adds a spiended to base to my experience. This past summer they surveyed thousands of training professionals. I'm convinced that this survey provides us where credible picture of current practice-- not the way it ought to be-- but certainly the way it currently is in the cubicles across the nation where people who call themselves designers, developers, trainen education specialists and educational technologists labor.

• There is little talk about instructional design models in the field. Most training departments fight fires, responding to needs and issues initiated by others. It is hard to find the time to cogitate on Florida State to Michigan State's model when the Director of Data Processing is breathing down your neck with a request for a new course.

• The TRAINING study did, however, find something which support the potency of systematic approaches to training and development. They asked repondents to respond affir matively or negatively to these two questions: "We're too small to justify ISD;" and "Management wouldn't sup still for ISD." If respondents said yes to either, they were much more likely to report that training was less important in their organization now than a was two years ago. If they said no to both or either, they were 4 times as likely to report increased budgets! Ron Zemke's commented, "Those who practice a systematic approach fare better in their organizations."

 Have you ever for a moment doubted the omnipresence of objectives and evaluation in the real world of instructional development? The good news is that more than half of responding professionals in the TRAINING survey say they do indeed....

- write objectives in behavioral terms
 assess entry level skills and knowledge
 base media and method decisions on objectives
 test programs as they are developed
- evaluate the effectiveness of programs
- use feedback and test performance to revise

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write objectives in behavioral terms (60%)
 assess entry level skills and knowledge (64%)
 base media and method decisions on objectives (78%)

□ test programs as they are developed (65%)

evaluate the effectiveness of programs (65%)

use feedback and test performance to revise (87%)

If practitioners write objectives only 60% of the time, how often do you imagine that they classify them? Or use those classifications to make decisions? Or discuss the distinctions between Mager, Merrill and Gagne--with their implications for instructional design?

 Seventeen percent agreed to the statement, "Our organization is too small to justify the processes and procedures implied by the above items." And 29% said yes to, "Our management would never stand still for our taking the time to follow the processes and procedures implied by the above items."

• News for the front end analysis fans: not even 40% report conducting needs assessments and task analyses! Forty-seven percent do discriminate between training and non-training needs.

 Theory is of much more interest in the academy than it is to the practitioner. Only in the largest of corporations or agencies (e.g. the military or AT&T) is there support for discussion of the theoretical bases for instructional development standards and guidelines.

 Cognitive psychology and motivation theory are making small, slow inroads into the practice of instructional design. Large corporations, often in the telcommunications and transportation industries, and the military services, are reworking their standards and guidelines to include new perspectives and accomodate new technologies.

• The vast majority of computers that are available in industry and agencies are used for data management and word processing not CBT. In 1985 computers are more likely to be used for instructional purposes in the public schools than they are in corporate America.

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• The TRAINING survey found that we are still a long way from our in every corporation. In 1985, 27% of respondents report using CBT or our When CBT is used, it is used to teach about computer related topics Computers are only rarely a means to provide training for non-computer topics like leadership or basic sales skills.

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• Instructional interactive video and videodisc, all the rage at San Diego State, is just beginning to have an impact on the field. Just under list of TRAINING's respondents report hooking a computer up to video or a day player for training. Interactive **videodisc**, the most promising of those delivery systems, is being used in fewer than 3% of the settings.

 Graduate education has mixed impact. Post graduate certificates and master's degrees bore no statistically significant relationship to earning power. The doctorate did, adding \$4735 to annual earnings.

 Training professionals acknowledged the significance of graduus education by ranking formal education second, after OJT, as a contributor is their career development.

Conclusion

While we may lament that theory and practice do not match, remember that it has been a very, very good couple of years for our profession. We've enjoyed an optimistic employment picture, even with the downturn in the computer industry. And budgets are continuing to rise, albeit slowly. These days, everyone, even John Naisbett, Ronald Reagan, and my mom, is interested in technology and training.

So what can we learn from the discrepancy between what we are talking about in the academy and what happens in the field?

1. That our models, research and theories are not having the impact on the field that we desire.

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2. That academics must spend some time speculating why. Is it for lack of effort on our parts? A mismatch between our literature and the reading habits of practitioners? The inability of our graduates to make clear cases for systematic and theory-based approaches? An absence of lean and sturdy prescriptions for practice based on this research and theory?

3. That practitioners, too, must self-evaluate. Is the current state of practice sufficient? Do they take time to evaluate themselves and the assumptions under which they operate? Are practitioners availing themselves of new ideas, theories and technologies? Are their skills current? Are they allowing the bottom line to rule them without pressing back on behalf of more optimal instructional designs?

For the past decade, academics have turned to the field for illumination on what we should teach our graduate students. How many studies have there been which ask employers to please tell us what they want our graduates to be able to do? Dozens, maybe hundreds. While that is certainly one crucial source of information, it is not the only source.

The field is ruled by concern with getting the job done; the academy must focus on how it might be done better. There is obvious interdependence.

What I've experienced and what TRAINING found reminds me of a responsibility that graduate educators may overlook in our haste to be relevant to the needs of the field: We must do more than respond to the field. We must define it through the compelling nature of the research and development that we do and model it through the superlative quality of our graduates.

Nodding in agreement isn't good enough. I am asking every professor and student to think how he or she might contribute to the improved practice of instructional design. First think about it. And then, go out and do it.

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MICROCOMPUTERS AND CONTINUING MOTIUATION

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Abstract

this study investigated the effects of medium of instruction, task difficulty, and gender on continuing motivation. A total of 139 fifth and sixth graders with previous computer experience completed an initial learning task in one of the two media formats (computer or paper/pencil) and under either a hard or easy difficulty level. Subjects' choice of instructional medium for a second learning task was the measure of continuing notivation. Sixty-seven of the 69 computer subjects (97 sercent) chose to return to the computer, whereas only one of 70 paper/pencil subjects (one percent) chose to return to the paper/pencil form, p<.0001. The remaining 69 chose the computer for the second task. Questionnaire data indicated that computer subjects also evaluated their own performance significantly more highly, reported the task to be significantly more interesting and easier, and had a greater desire to study more of the same type of subject matter.

MOTIVATION

MICROCOMPUTERS AND CONTINUING MOTIVATION

Microcomputers are rapidly becoming an important medium of instruction. Research on computer-assisted instruction (CAI) has often focused on student learning through comparisons of several teaching methods (Clark 1983; Jamison, Suppes, & Wells, 1974). Some evidence exists that CAI may be more effective than traditional teaching methods (Bell, 1983; Kulik, 1983; White, 1983) However, Clark (1983) suggests that the causal comparing between CAI and achievement are confounded by the uncontrolled effects of novelty and instructional method Indeed, until recently relatively little attention had been given to how strong student motivation is to use computers and to continue to use them under various conditions. Like student achievement, willingness to return to computer-based learning tasks is also an important consideration related to the effects of computers.

The role of motivation in CAI is becoming a more prominent topic in the professional literature. Swemme and Anderson (1982) state that the motivational reinforcement of CAI is perhaps its strongest asset. The format of CAI has been looked at for clues on motivating characteristics which aid learning (Dence, 1980; Malone, 1980). Roblyer (1985) noted that the motivation behind the improvement of attitudes toward subject matter in the CAI format is often attributed to the computer itself.

Research is far from definitive on the extent to which microcomputers motivate students and the conditions that maximize the motivation. The effectiveness of CAI has been attributed in part to a novelty factor (Grimm, 1978; Kulik, Bangert, & Williams, 1983). However, neither Kulik, Kulik, & Cohen (1980) nor White (1983) found evidence for a novelty effect in their reviews of computer use. Computer experience has been found to be a major factor in computer attitudes (Enochs, 1984; Loyd and Gressard, 1984). The motivational effects of CAI have also been examined from a number of other standpoints, including retention, feedback, learner control, and individualization (Dence, 1980; Roblyer, 1985).

A considerable body of recent research has centered on continuing motivation (McCombs, 1984), which generally has been defined as the free choice to return to a previous learning task instead of an alternative task. The difficulty level of the original task and the gender of the learners are two factors that have been found to be associated with continuing motivation.

Task difficulty is well established as a factor that

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influences motivation (Lepper, 1985; Story & Sullivan, 1985). Return to task, as the measure of continuing motivation, has been found to be significantly higher when subjects initially perform an easy task rather than a hard one (Harter, 1975b; Hughes, Sullivan, & Mosley, 1985; Pittman, Emery, & Boggiano, 1982). Task difficulty has also been found to interact with subject gender. Boys tend to return more frequently to challenging tasks and girls to easier ones (Harter, 1975a,b; Wigfield, 1984). Whether these findings on continuing motivation as it relates to task difficulty and gender extend to computerassisted learning tasks has not been investigated experimentally.

A recent study by Mosley, Haas, & Story (1984) suggests that the use of the computer itself may be a strong factor in promoting continuing motivation. These researchers studied the motivation of sixth grade students for tasks of differing difficulty levels as presented exclusively by microcomputer. The overall return-to-task rate on the computer-based task was far higher than return rates in two previous continuing motivation studies (Hughes, Sullivan, & Mosley, 1985; Mosley, 1983) using learning tasks presented only in paper/pencil format.

The present study was conducted to investigate experimentally the relationship to continuing motivation of instructional medium, task difficulty, and sex of subject. Two types of media, computer and paper/pencil, were crossed with two levels of difficulty, hard and easy. The measure of continuing motivation was student choice of instructional medium for a second learning task after they had completed an initial task either on a microcomputer or in paper/pencil form. Student attitudes related to the two media were also assessed.

Method

Subjects

The subjects were 139 fifth and sixth grade students from six classes in a suburban school located in a middleclass socioeconomic area. All were familiar with Computers and the school computer lab where the research was conducted.

Materials

The experimental materials were two sections from the Grade 5-6 "Power Switch" unit from the (Energy Source Program, 1984). For this study, two separate sets of

Microcomputers and Continuing

eight questions each, one set to be answered at the set each of two sections, were adapted from questions in the original unit. The questions were prepared in paper/pencil form for the paper/pencil group and were set on floppy disks for the computer group. The format of the desig questions was the same on the computer screen as on paper Feedback was included after every item on the computer. The is normal in CAI, and after each set of 8 items for the paper/ pencil group.

The easy/hard variation in task difficulty was achieved by manipulating the difficulty level of the questions. The questions in the easy version were three choice multiple choice items. Those in the hard version were completion items which required subjects to recall the correct answer and write it in. The multiple-choice and completion items covered identical content. A preliminary tryout with one Grade 5 class and one Grade class indicated that the two versions did indeed vary in difficulty level. Students averaged 43% on the hard version and 74% on the easy version.

Procedures

Boys and girls were randomly assigned to one of the (97 p treatment groups, computer or paper/pencil, and to either the i the hard or easy difficulty levels. Except for their only assigned medium, the procedures were the same for the vers: computer and paper/pencil groups. 69 p

In both treatments, the text was read aloud by students who were previously identified by the teacher as good readers. The other students followed along. At the end of the first section, subjects answered the first set of questions on their own in their assigned paper/pencil or computer medium. Subjects then read the second section and answered the questions over it in the same manner. After finishing these questions, all subjects completed six-item questionnaire on which they marked their choice of medium (computer or paper/pencil) for a possible second learning task and indicated their perceptions of the initial task.

Data Sources

The proportion of subjects who chose to return to the same medium for the second task served as the measure of continuing motivation. Other data on student attitudes were obtained from the follow-up questionnaire items dealing with perceived performance, student interest, task difficulty, and desire for further study about energy. thei in T

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The experimental design was 2 (medium) x 2 (difficulty) x 2 (gender) completely crossed factorial design. Data were analyzed by analysis of variance for return to task and by chi-square for the questionnaire items.

Results

Return to Task

The frequency of subjects returning to task by treatment and gender is shown in Table 1. The 2 x 2 x 2 ANOVA yielded a highly significant effect for medium,

Insert Table 1 about here

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F(1,137) = 1488.32, p<.0001. Sixty-seven of 69 subjects (97 percent) in the computer treatment chose to return to the computer for a second learning task. In contrast, only one of the 70 (one percent) in the paper/pencil version chose paper/pencil for the later task. The other 69 paper/pencil subjects preferred the computer for the second task.

The effect for instructional medium was so powerful that it left little room for possible effects for task difficulty and gender. Nearly all subjects at both difficulty levels and of both sexes chose the computer as the medium for a future task. Of the three who did not. one male and one female were initially in the hard difficulty level for the computer group and one female was in the hard level of the paper/pencil group.

Student Attitudes

Attitudes of students in each group, as indicated by their responses on the follow-up questionnaire, are shown in Table 2. As shown in the table, significant

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differences favoring the computer group over paper/pencil subjects were found on all five items. Summing of the first two columns for items 1-3 reveals that more students in the computer group thought that they did well on the activity (85 percent to 69 for paper/pencil), that the activity was interesting (96 percent to 81), and that the activity was easy (80 percent to 47). More computer the paper/pencil subjects also reported that they would rates study energy again than another subject (29 percent to 11) and that they would rather do another energy lesson that not do another lesson at all (87 percent to 64 percent).

En Route Performance

Mean scores for performance on the 16 <u>en route</u> practice items were also calculated for the two treatment groups. The overall means were very similar for the two groups--7.72 items correct for paper/pencil and 7.64 correct for computer subjects.

Total time on task was approximately 45 minutes for both the computer and paper/pencil subjects and did not differ significantly between the two groups.

Discussion

The present study was conducted to investigate the effects of medium of instructional practice and task difficulty on the continuing motivation of boys and girls Results indicated an extremely strong preference for further instructional practice on the microcomputer over paper/pencil format. This effect was so strong that it left room for only slight variations related to task difficulty and subject gender. Questionnaire responses d subjects also revealed much more favorable attitudes toward the computer than paper/pencil.

The most profound finding was the strong motivation effect of the computer as indicated by the fact that 67 at 69 students (97 percent) in the computer group and 69 at 70 (99 percent) in the paper/pencil group chose the computer for their second learning task. Though microcomputers have been cited as having high motivation value (Lepper, 1985; White, 1983), the overwhelming preference demonstrated by subjects in this study was certainly unexpected. Preference for the computer was nearly unanimous whether students did the initial task of the computer or in paper/pencil format. This powerful preference occurred even though students in the computer group did not perform any better on the <u>en route</u> practice items for the learning task than did those in the

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Another strong finding was the important positive effect the computer had on student attitudes. The more positive attitudes revealed by the questionnaire responses complement the return-to-task data. Certainly interest is an important component of motivation (Hawkins, 1984; Maehr, 1976; Malone, 1980). Subjects in the computer group rated the learning as more interesting than those in the paper/pencil treatment, even though the substance of the activity was the same for both groups. Similarly, more subjects in the computer group thought that they did well on the activity and that it was easy. Yet, these impressions were not substantiated by the performance data for the task--the two groups performed almost equally well on the practice items, with a very slight, nonsignificant difference favoring paper/pencil subjects. That is, since the computer group did not in fact outperform the paper/pencil group, merely doing the task on the computer apparently resulted in their thinking that they did well and that it was easier.

The positive attitudes associated with the computer as a medium of instruction also generalized to the subject matter itself. A significantly greater number of subjects in the computer group than in the paper/pencil group reported a preference for studying energy again over studying some other subject matter and over not doing another activity at all. That use of the computer to study particular subject matter could increase students' interest in that subject-matter area is potentially an important finding. It would be especially valuable if students could maintain the increased subject-matter interest on a long-term basis and if they were motivated toward more independent study of the subject-matter area.

The strength of the motivational and attitudinal effects associated with the computer were surprising in that it was intentionally used only as a substitute for the paper/pencil medium. To keep other conditions highly similar across the two presentation media, no other capabilities such as special graphics or personalized or interactive feedback were incorporated into the computer treatment. The results produced by the computer under these constraints suggest that instructional applications that capitalize on its special capabilities (Sawyer, 1985) may further complement its motivational potential.

Although this study was designed to deal with student motivation, it also yielded data on <u>en route</u> performance on the learning task. In contrast with the motivational and attitudinal data, the performance scores of the computer and paper/pencil groups were virtually identical.

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Thus, there was no evidence that the more positive attitudes of the computer group or their item-by-item feedback had an effect on their achievement on the learning task. This finding is consistent with Clark's (1983) contention that different presentation media <u>ser</u> do not directly affect student learning when the other elements of the instruction are the same across the two more media.

The medium of instruction was so much more powerful a variable than either subject gender or task difficulty that no meaningful conclusions can be drawn from this study about the relationship of the latter two variables to continuing motivation. The overwhelming preference is the computer washed out any differences that might have occurred for gender or task difficulty under other conditions. This preference was nearly unanimous atom both females and males and across both the hard and easy difficulty levels.

The present findings clearly reveal that microcomputers potentially have strong positive motivational and attitudinal effects in the classroon. Still, considerable caution should be exercised in generalizing too freely from these results to long-term classroom practice because this study measured only immediate effects from a one-session experiment. The novelty effect often associated with computers might have been a factor in the present results, but any such effect may have been reduced by the fact that the subjects were experienced with computers. Overall, the positive result favoring the computer group were so strong and consistent that it seems highly probable that they were due primarily to the appeal of the computer itself and only secondarily if at all, to other factors.

A worthwhile area for further research is the study of effects of microcomputers when they are used as the primary medium of instruction with a program over an extended time period. Would students continue to show the strong preference for the computer that they demonstrated in this study, or would it lose much of its appeal over time? Student interest in the subject matter itself and student achievement would also be important factors to investigate in such longer-range studies. Research on the effects of microcomputers over an extended period should help us better understand their most productive uses in promoting student motivation and achievement in the classroom. Continuing

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Table 1

Frequency of Return by Medium of Instruction, Gender,

tionnaire] Paper/Pencil Practice Computer Practice to you thi Female Male Total Female Male Total On this act 17/18 18/19 35/37 1/19 0/15 1/34 Hard (94%) (95%) (95%) (5%) (0%) (37) ster -/Pencil I thought t 18/18 14/14 32/32 0/15 0/21 0/36 Easy (1007)(100%) (100%) (0%)(0%)(07)muter Pencil I thought 1 35/36 32/33 67/69 1/34 0/36 1/70 Total (97%) (97%) (97%) (3%) (0%) (1%) Deter.

#/Pencil

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1 The cell entries represent the number of students out of the total cell number who chose to return to the same medium for the second task. For example, 17 of the 18 female students (94%) on the computer version of the hard task chose the computer for the second task. In contrast, only one of 19 female students (5%) in the paper/pencil version chose to return to it. The other 18 chose the computer version for the second task. Compute

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Practice to you think? Total this activity, I think I did: very 1/34 very 2(3) = 10.751 badly well badly well 49%) 36% 12% 3% p <.02 (37) puter 17% 14% 17% 52% r/Pencil I thought this activity was: 0/36 very very 2 (3) = 10.417) interesting interesting boring boring (07) 57% 39% 3% 1% p <.02 mter giPencil 47% 13% 6% 34% 1/70 I thought this activity was:) (1%) very very **X**²(3) = 17.888 hard hard easy easy nter m/Pencil 19% 61% 17% 3% p <.0005 13% 40% 17% 30% out he same he 18 greturn to do more activities with you, what would you prefer? the hard contrast, pencil (1) study energy again: the com-(b) study some other subject: Computer = 29% $\chi(1) = 4.259$ Computer = 71%Paper/Pencil = 14% Paper/Pencil = 86% p <.05 (a) do another energy lesson: (b) not do another lesson at all: Computer = 87% $\chi^{2}(1) = 9.991$ Computer = 13% Paper/Pencil = 64% Paper/Pencil = 36% p <.002

IITLE: THE EFFECTS OF ORGANIZATIONAL CUES ON LEARNERS' PROCESSING OF INSTRUCTIONAL PROSE

NUTHOR: PATRICIA L. SMITH

THE EFFECTS OF ORGANIZATIONAL CUES ON LEARNERS' PROCESSING is the C INSTRUCTIONAL PROSE

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Researchers and developers have given considerable iron suc attention recently to the design and development of instant presenta text (Jonassen, 1983, 1985; Waller & Duffy, 1985). Guidelie organiza arising from this emphasis recommend techniques with which been suc authors of instructional messages, whether they be mediated organize printed text, CRT display, or other electronic media, may a 1983: Wc in order to design affective, unambiguous text. A very com-Ûne recommendation is that designers of instructional text man is that structure or organization of an instructional passage as a tasks, t as possible through the use of outlines, headings, summaries strategi 1779) if titles, marginal notes, and transitions that cue top-level students structure (e.g., Hartley & Burnhill, 1980; Irwin & Davis, P perform Provision of such cues in text is hypothesized to promote task whi top-down processing, i.e., the formation or activation of lists. relevant schemata in order to ease the decoding burden of the abi reading.

the lea Although the use of such cuing techniques has proved 1 Th enhance retention and comprehension in many cases, this effe has not been unilateral (Brooks, 1981; Christensen & Stords as a me student 1955; Hartley, Kenely, Owen, & Trueman, 1980; Klare, Shuford Nichols, 1958). These equivocal effects may be the result of 1983). learners' differential susceptibility to organizational cuts signifi text. Some learners may simply be unaware of the role of the have ou cues in the instructional message and/or how to utilize the to LD a

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in order to enhance comprehension and aid recall. the case, instructional designers may faithfully incorporate mplicit organizational cues in their materials, and still find that substantial portions of their target audience do not benefit from such textual aids. The studies reported in this presentation investigated the differential effects of ent of instruorganizational cuing and strategy training on a group which has 985). Guideling es with which teen suggested as particularly insensitive to the effects of organizational cues: learning disabled adolescents (Stanovich, ey be mediated o c media, may man 1983: Woodward & Peters, 1983).

One explanation offered for LD students' learning problems A very com is that they possess the innate capacity to succeed on such onal text make m tasks, but lack knowledge about and/or the ability to use passage as ent strategies which promote efficient learning. Torgesen (1977. ings, summaries (979) investigated this hypothesis in his seminal study of LD cue top-level students' ability to memorize. He found that LD students win & Davis, 1951 performed as well as their nonLD counterparts in a memorization d to promote task when first taught a strategy for learning stimulus word ctivation of lists. Torgesen (1980) argued convincingly that LD student had ng burden of the ability to learn, they simply did not know how to approach the learning task.

s has proved to ases, this effect ensen & Stordahl. Klare, Shuford, be the result of izational cues the role of the o utilize these

The concept of strategy training has been widely recommended *s a means of designing effective instruction for secondary LD Etudents (Alley & Deshler, 1979); Smith, 1983; Woodward & Peters, 1983). Alley, Deshler, and their colleagues have made Significant contributions in strategy deficit remediation: They have outlined a series of steps for teaching learning strategies to LD adolescents (Deshler, Alley, Warner, & Schumaker, 1981) and

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have completed numerous studies demonstrating the efficient Th this approach. A modification of this approach was employed pale-Ch Study 2.

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This presentation will describe the findings of two to order to that investigated the following questions related to this different specific audience's response to organizational cues in texts. (compare

Study 1

-- Does organizational structure have differential effects a supervi and nonhandicapped learners? Do these effects vary according compret the type of organizational structure? content

Study 2

-- Can a reading strategy employing recognition and utilized of organizational structure be taught to LD students? How be this training influence their recall and retention of instructional prose?

Study 1

Participants and Methodology

The participants for this study were 37 LD and 50 ^{organi} nonhandicapped students from a suburban high school (grades ^{assess} through 12) in central Oklahoma. Students from each group ^{when p} randomly assigned to treatment conditions such that half of ^{adapte} group read a passage with a comparison-contrast top-level ^{struct} structure and half read a passage with a description top-level ^{obtair}

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idings of the m ated to this al cues in texts

The instructional passages (7-8th grade reading grade level, ale-Chall readability formula) used in this study were content reading passages from high school social studies texts. passages with two different top-level structures were used in order to ascertain if LD and nonhandicapped students were differentially sensitive to a very cohesive structure (comparison/contrast structure) and a less cohesive structure

Data were collected in three sessions. First, students were ential effects : supervised by their teachers while answering the ten pretest comprehension questions designed to determine prior knowledge of ts vary according content. One week later, they read their assigned passage. completed the immediate recall task, and then responded to the

idescription structure).

set of 15 posttest comprehension questions. One week after the above procedure, the teachers administered the delayed recall ion and utilization task. students? How o

ention of

LD and 50 school (grades 10 om each group w h that half of M st top-level

Comprehension items were scored as right or wrong. Recall protocols were scored in two ways. First, they were scored for idea units recalled using a procedure suggested by Meyer's (1975) discourse analysis technique. Interrater reliability of the scoring was found to be .97. Participants' sensitivity to organizational structure and author's cuing of such structure was assessed by their use of the author's organizational structure when producing their written recall protocols. A rating scale adapted from Swanson (1980) was used to assess use of text structure in recall. An interrater reliability of .83 was ription top-level obtained using this instrument.

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Results

Two 2 (passage: comparison/contrast, description) is (group: LD and nonLD) analyses of covariance with prior is as a covariate revealed the LD students were indeed less sensitive to the author's top-level structure, regardless of passage type, both at the immediate stage ($F_{1,81} = 4.19$, p (.044) and at the delayed recall stage ($F_{1,81} = 5.85$, p (.018). This lack of sensitively to structure influenced participants' level of recall. Two one-way ANCOVAs examines three levels of text structure use (high, medium, and low of immediate and delayed recall. Text structure use had a significant effect on immediate recall ($F_{1,51} = 6.84$, p .002) and delayed recall ($F_{1,51} = 11.51$, p < .0001). Tables 1 - 6 show the means of these treatment groups by the types of learners.

Insert Tables 1 - 6 about here.

Study 2

Participants and Methodology

Participants were 73 learning disabled adolescents (pro-10 through 12) in two high schools in Oklahoma. The schools randomly assigned to one of the two treatment groups. An examination of reading test scores from the two groups indices that groups were equitable in general reading ability. One proreceived instruction in a reading strategy emphasizing the

recognition and use of authors' organizational structure while ription);; with prior received a placebo instruction on generic problem solving (not indeed less related to prose processing), The Productive Thinking Program ; regardless (Covington, M.V., Crutchfield, R.F., Davies, L., & Olton, R.M., s) = 4.19, 1974).

= 5.85, p (During the week prior to instruction, each group was metested in order to assess their recognition of common influenced organizational structures, their recall of instructional prose. ICOVAs examined and their ability to organize their recalls using the author's um, and low organizational structure. The following week, each group use had a received approximately four hours of instruction. The · 6.84, p experimental group completed print- and teacher-mediated 0001). instruction, including instruction on recognizing five groups by the

about here. Practice with examples and nonexamples, teacher and peer modeling of strategies, and analogical illustrations to describe mental processes. The instructional strategy for this training followed these phases:

olescents (grade a) students were asked to read and recall a lengthy passage . The schools = With an explicitly cued text structure;

groups. An b) they were asked to describe the manner in which they went o groups indical about reading and remembering the material and the ability. One ^{of in}efficiency/inadequacy of this approach was discussed; hasizing the c) a new strategy using text structure as an encoding and

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retrieval cue was presented as a more efficient/effective approach to this type of reading;

d) students were taught to recognize five typical super conduct: structures: Thi

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recall:

e) they practiced this identification with increasing effects complex prose; (F1.30 =

f) the text processing strategy was presented, modeler ourform the instructor in a think-aloud manner, and then practices recogni peer dyads with increasingly complex material; and and on

g) students practiced identifying instances when the .001) . strategy could be appropriately applied. groups.

The control group completed workbook exercises on generation problem solving strategies such as locating and describing problem, considering alternative solutions, etc. At the conclusion of the week, students completed a posttest that assessed their recognition of common organizational structure their use of structure in organizing recall of an instructure passage, and their recall of the passage content. One week the final instructional session, all students responded to # delayed posttest which was an alternate form of the posttest

Results

Four separate 2 (reading level: low, reading level * 4 7.0; high, reading level = 7.1 - 10.0) X 2 (treatment: Conclu experimental, control) analyses of variance were conducted TI order to examine the main effects and interactions of the studen treatments and reading levels on four dependent variables Counte (immediate recognition of structure type, immediate recall insens

8 it/effective rformance, delayed recognition of structure type, and delayed ecall performance). An alpha level of .05 was set prior to typical exp anducting the analyses. The ANOVAs revealed several main effects, including main h increasing uffects for treatment on immediate recognition of structure type 151.30 = 141.954, p < .001), on immediate recall nted, modeles performance (F1,90 = 26.039, p < .001), on delayed en practice recognition of structure type (F1,50 = 99.562, p < .001), and and on delayed recall performance (F, sp = 20. 787, p < es when the (01). No interactions were found between treatments and reading croups. Tables 7 - 8 show the means in the analyses. cises on general d describing the c. At the osttest that Insert Tables 7 - 8 about here ional structures, an instruction nt. One week and Learners' written recall protocols showed evidence that responded to a students in the experimental group used the text structure f the posttest. strategies they had been taught: several drew pictures of the structures, other underlined key words, and many organized their recalls according the text top-level structure. ng level = 4.0 atment: Conclusions

e conducted in ons of the variables late recall

The results of Study 1 indicate that, as anticipated, LD ^{students} are not as sensitive as their nonhandicapped ^{counterparts} to the organization of instructional prose. This ^{insensitivity} appears even when prior knowledge is statistically

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partialed out. In addition, results suggest that this lack a sensitivity contributes to LD students' poorer recall and retention of instructional prose.

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The results of Study 2 indicate that training in a term structure use strategy did significantly improve both student recognition of these structures and their recall of instructures content, and this effect remained relatively stable over a week. In other words, the results strongly suggest that students who typically experience severe difficulty in reading comprehension can be taught to use a text structure strategy. this instruction can improve their recall of information was social studies passages. An examination of the students' real protocols indicated that students in the experimental group actually used the strategy during the reading and recall take In addition, in the weeks following the study, the LD students teachers reported that the students continued to make reference to and use their newly acquired reading strategy. Evidently strategy training had considerable impact upon students' encode and retrieval behaviors.

The conclusions of these studies have several implication for designers and developers of instructional print materials First, they provide evaluative data on a particular instruction strategy for teaching toward cognitive strategy outcomes. Second, they point out that including explicit cues to organizational structure in instructional prose may benefit on a portion of the target audience, excluding those portions of a audience that are poor readers. Third, they suggest some additional instruction ("self-conscious text," Pace, 1995) the

at this lace recall and

be included alongside content instruction that will aid tearners who have immature text processing strategies.

Future investigations are planned to examine other

instruction will be designed to teach this text processing

affectiveness, and transferability of this learning will be

implications of text structure cuing and strategy use. First.

strategy training will be extended to include instruction using

renger passages that are typical of the passages that LD students

wist contend with in content area classes. Second, content area

ing in a test a both student l of instruction able over at the iggest that ilty in reading strategy alongside targeted content objectives. The efficiency, :ure strategy... ormation with gramined. students' rece ental group d recall tasis. he LD students make reference Evidently the tudents' encodin

al implications nt materials. ar instruction utcomes. es to y benefit only portions of the st some e, 1995) that

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Table 1 -

Mean scores on Comprehension Positiest

	Group	
Pessage	LD	NonLD
dversative	8.000	11.269
	(3.406)	(1.710)
	<u>n</u> =21 -	<u>n</u> =26
ltributive	7.125	10.958
	(2.604)	(1.899)
	<u>n</u> =16	<u>n=24</u>

Note: Maximum score = 15.

mis 3

Number of Idea Units Recalled -- Immediate Recall

	-	Group	
INLD	Passage	LD	NonLD
59	Adversative	21.063	40.615
0)		(10.871)	(14.577)
		<u>n</u> =21 -	<u>n</u> =26
	Attributive	24.095	41.375
		(11.749)	(18.939)
		<u>n</u> =16	<u>n</u> =24

Wite Total number of idea units = 159.

Table 3

ean Number of Idea	Units Recal	ledDelayed Recall		ties Ratings of
		Group		
Passage		LD	NonLD	Passage
Adversative		14.500	30.654	Adversative
	100 A	(11.599)	(12.652)	1000
		<u>n</u> =21 *	<u>n</u> =26	
Altribulive		17.571	31.042	Altributive
		(12.385)	(15.708)	1000
		<u>n</u> =16	D=24	

Note: Total number of idea units = 159.

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Note Ratings I

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Table 4

table 4

ten Batings of Structure Use--Immediate Recall

	Group	la la
Passage	LD	NonLD
oversative	5.300	6.654
	(2.939)	(2. 1 97)
	<u>0=21</u> -	<u>n</u> =26
ribuliva	5.437	6.833
	(3.098)	(2.823)
	<u>n=16</u>	<u>n=24</u>

Note Ratings ranged from 1 (low) to 10 (high).

Table 5

	Group		
Passage	LD	NonLD	
Adversative	4.500	6.654	
- - -	(2.893)	(2.497)	-
	<u>n</u> =21	<u>n</u> =26	
Attributive	3.938	4.708	
	(3.098)	(2.662)	
	n=16	D=24	10000

Mean Ratings of Structure Use--Delayed Recall

Note: Ratings ranged from 1 (low) to 10 (high).

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LD	-	Stu	ructure Use Rating	
	- HEALE	Low ⁸	Medium ^b	HighC
14				
7)	aributive Innatiola	16.60	17.37	33.25
5		(6.39)	(7.78)	(11.44)
в		<u>n</u> =5	8=1	<u>1</u> -4
)	Deleyed	12.22	7.00	30.00
	100	(8.50)	(3.16)	(10.17)
	100	д=9	<u>n</u> =4	<u>n</u> =4
	Innediate	22.71	23.29	27.67
		(16.02)	(6.73)	(11.98)
		<u>n</u> =7	<u>n</u> =7	<u>n</u> =6
	Deleyed	12.50	19.80	23.80
		(13.01)	(8.70)	(12.40)
		=10	д= 5	<u>0</u> =5

her of Idea Units Recalled by LD Students as a Function of Structure. Use and

Interview of idea units = 159. Interview of idea units = 159.

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Table 7

Mean Structure Recognition Scores

Table -

Hote

on Posttest and Delayed Posttest

		Treatm	ent	
Reading Level		Experimental	Control	readin
Low (4.0 - 7.0)				Low
Posttest	11.12	4		
M		2.29	.11	
SD		. 69	.33	
<u>n</u> -		17	9	
Delayed Postto	est			1 85
н		2.18	.22	
SD		.88	.44	
<u>n</u>	117	17	9	
High (7.1 - 10.0))			His
Posttest				
Ħ		1.85	0	
SD		.90	0	
<u>n</u>		13	15	803
Delayed Postt	est			
ж		2.77	.33	
SD		1.09	.49	
<u>n</u>		13	15	6 44
		· · · · · · · · · · · · · · · · · · ·		

Note: Maximum score possible = 3

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Table 8

Main Idea Units Recalled on Posttest and Delayed Posttest

		Treat	nent
130	and the second sec	Experimental	Control
ontrol	Reading Level		
	Low (4.0 - 7.0)		
	Posttest		
.11	Ħ	11.59	5.78
.33	SD	6.09	3.63
,	<u>n</u>	17	9
	Delayed Posttest		
.22	H	12.23	5.22
.44	SD	6.76	3.77
	<u>n</u>	17	9
	High (7.1 - 10.0)		
	Posttest		
1.112	M	16.0	6.87
	SD	5.99	4.63
	<u>n</u>	13	15
	Delayed Posttest		
. 33	H	12.85	6.27
.49	SD	6.04	2.76
	<u>n</u>	13	15

Possible delayed posttest = 128.

TITLE: INSTRUCTIONAL SIMULATION: RESEARCH, THEORY, AND A CASE STUDY

RUTHOR: PETER SMITH

INSTRUCTIONAL SIMULATION: RESEARCH, THEORY, AND A CASE STUDY Peter Smith School of Education Seattle Pacific University Simulation

A Paper Presented to the 1986 AECT Annual Conference January 1986

2

INTRODUCTION

imulation

Simulations have been used to deliver instruction in educational, military, and industrial settings for many years. Although the technique has repeatedly been demonstrated to be effective, its use has been somewhat limited in higher education because of the relatively high costs connected with the development and presentation of the materials. With the advent of computer interactive video, simulation has become more affordable for everyone. Thus, simulation holds great promise for future application in many instructional settings. This presentation will focus upon theory, research, and practice related to instructional simulations.

Let us begin with a definition of the term simulation. A good starting point is to look at the way the term is described by the major indexes of the literature of Education. Two indexes, the <u>Current Index to Journals in</u> <u>Education</u> and <u>Resources in Education</u> include the following explanation to clarify the meaning of the descriptor "simulation." "Duplication of the essential characteristics of a task or situation." An examination of the literature itself reveals that most writers agree with

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the indexes, emphasizing the idea that simulation indeed "duplicates the essential characteristics" of reality. According to various writers, our simulated reality may be abstracted and/or simplified (Heinich, Molenda, & Russell, 1985), lifelike (Cruickshank, 1966), and/or controlled (Fink, 1973).

Simulations do more than merely present manipulated "realities," however. In addition, they call upon the learner to respond through decision-making (Rice, 1966), problem solving (Cruickshank, 1966), and/or role playing (Pollack, 1973). Further, participants in simulations must deal with the consequences of their responses (Spannaus, 1978).

While most writers appear to define simulation in of Hi slightly different terms, common elements are also evident. prese Based upon definitions from the literature, the following simu eclectic version is offered: simulations are controlled lear: representations of real situations, calling for participants be o to respond, and providing some form of feedback to those dire responses. Instructional simulations are those simulations prop intended to result in predetermined learning outcomes.

It is useful, at this point, to make a distinction between simulations as defined above, and games. Games have,

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Simulation

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This work will deal with instructional simulations as ≥, 1966). used in higher education, and will focus upon applications > playing in the area of preservice and inservice teacher education. lations must First, a brief historical review will be presented, pannaus, featuring the pioneering work of Bert Kersh and associates at the Teaching Research Division of the Oregon State System of Higher Education. Then, a summary of research will be ion in presented, followed by a short descriptive analysis of how lso evident. simulation relates to representative elements of three following learning theories. A rationale for using simulations will trolled be offered and illustrated with a case study. Finally, some participants directions for future research and development will be to those proposed. simulations

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HISTORICAL OVERVIEW

Simulations have been successfully used for many applications in military training. Richard Braby of the Naval Training Device Center in Orlando, Florida (Twelker d970), argues convincingly for using simulations:

I don't think we could ever talk a pilot into having the behavior that he must perform in the aircraft. In could talk to him for 30 years and he would never be able to perform under the stress of actual flight. In other words, in the classroom you don't have the stimuli that will actually trigger the behavior...I think you have to experience it." (p. 1)

Other applications from the military have included relatively simple simulations such as "pocket blinkers which simulate the action of a ship's blinker light and enables trainees to practice Morse Code, . . . to exceedingly complex weapons systems which require teams of operators and analogue or digital computers." (Twelker, 1970, p. 2)

Likewise in industry, simulations have been used to deliver instruction. A good example is the flight simulator Simulati

Simulation

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for many raby of the ida (Twelker, ons: used by the Boeing Company to train pilots. These simulators employ sophisticated computer and video systems to present realistic flight situations to trainees. procedures ranging from normal flight, to emergency situations, can be simulated to provide pilot-trainees with wery realistic, controlled practice environments.

into having aircraft. You uld never be al flight. In nave the shavior...I In the early 1960's, Bert Kersh and associates at the oregon State System of Higher Education's Teaching Research pivision, developed and conducted research using a sort of educational "link trainer." In this case, the simulation was designed to help preservice teachers develop competencies in classroom management techniques. Later, the simulation techniques were extended to "discovery teaching" as well.

luded blinkers which and enables edingly operators and , p. 2)

en used to ight simulator The Teaching Research program included the systematic study of three simulation packages over a period of more than eight years. Their first simulation effort was intended as a research vehicle, through which sufficient information could be obtained to develop further materials. This first simulation program, "Mr. Land's Sixth Grade," consisted of a comprehensive package including: (1) an orientation to the school and community, (2) individual tecords on each student, and (3) sixty problem situations presented life sized, on 16mm color sound films. Students

engaged in simulation training were placed in a room which was arranged to look exactly like an elementary classroom, complete to the teacher's desk and the American Flag. However, instead of facing a class of actual children, the "teacher" faced a large rear screen upon which a sixth grade classroom full of children, and problems, was projected. Whenever the "teacher" wanted to make a response, the film display was put on still frame, and the response was enacted in exactly the same manner as if in an actual classroom. On the basis of the "teacher's" response, a trainer/operator displayed another film showing the class' behavior either improving, or getting worse.

The Kersh group conducted many experiments on the original classroom simulator, providing important basic information for subsequent researchers. Results will be reported later in this paper. Toward the end of the 60's, additional simulations were developed and field tested. It was hoped that these "Low Cost" materials, dealing with classroom management and discovery learning techniques, would be widely disseminated. Instead of employing 16mm films, these simulations used a slide and audio tape format, with accompanying background materials. They were not developed or distributed beyond the field testing stage.

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Simulation

room which classroon, Flag. ildren, the a sixth grade rojected. e, the film e was enacted lassroom. On r/operator ior either

on the nt basic s will be f the 60's, tested. It ng with niques, ng 16mm tape format, re not g stage.

During the 60's others were also experimenting with the of simulation in teacher education programs. Vlcek (1966), and Girod (1969), experimented with Kersh's elassroom simulation materials in varied settings. Wynn (1964) examined simulations for teacher education using an Minbasket" technique. College students role playing elementary school pupils were the basis of simulations Mayeloped and studied by Dettre (1967) and Hershey, frumboltz, & Shepard (1965). Here, college students played the part of elementary pupils to give practice in "simulated" teaching. Like Kersh, Broadbent (1967), Cruickshank (1966), and Utsey, Wallen, & Belden (1966), used 16mm films to present simulated classroom situations. Broadbent's "Brockport Simulation" presented 32 teaching problems set in a fictitious community. Ten of the problems were presented via film, the remaining ones were written materials. The stimulus situations were intended to stimulate group discussions of possible responses. These materials were also used by Cruickshank (1966). Utsey, et al., (1966) used films of children reading to give students practice in assessing reading ability.

Peer teaching, or the use of college students to simulate elementary school classes, continued to be used and studied during the 70's. Emmer (1970) focused on elementary

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education situations; Lehman (1970) on the teaching of secondary school biology. Simulated situations presented through written problem descriptions were developed by Zuckerman (1979). Situations ranging from administrative tasks, to planning activities, to classroom management, were included. Participants received feedback from simulation leaders regarding the adequacy of their responses. Drawing from the work of his colleagues in the United States, Tansey (1970) developed successful simulation materials for a teacher education program at Berkshire College of Education in England.

Computer based simulations began to appear during this teacher period. Day & Parnes (1975) developed programs which exerciprovided teacher trainees with practice in making "pupil Comput behavioral interventions." Students interacted with a Strang computer which simulated the behavior of five handicapped simula students.

Another computer based simulation was marketed through discus the CONDUIT system. This program, called "School hands Transactions," was described as follows: "This series of by an simulations places a prospective teacher in a realistic teacher school setting and asks him to solve problems involving the op students, other teachers, parents, and administrators. Each regar, package includes three to five different simulations. Using

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Simulation

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ling of these simulations, teachers can explore the effect of a presented variety of teaching styles and strategies." (p. 18) The oped by aterials were designed to run on Apple Computers, and are nistrative. murrently available. igement, were

simulation so far, the 80's have brought interesting new Drawing sevelopments in simulations for teacher education. For ates, Tansey example, an entire graduate course in early childhood mucation was taught via an elaborate simulation (Harper, of Education 1980). The National Center for Research in Vocational Education, Ohio State University (1982), has developed various simulations for use in training vocational education during this teachers. Included in the materials are role playing exercises, in-basket, case study, and gaming materials. 1g "pupil computers continue to be used for delivering simulations. Strang & Loper (1983) describe a microcomputer based indicapped simulation program in which the teacher trainee, hereafter referred to as "T," conducts a lesson with four students whose names are displayed on a monitor. T questions, ted through discusses, etc., with students whose graphically designed hands pop up. The computer based simulation is controlled eries of by an operator who is a physically isolated from T. Each teacher-student interaction is coded into the computer by volving the operator. A terminal display directs the operator ators. Each regarding how to respond to the teacher. The pace of the Using

interaction is similar to reality, due to the fast program routine, and operator training. Following the lesson, the teacher is furnished with a hard copy printout of her/his "teaching profile," pertaining to relative amounts of information, positive affect, feedback, etc. Two, twenty the d minute sessions are included. Another microcomputer based Instr simulation for teacher education has been developed by techn Schieman & Winn (1983). Here, an incident is presented via can b video which is stopped at a decision point. The user is theor then provided with alternative responses. After a response class is selected and entered into a computer, a probable response based is shown. Later

Simulation

proce

Over the past 25 years, a number of different types of simul simulations have been incorporated into teacher education which programs. Both entire courses, and parts of courses have theor been presented via simulations. Techniques have ranged from the r in-baskets, to case studies, to role playing, to computer makir mediated simulations. Stimulus situations have been that presented in written, filmed, live, and computer formats. expl: Interest has remained high in spite of the rather great of st amount of time and expense connected with the development of the necessary materials. After review of simulation efforts during this period, one is left with the impression that the lear technique was continually used, but not on a large scale. parac

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Simulation

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rent types of ir education courses have ive ranged from to computer we been cer formats. ther great development of ilation efforts ession that the large scale. THEORY AND RESEARCH

Any instructional materials may best be developed if the design can systematically relate those materials to instructional theories. One advantage of simulation techniques resides in the extent and degree to which they can be related to major instructional and/or learning theories. For example, when Kersh first developed his classroom simulation materials in the early sixties, he based them upon a behavioristic, operant conditioning model.

Later, he changed his orientation to an information

processing framework as he further developed his simulations. This illustrates quite nicely, the extent to which simulation has potential connections with various theoretical explanations of learning. In this section of the paper, some of those connections will be illustrated by making them explicit. As a footnote, it should be added that space and time do not permit a fully extended explication of those connections. One or two major points of support will be identified for each position.

Briefly stated, operant conditioning theory explains e learning in a stimulus, response, stimulus (reinforcement) Paradigm. The relationship between the stimuli, responses, and subsequent reinforcing stimuli, represents the crucially important relationship: reinforcements should occur rapidly and on predetermined schedules to be most effective. Here simulations offer some special and unique training advantages. In a simulator, reinforcements can occur under conditions controlled by an operator/trainer. They can be given either in "real time," or on schedules that maximize their instructional effect. For example, in the natural setting, a reinforcement may not occur immediately, but if the simulation designer believes that it should occur riche away, this can be built into the simulation sequence. Further, because simulations can exercise students through repeated trials of any problem situation, continued and repeated reinforcements may be used to shape behavior. Correct responses may thus be rapidly and efficiently developed, thanks to the controlled nature of the simulation system.

Turning to information processing explanations of learning we now find an emphasis on the processes involved in the storage, retrieval, and subsequent use of information and learned skills in new settings. The informational value of "reinforcements" or feedback now becomes very important. In the case of the Kersh materials, the feedbacks provided by the simulator were originally regarded as simply

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the crucially meinforcing stimuli." Kersh came to believe, however, that occur tapidir he informational value of feedback was very important, and ctive. Here. weloped the idea of "controlled feedback." Now, through ning arcopts, cues, repeated trials, or debriefing, crucial n occur under information contained within the multiple feedback loops of They can be the ongoing instructional situation could be made apparent hat maximize to the viewer. he natural

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Cognitive approaches to the learning process emphasize the notion that learning stems from a basic reorganization if knowledge which occurs within the learner's cognitive structures. The resultant "insights" are characterized by me discovery of previously unknown relationships. Often, such insights can be facilitated when reality is distorted, ten situations can be presented in compressed time, or through other techniques which make new relationships quite Apparent. Simulations, with their capacity for time compression and other forms of reality manipulation, Movide unique opportunities for new perceptions of Mality. These can lead, upon reflection and thought, to the insightful discovery of new relationships and fundamental changes in the cognitive structure.

These illustrative examples of relationships between simulation and learning theory are indicators of the degree

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to which simulation can be designed to follow various theoretical constructs. Additional cases could be made for connections between simulation and other theories as well, for example modeling/imitation, social learning theories, neurological approaches, etc. Clearly, simulation offers a vehicle for instruction which can be studied and developed within the contexts of many theoretical frameworks.

We turn now to a review of the research conducted on the various forms of simulation employed in teacher education. This review will cover a twenty five year period between 1960; and 1985. The studies will be organized into three basic categories according to their major focus: (1) feasibility studies, asking the question: "can simulations be developed and operated for reasonable costs?", (2) presentation mode studies, asking the question: "in what form(s) so simulations work best, and (3) outcome studies, asking the question: "what kinds of measurable changes in student response result from the use of simulations?" The reader will recognize that, as in most category systems, some overlapping occurs. The studies cited will be confined to those conducted on simulations for teacher education. Exceptions will be made for reports summarizing large programs of simulation research, and a few, selected simulaton studies from other fields which, in my opinion,

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Feasibility

As one reviews the studies, it quickly becomes apparent that relatively few have focused upon the feasibility question: "Is it possible to produce adequate and reliable simulations for an acceptable cost?" During the late sixties, Twelker and associates at Teaching Research in gregon, set about to answer this question by developing and field testing two sets of simulation materials. Their objective was to produce "low cost" materials which could be used widely in teacher education programs. According to fwelker (1970)

The original "classroom simulation" materials developed by Kersh (1963) provided students with an opportunity to react in a lifelike manner to film sequences, and to experience probable pupil consequences. Although quite effective, these pioneering efforts were limited, in terms of the expense of materials and equipment, and the time required to train even small numbers of students. These limitations led to the development of "low cost" instructional simulation materials for use in teacher education programs. (p. 11)

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Two series of simulations were ultimately developed, the "Classroom Management Series," and the "Discovery Teaching Series." The classroom management series was field tested at ten sites scattered across the country. The Discovery series was not developed sufficiently to field test. Results, in the words of Twelker:

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... revealed that the Classroom Management Series requent left little to be desired in way of timliness and words (credibility. Designwise, improvements were indicated evalua that would be expected to have a significant, positive receiv effect on strength, robustness, reliability and affect qualit: created by the system. Data revealed that the had bematerials did not cause all students to reach expected comple proficiency, and affect was borderline in some cases. words The system was found to be manageable. (p. ii) all th

While the system did not prove to be as effective as hoped do." (or planned, improvements were indicated that were expected nlow s to have positive effects on the "strength, robustness, that t reliability, and affect" created by the system. Twelker Materi indicated that such changes would "not be impossible to test w perform," and that they "should not be ignored." (p. 102) In spite of this, however, no further changes were ever mate В upon the materials, nor were they redeveloped or simula this s disseminated.

veloped, the overy Teaching field tested at Discovery Id test.

int Series liness and /ere indicated .cant, positive .ity and affect nat the reach expected .n some cases. p. ii)

tive as hoped were expected bustness, m. Twelker bssible to L." (p. 102) were ever made or

Thirteen years later, in 1983, Schieman and Winn reveloped and field tested three simulations: "Music," "management," and "Counseling." Critical incidents were eresented via an interactive videotape system. After viewing a stimulus situation presented by videotape, the student entered a response into a microcomputer, and a video requence showing a probable response was presented. In the words of the authors, "... the results of the formative evaluation were very encouraging. All three simulations received high ratings on attitude, realism and technical quality." (p. 330) After the development of the materials had been completed, they were evaluated once more as complete packages by an external evaluator. Again, in the words of the authors "...we were pleased to conclude that all three simulations were convincing, well liked, and for the most part successful in achieving what they set out to do." (p. 331) Some limitations were noted with the relative slow speed of tape access, and a few participants indicated that they would have preferred more interaction with the Materials. However, in general the findings of the field test were positive and encouraging.

Buehning and Schieman (1983) developed a classroom Simulator for music teachers. As in the previous study, this simulation was presented through an interactive video

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tape format. Speaking to the feasibility question, they reported:

An evaluation conducted by an outside examiner revealed its effectiveness and indicated that the strategy can and should be an integral part of teacher training programs. This project demonstrates that available technology can be used to structure and deliver instruction in human interaction. (p. 55)

Related to the question of feasibility is the matter of the time required for students to complete simulation training. Simulations have been criticized on the grounds that they take more training time than "conventional" instruction. Coleman (1973), in summarizing the Hopkins Game Research, revealed that indeed simulation training does take more time than instruction using an "information processing" (more conventional) approach.

If simulations can be designed to reduce training time then their feasibility is enhanced. Two studies of classroom simulation have directly investigated this question. In the first study, Twelker (1965) found that prompts made simulations more efficient, in the second study

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girod (1969), comparing audio tapes with filmed versions of simulated materials, found that the training time was reduced using the audio tape version. These data suggest that simulations can be designed for reduced instructional time, thereby increasing their feasibility relative to other instructional modes.

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raining time, s of this ound that second study In at least two cases involving simulations developed for teacher education settings, Broadbent's "Brockport" simulation (1967), and the Conduit simulations (1985), materials have been disseminated through commercial publishing houses. Although no experimental test of feasibility can be reported on these materials, one assumes that their continued availability through private, for profit concerns, demonstrates cost effectiveness.

In summary, we would note that while the early attempts toward "low cost" simulation by Twelker and associates was not successful, subsequent simulations have been successfully developed and disseminated. Simulations have a potential for efficient instruction, with the most recent versions, based on interactive video formats, showing particular promise for continued low cost development.

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Presentation Modes

A number of studies have sought to compare various alternative methods of presenting simulations in teacher education. Girod (1969), compared film and audio tape versions of classroom simulation materials dealing with classroom management. He found that the audio tape version required fewer learning trials to criterion, but his subjects generated a greater number of errors in responding. In another comparative study, Hershey, et al. (1965), conducted an experiment designed to look at the effects of observations in a real class, compared with simulated teaching (students teaching other students) on: course grades, final exam scores, attitudes, career plans, ability to apply psychological principles, and general course satisfaction. While he found no significant differences between his training conditions, his subjective evaluation was that the live observations had a more general benefit, while the simulations were better suited for the development of particular, specific skills.

The degree of fidelity that is optimal for effective simulations has been a question of interest to several researchers. Guetzkow (1962), in summarizing simulations developed in military settings, concludes that "In general (these) experiments ... show that high fidelity simulations ... are not necessary for high positive transfer." (p. 40)
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one of the more systematic investigations of the effects of fidelity in simulations was conducted by Bert tersh (1965). Kersh studied the following dimensions of what was called "realism:" (1) image size: life sized vs. email (2) feedback mode: visual vs. verbal (3) response mode: enactment of responses vs. verbalization of response, and (4) orientation to simulation: large life sized projections vs. small projections. Various combinations of simulation conditions were tried, ranging along a dimension labelled "realism." The most "realistic" training conditions were those in which the trainees received life sized projected materials during their orientation sessions, and enacted responses to life sized projections of problem situations. At the other extreme, students receiving "non realistic" training had an orientation consisting of small images, then responded to situations presented by slides, on a small screen, by verbally describing what they would do.

effective everal mulations n general, imulations " (p. 40) Students undergoing simulation training under varying conditions ranging from "nonrealistic" to "realistic" were compared in terms of performance on a post test consisting of response quality to simulated situations. Kersh found no significant differences on most of the variables he examined, with the exception of the large versus small sized projections for orientation. Here, he found a slight difference in favor of the small sized "nonrealistic" mode.

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His overall conclusion was that "realism" was of relatively In minor importance. An interesting sidelight to this study realism was that further analysis uncovered the fact that all to some subjects were able to achieve the same level of performance not been regardless of entry level. It appeared that simulation to date could have equalizing effect in bringing students with with simulat widely varying backgrounds to similar levels of attainment. related form of

Using the Kersh materials, Twelker (1965) investigated underli the effectiveness of various types of prompts given to "cognit subjects as they proceeded through simulation training. In this study, two types of prompts were compared to It training with no prompts. In one treatment, subjects were prompti given prompts which would help to identify the problem demonst presented in the simulated episode, in the second, subjects present received prompts which would help them generate a correct simulat fidelit response. The prompts were of a general, rather than specific nature. Training including one or both types of importa process prompts was compared with that in which no prompts were presented. Dependent variables included training session At length, post test performance, and affect. Twelker found that "problem identification" prompts had unmeasurable outcom outcom effects. The "response" prompts had the effect of of the shortening the time necessary for trainees to reach Will b criterion.

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of relatively In summary, it's not surprising that dimensions of this study malism have been studied. It may, however, be surprising hat all to some, that the "realism" or fidelity of a situation has f performance not been demonstrated to have universally any strong effects imulation to date. Perhaps the important "reality" factor for those nts with with inulations designed to develop cognitive abilities is less f attainment. related to the form of the stimulus materials than to the

form of the essential decision-making dynamic which investigated inderlies the simulation process. To my knowledge, this jiven to "cognitive realism" has not been explored. raining.

It is also not surprising that some varieties of bjects were prompting would be effective in view of the value they have demonstrated in other media-related studies. Insofar as nd, subjects presentation variables are concerned, research on "classroom a correct simulation" to date would seem to indicate that the fidelity of the presentation materials may not be as h types of important as variables related to the instructional process, such as prompting.

Cognitive Outcomes

At this point, let us turn to studies focusing upon the outcomes of simulation training. Three broad categories of Outcomes will be considered. In the first, the lower levels of the Bloom (1956) Taxonomy, "knowledge and comprehension" Will be emphasized. The relevant question here is whether Simulations can teach students facts, principles, and

responses. The second level, which roughly corresponds with respo the "analysis" level of Bloom, deals with outcomes related 11965 to the discrimination of cues, and the identification of able problems. Finally, the third category will be concerned exhib with those studies which have explored the extent to which probl simulations have led to Bloom's "application" level, or be cc transfer of what was learned into actual classroom settings It is perhaps this latter category which is the most important, because it speaks to a major reason why be re simulations are claimed to be used: to increase one's theil ability to respond appropriately in actual settings. in te Perhaps this is why the great majority of the studies deal Stude Iden with the application, or transfer question, a comparatively smaller number deal with knowledge and analysis.

(196 We begin our review with a consideration of those disc studies which have looked at the Bloom "knowledge and Howe comprehension", levels. Cherryholmes (1966) after reviewing simu six simulation studies, rejected the hypothesis that deve students would learn more facts, and retain them longer tra: using simulations as compared with "conventional classroom prol activities." Coleman (1973) reported contrary findings in cla: that he found that students using simulations had an increased ability to learn facts.

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When we turn to the matter of learning specific Onds with responses, the data are more clearly positive. Both Twelker related (1965, 1970) and Kersh (1965) reported that students were on of which problems novel to the students, these post tests could also , or be considered as tests of transfer as well.

settings.

's . es deal ratively Moving up the Taxonomy to "analysis," five studies will be reported. Kersh (1965), and Twelker (1965), found that their original classroom simulation materials were effective in teaching students valuable cue discrimination skills. Students were able to pick out the information necessary to identify the problems which were presented.

ose nd reviewing : ger ssroom gs in Similarly, using variants of the Kersh materials, Girod (1969) reported that his subjects were increasingly able to discriminate cues necessary to identify simulated problems. However, in contrary findings, Vlcek (1966) reported that simulation did not demonstrate any greater ability to develop problem identification skills when compared with no training at all. This was true regardless of whether the Problems were presented via simulations, or in actual classrooms.

This brings us to the studies which have explored the simulat applicability, or transfer of simulation training to actual Indicat settings. Kersh (1965), investigated the transferability problem of simulation training to actual classroom practices. found t Unfortunately, he had to abandon his attempt to answer this simulat question because: (1) there was a one year interval between problem the time his subjects received simulation training and when problem they were in actual teaching situations, (2) he had no particu readily available instrument through which he could measure s blues simulation's effects in a classroom, and (3) he had no control group against which his simulation trained students Us could be compared. Although he was unsuccessful in student measuring the extent of transfer, he did circulate a new sit questionnaire to supervising teachers which revealed that report: students having had simulation training were judged as being simula: able to take over classes weeks earlier than students who be was had not received such training. classr

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In a field test of Kersh's materials at Michigan State University, Vlcek (1966) reported that students undergoing simulation training, as opposed to students having no such

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cimulation," Broadbent (1967) reported informal findings indicating that simulation students developed increased ecoblem solving abilities. Likewise, Ryan (1965, 1968) found that when students solved problems presented via simulations, they exhibited an increased ability to solve problems in real settings. She concluded that practice in problem solving under realistic conditions should be given, particularly in specially created situations where students could apply their newly acquired knowledge.

ined students Using the Kersh materials, Twelker (1965) found that students were able to learn and apply correct responses to new situations presented via simulations. Later, in reporting the results of his field testing of the "low cost" simulation materials, Twelker (1970) indicated that although he was not able to demonstrate that his system changed the classroom behavior of student teachers, he was encouraged enough to speculate that:

> It is heartening to note that the research of Forgan (1969) supports the intuitive hunches that simulation bridges the gap between the textbook and the operational situation. In fact, the ability of the system to change behavior in the classroom leads this writer to speculate that the objectives stated in

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Chapter II may be too rigid ... and should be relaxed... (p. 101, 102)

Emmer (1970) studied a peer teaching simulation experience to see if benefits would transfer to the teaching of actual pupils. He determined that transfer did indeed occur. Similarly, Zuckerman (1979) investigated transfer with his simulation program called "Hey Teach." Preservice teachers were given practice in four areas: (1) administrative tasks, (2) planning tasks, (3) implementation of instruction, and (4) classroom management. Informal reports from supervising teachers were that students who had received the "Hey Teach" program were better able to handle real classroom tasks.

Although the following study did not specifically deal with simulations used in teacher training contexts, they are included here because of their great general value. Both Coombs (1978), and Coleman (1973), summarize the long term, systematic research program in simulation/games carried on by the Center for Social Organization at Johns Hopkins University. After reviewing this extensive body of research, Coombs (1978) concluded that: (1) simulations can transmit factual information, but not better than other modes, (2) simulation does not seem to be a particularly

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good way to teach cognitive skills, (3) simulation games alter the character of a class in a positive manner, and (4) simulations improve the motivation of students.

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ons can her arly In summary, we find that when simulations are used to instruct students in factual information, the evidence is sixed regarding their effectiveness. However, indications are that simulations can develop the capacity of students to give specific responses. Similarly, although by no means overwhelming, the experimental findings suggest that simulations can be successful in teaching problem identification skills. Turning to transfer in problem solving, we find most of the studies indicating that simulation is effective in leading students to greater problem solving abilities.

Affective Outcomes

Affective responses to simulation training have also been widely studied. These fall into three categories: (1) attitudes toward the simulation instruction, (2) attitudes toward the subject of the simulation, and (3) attitudes toward self.

With regard to attitudes toward simulation instruction, in his review comparing six simulation studies with

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"conventional classroom activities," Cherryholmes (1966) asserted that students participating in a simulation exercises showed more interest in instructional activities, and more readily had significantly altered attitudes.

Cherryholmes' findings were later confirmed by their Cruickshank (1966), who, after studying forty students a sim receiving 31 simulated critical incidents during the first parti two weeks of student teaching, reported that students artic reported greater satisfaction and ability to cope with game, teaching problems and preferred the (simulation) laboratory exerc to starting student teaching two weeks earlier. altho

Similarly, Broadbent (1967) reported that students who had completed his "Brockport" simulation program rated it favorably, and "learned about themselves, their methods of al., reacting to attacking problems, and their relationships to "simu students." (p. 42) conc

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Reporting contrary findings, Twelker (1970), found some difficulties with his low cost simulation materials in their ability to hold the interest of students. He concluded that enti "The ability of the system to attract and hold the interest seve of the target audience seems marginal." (p. 99) However, he stud

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(1966) also noted that attitudes were not unfavorable. "It could be on concluded that although there is room for improvement, tivities, affect was not negative." (p. 99) les.

Buehning and Schieman (1983) concluded that through their classroom simulation for music teachers, "we produced lents a simulation that was both highly motivating for the he first participants and instructionally meaningful." (p. 55) In an article entitled "Changing Attitudes with the 'School With game,'" Plummer (1973) reported that this simulation aboratory exercise "generated positive affect." (p. 46) However, although the students seemed to enjoy the exercise, they did not view it as one which provided learning.

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In agreement with most of the research, Hershey et al., (1965) measured student affective responses to "simulated" teaching (students teaching other students), and concluded that student satisfaction with the course was enhanced through simulations.

found some s in their luded that interest wever, he

Harper (1980) took the novel approach of teaching an entire graduate course through simulations. He noted Several advantages, among which was a "high degree of student involvement." Moreover, he reported that his students rated the simulation course over lecture versions.

However, he also noted that some individuals were very store ot critical of the simulation course.

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A study by Bond (1965) investigated the effects of reported classroom simulation on the attitudes of education majors simulati toward topics in educational psychology. He reported The general, the findings of the project are not sufficiently In conclusive to permit any clear cut recommendations of points procedure on the use of simulation to influence attitudes a mulat education majors toward professional course content." favorab (p. 17) However, he also indicated that informal statements sonewha of evaluation justify continued research in the area. extend

In his evaluation of the Hopkins Game Program, Coleans psychol (1973) concluded that students undergo a change of attitude develop toward the real life persons whose roles they assume in the positic simulation. This change of attitude is positive, but may be self-ku short lived. The more concrete the simulation game, the traini more strongly the attitude change effect seemed to be.

Two researchers found an enhancement of a student's B self confidence as an effect of simulation training. Vices some i (1966), using Kersh's materials, found an increase in the studie self confidence of student teachers. Similarly, in a much Many 1 more recent study, Schieman and Winn (1983) reported that

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mong other advantages of their system, students had increased confidence in their teaching ability. Finally, studies by both Broadbent (1967) and Hershey, et al., (1965) reported increases in student "self knowledge" coming from eimulation training.

In summary, I report that the overwhelming evidence coints to a high degree of student satisfaction with attitudes of simulaton training. With few exceptions, students report favorable attitudes toward simulation. The studies are . statements somewhat less clear on whether these favorable attitudes extend to entire courses, subject matters, and even perceptions of subject content areas such as educational psychology. Simulations do appear to have the potential of f attitude developing favorable attitudes toward any roles and ume in the positions simulated. Finally, students report increased but may be self-knowledge and self confidence accruing from simulation training.

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Conclusions From the Research

Before any conclusions can be drawn from these data, some important qualifications should be noted. First, the studies cited represent a mix of methodological approaches. Many reported findings are "informal." Furthermore,

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although classroom simulation has been studied in several different contexts, few efforts have been attempted to systematically, and over a long term, investigate variation connected with the technique. For these reasons, any conclusions must be viewed as tentative, certainly not definitive. With these reservations noted, I list the following preliminary conclusions:

Simular

- Simulations have the potential of developing the capacity of students to learn specific responses given situations.
- Simulations have the potential of developing the capacity of students to identify and solve problems.
- 3. In the design of simulation, factors related to a physical fidelity of the materials to the physic situation may be less important than the degrees which the simulation models and exercises studen in realistic problem solving processes.
- 4. Simulations are costly to produce, but do have a potential for efficient, low cost applications, particularly when delivered via interactive vide formats.
- 5. Students enjoy simulation exercises.
- 6. Students report higher levels of self understand

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RATIONALE

We have seen that simulations have been successfully

employed in many different teacher education applications.

Materials can occur within a framework drawing upon several

We have also seen that the development of simulation

and greater confidence after receiving simulation

After reviewing the studies of simulations used in

macher education, my overwhelming impression is that many

pre questions are raised than are answered. Some of the

mestions for future research will be given in the final

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ted to the physical degree to students have a

ions, e video learning and instructional theoretical perspectives.
Finally, the research conducted to date, while spotty and
incomplete, does suggest that simulations can be used
successfully in the development of higher level cognitive
abilities, notably problem solving, and that simulations are
viewed favorably by students.

standing

In his now classic work entitled "Readiness for Learning," Bruner(1960) characterizes the instructional Process as proceeding through three phases: acquisition,

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transformation, and evaluation. Briefly, acquisition concerns precisely what the name suggests, the acquisition usulat of information. This correlates to the lower two levels of the fac the Bloom (1956) taxonomy. During this phase, the emphasis foundat is upon the gathering, storage, and retrieval of actual information. In "transformation," learners "manipulate" reviewi knowledge to make it fit new tasks. In terms of the Bloom aducati taxonomy, operations such as "analysis," "synthesis," and precise "application" occur. Finally, during the phase of employe "evaluation," learners judge whether the way they have manipulated information is adequate to the task. This corresponds with Bloom's "evaluation" level. Bruner inserv: indicates that "in the learning of any subject matter, teache: there is usually a series of episodes, each episode procedi involving the three processes." (p. 421) simula

In which of these phases might simulations most approp properly be employed? The answer is not absolute by any simula means, because simulations have been used to support all three. However, it is in the "transformation" and м "evaluation" stages, that the greatest degree of success has initia been attained. At least, the literature discribing uses of althou simulations in teacher education contexts would suggest Succes this. Simulations seem particularly suited to providing educat practice in cue discriminaton, and problem solving.

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onput in the context of preservice teacher education,isitiaisulations might best be employed then, as a bridge betweenevelsthe facts, principles, and skills learned in educationalemphasicfoundations classes, and the experience of serving in anictual classroom as a student teacher, or intern. Inate*reviewing the applications of simulations in teacherBlocneducation, it is not surprising to find that this is* andprecisely the point at which most simulations have beenexployed.

Simulations are useful not only for preservice, but inservice teacher education as well. Here, practicing teachers may have opportunties to try out new instructional procedures, and sharpen their discriminatory skills in simulated settings. Again, the "transformation" and "evaluation" phases as described by Bruner seem to be appropriate points in the learning process to employ. simulation.

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Might we conclude that simulations have no place in the is has initial acquisition of information? Not necessarily, s of although few, if any, examples of the technique being successfully employed in such settings, at least in teacher education programs, seem to exist.

Turning to the design of simulations, we find that

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their optimal format seems to be related to the nature of the objectives connected with instruction. At least in teacher education, we have some evidence that high degrees of fidelity of stimulus situations may not be as crucial a factor in designing successful simulations as faithful replication of problem solving processes. Therefore, "reality" may be presented via small screens, and subjects may not be required to act out their responses as if in the actual situation. Insofar as the problem solving process is exercised, simulatons might be successfully presented by video and require verbal or written responses.

It is important to note, however, that the episodes must be believable, if not projected in life sized images. Believability requires that the problems be realistic, that possible decisions be reasonable, and that sufficient information be available for decisions to be made. Furthermore, the feedback to the learner must be such that there is little question that such feedback would indeed occur in the real situation. It is, then, the integrity of the materials which is most important. The integrity and "reality" of the decision making process which seem essential for a successful simulations.

As is true for most instructional materials, the

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nature of east in gh degrees crucial a ithful fore, i subjects i f in the process tesented by

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such that indeed tegrity of rity and em maluation of simulation training systems should include stb cognitive and affective elements. In the cognitive mea, any factual material which is presented, and which the modent is required to remember, should be measured to see if it is presented in a clear fashion. Similarly, if cue discrimination is an objective, this should be measured as well. Most simulations are designed to exercise students through problem solving strategies, so the degree to which the materials develop problem solving skills should be musidered. A simulation is supposed to lead to improved performance in actual situations, so tests of transfer to ktual settings should be included in most evaluations of unulation training. As in virtually any training package, itention should be paid to the objectives when designing maluation instruments.

Similarly, affective outcomes should be a part of Megular evaluation. Here, the student's attitudes toward the Mimulation training situation, and toward the general disciplinary content should be monitored.

The feasibility question becomes important in many, if bot most, applications of simulations. The costs for developing and operating simulations should be monitored, with procedures and techniques for reducing them thoroughly taplored.

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A CASE STUDY

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Last winter, I set about to develop some simulation materials for use in the preservice teacher education program at Seattle Pacific University. It was, and remains, some my hope that a continuing, systematic program of research and development in simulation will be undertaken at Seattle is Twelk Pacific, and that the present materials represent the very first beginnings of that program.

This case study will summarize the development of a lassrool prototype classroom simulation system, from initial arlier (development, through field testing. It is hoped that it invelopm. will serve to illustrate, in a concrete way, the way in w used ' which simulations can be developed and used in higher wre des educaton. This account will be given in five parts: (1) a fellowin description of the background situation, (2) questions Hudents standard to be answered, (3) a description of production techniques, (4) a description of the field testing, and stould e Tiolate (5) the results and conclusions.

The situation.

The materials were developed for use at Seattle Pacific inon-di University, an independent institution enrolling the rule approximately 2500 students, located in Seattle, Washington. Nould :

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mecifically, the simulations were developed for use by reservice Education students engaged in their internship wodram. The content of the simulations was focused on lassroom management techniques for two reasons. First, it as determined that this was an area in which interns could as some additional training, and second, I had access to me classroom management principles which had been developed br Twelker's "low cost" simulation package described arlier. These classroom management principles had beed gveloped after a careful review of the literature, and represented a thoughtfully developed, systematic approach to dassroom management. I secured permission to use the wrlier content materials virtually intact. Much saving in development time was thereby attained, as this content could Me used with little modification. The simulation materials were designed to exercise students in the use of the following three principles of classroom management: (1) If Hudents are about to begin an activity where rules and standards of conduct have not been established, the teacher Mould establish such rules and standards; (2) When students Fiolate the rules and standards in ways that are not disruptive of others in the class, the teacher should act in a non-disruptive manner; and (3) When students are violating the rules and standards in a disruptive way, the teacher should act with enough forcefulness to end the disruption.

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The University had acquired several interactive video stations, consisting of Apple and IBM microcomputers connected to Panasonic AG 6200 videotape recorder/players. In addition, the Professional Authoring Software System (PASS) developed and marketed through the Bell & Howell Company was available for software development. The PASS materials allowed the development of branching computer managed instruction programs, incorporating video sequences.

In addition, the University had half inch, VHS format Th the sim video recording and editing equipment available through its worked, Instructional Media Center. I was experienced in the use of laving this equipment, having produced a number of video programs mteria for educational use in the University. Further, I had becaus∈ access to a fifth grade classroom, as one of my graduate asount students volunteered her class for the taping.

Ouestions to be answered

from st In developing the materials, I had three different include kinds of objectives. The first, and most important, was to determine the degree to which the equipment and software would allow the development, and reliable delivery of simulations through an interactive video format. These feasibility considerations could be stated as:

1. How much will it cost, in time and materials, to develop the materials.

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video	2. Will the PASS software allow the degree of
1 Street	flexibility necessary for successful simulations?
ayers.	3. Will the interactive video system be sufficiently
tem	reliable to allow the materials to be used in
'ell	an individualized mode?
PASS	4. Will the instructions and procedures be
ter	clear and manageable for students to proceed

independently? quences.

2.

training?

format The second type of question related to the content of the simulations. If the hardware and software systems ugh its wrked, would the students gain anything of value from e use of laving gone through the simulation training? Because the ograms Mterials which were developed were experimental, and because only four episodes were included, the relative uate mount of training in the content was rather limited. How such cognitive learning of the materials could be expected from such materials? Specifically, the relevant questions included: was to

1. Will the students "discover" and apply the

classroom management principles as they

Will the students be able to state the

principles of classroom management two

weeks after they have completed simulation

interact with the situations?

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The third and final question concerned the question of affective student response to the simulation training. Specifically, it was: Do the students enjoy participating in the simulation exercises?

Production of the materials

Production of the prototype materials proceeded along the following stages: outline of content, flow chart, scripting, taping, video editing, CAI authoring, and initial test.

Outline of Content: It was decided that the materials the stud would have two main sections. In the first, an introduction requence to classroom simulation project would be presented on video response in the form of a mini-lecture. Here, the students would be informed about the general content of the package (classroom choices management), and would be introduced to the concept of simulation delivered via interactive video. In

In the second section, the students would engage in the video. simulation itself by responding to four simulated classroom tape, t incidents designed to give them practice in using the video s classroom management principles. First, a stimulus situation would be presented via video, with the "stage <u>Flo</u> being set" through audio overdubbing. After the problem had vil of been presented, the computer would direct the student to flow ch

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uestion of ning. cipating in

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materials .ntroduction ed on video :s would be (classroom ept of prerate a response: "What would you do in this situation?" pter the student had responded, the computer would display mitiple choice options, asking the student to match the response they had made with one of the choices. After mking the choice, a video sequence would be displayed mowing the probable student response to that choice. following the video sequence, the computer would deliver a text screen interpreting the feedback sequence to the student. If the response was correct, the student would move on to the next episode; if the response was incorrect, the student would be re-cycled through the original problem sequence again. Re-cycling would continue until the correct response was selected. It is possible that students might so through any episode as many as four times, as four choices of response were given.

gage in the classroom the us "stage

problem had dent to In the final section, the principles would be summarized in the form of another mini-lecture delivered via video. In addition, the student was directed to rewind the tape, turn off the equipment, and prepare the interactive video station for the next user.

<u>Flow Chart</u>: A flow chart was developed, illustrating all of the branching possibilities. Please refer to the flow chart in the appendix.

Scripting: A script was developed for the introductory thereby s and final mini-lectures. The content was taken directly reedback from the "low cost" simulation materials. No scripts were follow th case of t prepared for the simulation episodes. Rather, general response descriptions of situations were prepared.

Taping: On the appointed day, the simulation stimulus following situations, and the feedback sequences were videotaped in an actual fifth grade classroom. The children did not memorize studied scripted material, rather, the situations were described and mterial they were asked to respond "naturally" as if the situation "nonprom had actually occurred. If anything was said, they were faster t directed to make responses in their own words. I was was nece directly involved in the filming of Kersh's classroom version simulation materials in the early sixties, and remembered screens, that in that situation, the approach described above proved in a le: to give the most natural appearing sequences. The technique worked satisfactorily again, most individual sequences were taped in fewer than five takes, many requiring only one or two.

Video Editing: After the situations were taped, the mini-lectures and the situations and feedbacks were edited to a VHS format tape which would be used in the interactive video simulation program. To minimize tape travel and

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sereby save time of video access, the most probable roductory reedback sequences should have been edited to imediately lirectly fellow the relevant stimulus situation. However, in the ipts were use of the prototype materials, no basis for judging which neral response would be most probable could be determined. merefore, the "correct" feedback was placed immediately following the stimulus situation. stimulus

CAI Authoring: The Bell & Howell PASS system was ot memorize studied and learned in sufficient depth to create the scribed and sterials. This authoring system has a "prompted" and situation "nonprompted" versions, the former being somewhat easier and y were laster to learn. In the development of the materials, it Ms necessary to learn the procedures of the "nonprompted" Mersion to complete the necessary programming. Text membered greens, and branching commands were developed and entered ove proved in a lesson called "CLASS." e technique

i, the e edited teractive and

ences were

ly one or

Initial Test: After the CAI and video materials were eveloped, they were combined for a first trial. In a dissapointing turn of events, the system failed to start and Stop the video sequences at the correct points. Initially, the tape had been edited to have an approximate five second Window" at the beginning and end of each sequence. It was Mought that this would be sufficient to correct for error

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in tape addressing. Unfortunately, this assumption proved to be incorrect. The tape was re-edited to have a fifteen second black segment at the beginning and end of each sequence. This proved to allow enough time for address error.

It became apparent that the error of tape addressing was a cumulative one. That is, each error was added to the next, so that after several stops and starts of the tape, the error became large enough to render the video unusable. This was corrected by having the video sequences automaticaly re-calibrate themselves after two episodes. This procedure, while making the video segments more accurate, had the disadvantage of creating a lengthy wait period for students while the calibration process occurred. In spite of the necessary adjustments of the system, a satisfactory prototype set of materials was finally completed.

Field Test

An Apple/Panasonic interactive video station was moved to my office so I could observe, at close hand, how the system worked as individuals interacted with the materials. A sign up sheet was prepared with time slots for twenty students. Interns were encouraged, by their supervisor, to sign up for the simulation sessions and met some optional

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on proved to fifteen "polunteers" signed up for the simulation sessions.

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o unusable.

When they arrived, the materials were described in general terms, then the students were directed to proceed. Mey were also encouraged to ask questions at any time, and powrite comments on the written response forms. I made syself available for easy access to the students as they engaged in the simulation materials. Their verbal comments were recorded for later analysis. All of the students completed the simulation training.

pisodes. nore gthy wait s occurred. tem, a Results and Conclusions

A number of questions were posed at the outset of the development of the prototype materials. Results will be reported in terms of these questions.

 How much will it cost, in time and materials, to develop the materials.

was moved ow the materials. twenty rvisor, to optional It took approximately 100 hours to develop the materials to the prototype stage. However, it should be noted that no time was required for content development as the "low cost" materials were adapted to the current project. costs of developing the materials were, of course, related to development time. In addition to this, material costs for tape, diskettes, paper, supplies, etc., was approximately \$50.00. For

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those interested in costs of hard	ware and software prelimin
already on hand, it is estimated	that the total cost to "disc
for necessary hardware and softwa	are, including the four epi
video equipment, and assuming one	interactive video proved t
station, amounts to approximately	\$15,000. a number
2. Will the PASS software allow the de	gree of flexibility content
necessary for successful simulation	situatio
The PASS software did permit adequ	ate flexibility to subseque
develop the materials. Limitation	is were noted not in f. Will the
the CAI software, but in the natur	e of the interactive classroo
video tape system.	simulati
3. Will the interactive video system b	e sufficiently Testin
reliable to allow the materials to	be used in an for Fe
individualized mode?	1. Do the s
No reliability problems occured wi	th the field test. exercise
The equipment operated flawlessly.	No form
4. Will the instructions and procedure	the mat
manageable for students to proceed	independently? satisfa
Instructions and procedures were	clear enough for most they co
of the students to follow. Some	minor changes in
wording were indicated. Few ques	stions related to the I cond
instructions or procedures were n	noted. Successful
5. Will the students "discover" and ap	oply the classroom time "wast
management principles as they inter	act with the Froblem mag
situations?	taterials

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51 reliminary indications were that students were able software "discover" and apply the principles on three of the total cost four episodes. In one case, the stimulus situation uding the proved to be too ambiguous to elicit a response in a tive video a number of cases. This is not a fault with the flexibility content, but rather with the way in which the stimulus situation was presented, and can be corrected in subsequent versions of the materials. ibility to oted not in will the students be able to state the principles of classroom management two weeks after they have completed interactive simulation training? iently Testing for knowledge of the principles is scheduled in an for February, 1986.

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7. Do the students enjoy participating in the simulation exercises?

No formal measures were taken of student affect with the materials. However, most of the students indicated satisfaction and enjoyment in unsolicited comments as they completed the materials.

I concluded that the The prototype materials were Successful. The major difficulty with the system was the time "wasted" while the video segments were located. This Problem may be corrected by including provision in the Materials for the students to be doing something,

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responding, reading, etc., while the video sequence is located. In this way, these interruptions in the flow of the lesson can be minimized.

FUTURES

The main limitation of the interactive video system described in this paper relates to the fact that the video is tape based. Random access video disc would eliminate most, if not all of the problems of inaccurate tape access, and tape transport time. However, at the present time, production of video discs is very costly and not within the means of many potential local producers, including myself. Promising developments in video disc technology indicate that production costs may, in the near future, become low enough for local production of the type described in this paper, however. In my opinion, the advent of low cost video disc production will lead to significantly improved interactive based simulation systems.

Perhaps of greater importance than hardware refinement will be the growth of a research base from which effective and efficient simulations can be specified and designed. Is reviewing the research literature on simulation in general, and teacher education applications in particular, I was

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eo system t the video eliminate tape access, nt time, t within the ing myself. indicate rssearch programs, such as those conducted by Johns Hopkins in game research, and Teaching Research Divsion of the pregon State System of Higher Education's classroom simulation research. I would agree with Tansey (1970) that "later workers (in simulation) owe a debt to Kersh, Twelker, and Cruickshank." (p. 300) This is not to deny the value of individual experiments, because they do provide relevant and useful information. However, it is when variables are systematically explored, when experiments can be replicated, and when complex interactions among treatments and subjects can be explored in repeated studies, that the much valuable and reliable information can be gained.

moressed by the value derived from longer term, systematic

With this sort of programmatic effort in mind, I would in this propose a research agenda in which variables are w cost video systematically explored as follows. Variable categories, we with three illustrative examples are provided.

Stimulus variables

refinement effective esigned. In in general,

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- * Value of positive vs. negative examples.
- * Value of various types of prompts and cues provided at various points in the simulation.
 - * "Realism" fidelity of the simulation to the underlying cognitive processes being simulated.

Response variables

Simulation

- * Individual vs. group response
- * Real time vs. delayed, contemplative response
- * Constructed vs. selected responses. Sequencing variables
- * Simulations location within larger instructional systems: beginning, middle, end.
- Optimal length of simulation training related to larger instructional system.
- * Value of simulation for "acquisiton," "transformation," and "evaluation" phases of the learning process.

Content variables

- * Ability of simulations to facilitate attain cognitive outcomes at all levels of the Bloom Taxonomy.
- * Ability of simulations to effect attitude change.
- Relationship of varying simulation techniques to varying content areas.

Subject variables

- Effectiveness of simulations with varying learning styles of students.
- Effectiveness of simulations with varying ability levels of students
- * Effectiveness of simulations with students posessing varying amounts of background information in a given subject.

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General variables

- * Effectiveness of simulations used in connection with group vs. individualized instruction.
- * Effectiveness of simulation used in inductive vs. deductive instructional sequencing.
- * Effectiveness of simulations used in connection with other, specific instructional approaches.

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Variables such as those suggested above, should be investigated individually, and in experiments designed to examine interactions among them. A thoughtfully developed research agenda, particularly one which followed a particular learning and/or instructional theory, conducted over an adequate period of time, would provide significant cognitive benefits for future developers of simulation materials.

> The simulation technique has shown itself to be an effective training mode, in some situations uniquely Valuable in achieving cognitive and affective outcomes. With increasingly affordable and sophisticated hardware and software, this approach promises to add much to our ability to develop effective instructional programs. A systematic, long term research effort will help future developers to use Simulations in their most effective and efficient manner. It is interesting to note that, in a recent address to the

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Harvard Board of Trustees, President Derek Bok (1985) waxe	4
eloquent about the potential benefits of simulations in	
promoting "active learning" in higher education. Simulati	sloom, B
is an educational technique whose time has finally come.	hand
Let us exploit this valuable instructional technique to it	sok, D.
greatest that we may be of greatest service to our student	Har
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'ASSUMES



IITLE: "NEWSCAST FROM THE PAST": A DYNAMIC NEW TU SERIES WITH A GLOBAL PERSPECTIVE ON WORLD HISTORY

AUTHOR: DREW TIENE

"Newscast From the Past": A Dynamic New TV Series with a Global Perspective on World History

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Drew Tiene

Kent State University

What if you had a special television set that you could turn on to see Joan of Arc in full battle regalia leading the French into battle, or Galileo sighting the moons of Jupiter in that new invention the telescope, or Martin Luther arguing with Church authorities about the sale of indulgences? Would you tune in?

grom t) Few would be able to resist such an opportunity to format peer into the past. The closest thing to such a device period is currently available to teachers on the "Newscast From the sore si Past" television series. The Black Death sweeps across the sc Europe, Gengis Khan's barbarians terrorize the peoples of histor Asia, Copernicus proposes the radical idea that the sun is the center of the solar system, Hernando Cortez marches upon Public the mighty Aztec Empire with his small band of Spaniards, and was fu Mughal emperor Shah Jahan constructs the magnificant Taj Nation Mahal in memory of his beloved wife.

Each of the six programs encapsulates the events of a given century as if it were a fifteen minute evening newscast. The telecasts are delivered by an anchorman and a team of "on-the-scene" reporters, covering their stories from remote corners of the world. They include interviews with famous figures, dramatic moments in history captured on tape, and the Series

"numan interest" stories, debates on significant issues of the time, and even some commercials for new products of the day.

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hity to device ast From the across coples of the sun is narches upon paniards, and cant Taj

vents e evening norman and a stories from views with ared on tape, While reminiscent of Walter Cronkite's "You Are There," the "Newscast From the Past" differs from this previous series in several key respects. For a full half hour, "You Are There" focused upon a single major event from the relatively recent past, usually an incident from American history. It approximated the documentary genre more closely than it did the television news. On the other hand, "Newscast from the Past" more closely imitates the news telecast format, and it deals with worldwide events in the medieval period. Although its treatment of specific events is more superficial than the coverage was on "You Are There," the scope of "Newscast" is far more global and the breadth of history that it encompasses is far more extensive.

"Newscast From the Past" was produced at KLRU-TV, the Public Broadcasting Service affiliate in Austin, Texas. It was funded by the Corporation for Public Broadcasting and the National Endowment for the Humanities. The series was Written by a team of scriptwriters and historians, who Carefully monitored its content for historical accuracy. The final scripts were also mailed to reputable historians across the nation to doublecheck their accuracy. The program's six figure budget was large by educational television standards, and the production has a very professional look. A feature

film director was placed in charge of the shooting, and he successfully orchestrated a set of convincing performances on sets filled with realistically medieval looking paraphermalis

The high quality of this production was acknowledged by educators across the country during the so-called "Firstview" sessions, conducted by the Public Broadcasting Service to determine what programming should be made available on the school instructional television schedule. "Newscast From two Past" was voted first in this poll, as the new program that most deserved to be placed on the schedule. Furthermore, because it was produced with Corporation for Public Broadcasting funds, "Newscast" will legally be in the public domain for three years. This means that PBS affiliates will not have to pay the usual fees to broadcast it. "Newscast" is therefore a high quality bargain for local PBS stations, and consequently it is being widely aired throughout the country.

Public domain status also means that the programs can be videotaped off the air and used for instructional purposes from now until the end of the 1988 school year, without any of the usual copyright restrictions. Videotape distribution of the series will be forthcoming in the near future. A forty page teachers' guide to "Newscast" is available for \$2.25 from KLRU-TV in Austin, Texas (see the address at the end of this article). Already over 15,000 of these have been distributed to state education departments and public

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relevision stations throughout the country, from New Jersey california and from Alaska to Texas.

the Problematic Nature of World History Instruction A survey I conducted a few years ago revealed .hysmally low percentages of high school students able "Firstview" to identify twenty of the most influential figures in sistory on a simple matching exercise.1 these twenty men were taken from a list that included ast Fron the Jesus Christ, Sir Isaac Newton, Mohammed, Buddha, ogram that confucius, Einstein, Marx, and Columbus. Why is it often so difficult to interest adolescents in world history?

> Unfortunately, history is often taught with an emphasis upon obscure facts and figures. Why should today's teenagers be expected to memorize the precise year of the Council of Trent, the victor of the Battle of Tours, or the site of the Magna Charta signing? World history can become a "trivial pursuit" when it should be a meaningful one. While probably more worthwhile, the conceptual approach to history instruction may be no more inspiring. Lengthy lists of causes and results can remain meaningless abstractions to pupils unless they have carefully studied the circumstances involved.

Ideally, historical study will move students through several stages of awareness. First they will learn what took place (perhaps even exploring the difficulties encountered by

historians in trying to establish what actually did transpire). Next they will assimilate and synthesize this material, so that they can begin to understand why events unfolded as they did. Then students should start to draw their own conclusions about the past. Finally, they will hopefully apply what they have learned to present day situations. The lessons that history has to offer should help young people develop their own political views, and empower them to make thoughtful decisions based upon an expanded awareness that ranges far beyond the limits of their own personal experiences. Yet none of this personal growth will occur if a student is not interested in the historical events themselves. Motivation is, therefore, a critical issue.

televisio What can excite students about the study of history? thereby F One successful approach is to relate fascinating stories learner. about personalities of other eras and faraway cultures. Past" car History can captivate in the same way that literature does, course. (and it possesses the added allure of having really regard, i happened). But a solid history course must also be more than The "New: a scholastic "Ripley's Believe It or Not." It will hopefully convey some sense of what life was like in previous times. (or vide Like fine literature, it should transport the student into general other worlds. Teenagers can imagine themselves in the stately Roman forum, the opulent court of Louis XIV, a clamy classroo dungeon during the Spanish Inquisition, Magellan's weathered studies,

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For most high school history students, it is very difficult to accurately picture such scenes, because the information provided by the textbook is so limited. In trying to survey all of human history, descriptions of previous eras are sketchy at best. Some teachers can bring certain historical periods to life, but in many cases, pupils remain bored with the subject because they cannot relate to it. Yet these same students will sit for hours in front of their television sets at home, watching Marlon Brando play Mark Anthony, Napoleon, or Fletcher Christian. 6

As John Dewey so often asserted, experience is a critical factor in a young person's education.³ Film and television have the capability of re-creating the past, and thereby provide vicarious experiences that involve the learner. It is in this capacity that "Newscast From the Past" can make a significant contribution to a world history course. To see how effective the series may be in this regard, a survey was developed.

The "Newscast" Survey

How effective has the use of historical drama on film (or videotape) proven to be in social studies classrooms? The general instructional efficacy of film and television in the classroom has been well documented in a variety of research studies, dating back many decades.⁴ In fact, respected media

researcher William Allen wrote in the late 1950's, that, factual material, "in about 85 percent of the studies comparing motion picture teaching with conventional method films were found to be significantly superior."

The landmark studies into the use of films in history classes were conducted many years ago by researchers at Tal University. A 1928 study conducted in a junior high school American history class showed a filmed series of "photoplay entitled, "The Chronicles of America."⁶ A rigorous replication using the same films was carried ;out ten years later?⁷ Both studies found significant learning gains for students who viewed the film series, over a control group that received conventional instruction. It was also shown that pupils who saw the films became more interested in th subject matter. More recently, studies on teaching histor with televised material have yielded similar results. Cme carefully documented example was the favorable set of reactions to the classroom use of a television series entitled "American Cultural Heritage."⁸

However, the actual number of quantitative investigations conducted on the effectiveness of using fil or television to teach history is rather small. As such, seemed appropriate to test reactions to the "Newscast From the Past" programs. A survey was developed to examine a variety of issues related to the instructional potential (this series. How appealing is it to the primary target

50's, that, prdience, high school world history students? How easily studies pignt it be included in the typical world history curriculum? tional metions will it be in providing a more meaningful sense of history to young people?

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as in histor The survey was distributed to 363 students from four Irchers at 7 high schools in the Midwest. While the student sample was 'r high sche not scientifically selected, there was an effort made to of "photople obtain a representative crossection of students by including orous four distinctly different types of schools in the study. out ten year these sites included an upper middle class suburban school, g gains for an inner-city magnet school, a parochial school, and a atrol group vocational school. Students were given a series of 3 also shows statements about the show, and were asked to respond to each ested in the on a Likert scale. Scores were averaged for each item. hing histor Tabulated results are listed in the table of "Survey sults. One Ratings."

Survey Ratings

Rating scale: 2 = strongly agree 1 = agree 0 = neutral, -1 = disagree -2 = strongly disagree

As such, it scast From xamine a otential of target

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"Newscast Prom the Past" was entertaining. 1.01
Seeing historical events acted out was interesting. 1.24
Certain historical personalities "came to life" for me. .55
The program did a good job of presenting the sights and sounds of the Middle Ages. 1.10

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	The TV news format helped make the historical events seem real (as if they really happened).	.99	н
His	History is more interesting when presented as if it		genre,
	is current news.	1.14	presen
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	I feel that a series of programs like this would help		this P
	make a unit on the Middle Ages more interesting.	1.34	signif
	I think that "Newscast" programs could conveniently be used along with the world history text my	1 desire	50, it
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	differently than the impression given in the		Past'
	textbook.	.55	
	I prefer seeing "Newscast From the Past" to reading		In thi
	about the same events in a book.	1.22	techni
	I would like to read more about some of the events reported on the show.	.21	progra
	The program provided some special perspectives on how		genera
	dramatically the world has changed since the Middle Ages.	.95	trangi
	The program provided some special perspectives on		enteri
	how some aspects of life on this planet never change.	.41	class
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	has to offer.	.48	in hi
	The newscast included some people whom I admire (and hope to fashion myself after).	33	notor
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sistorical Drama as an Instructional Approach

Historical fiction has always been a popular film cenre, from Cecil B. DeMille's biblical extravaganzas to present day television "docudramas" about recent historical figures and events. The "Newscast" series uses this popular approach to portray famous moments and significant figures as accurately as possible. In doing so, it hopes to educate as it entertains. But the first issue is whether it succeeds as a dramatic production.

Students agreed with the item "'Newscast From the past' was entertaining," which obtained a rating of 1.01. In this age of bloated budgets and slick video production 1.22 techniques, it is no small accomplishment for an educational program to receive such a positive response from today's generation of adolescents, who are teased, titillated, and tranquilized by the media on a daily basis. An entertaining program, will, at least, tend to hold the class' attention, the first prerequisite for learning.

But getting a group of young people really interested in history is a difficult challenge. Adolescents are notoriously egocentric. Their concerns extend, at best, to an immediate peer group, but seldom beyond. Asking them to consider the tribulations of another society several centuries ago can be frustrating. Nor do young people often have a clear sense of their own personal history. In later adult life, we can reflect back upon the events and

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decisions that influenced our lives. Such recollections can take on a personal meaning for us, and an appreciation of one's own "history" develops. t, for most teenagers. these perspectives are years away. Furthermore, an interest in history naturally arises among members of the older generation, because they actually remember events now considered "historical." Young people have none of these advantages when it comes to finding meaningful lessons in the study of history.

Therefore, it was extremely encouraging to see that students felt very strongly on the survey that "Seeing historical events acted out was interesting" (rating of 1.24). This result alone perhaps should merit the use of "Newscast" in classrooms across the nation. Another issue, whether "Certain historical personalities 'came to life' for me" during the show, received moderate support (.55). In this case, the brevity of most of the appearances on camera may have limited the impact of these performances. Considerably greater support was given the statement, "The program did a good job of presenting the sights and sounds of the Middle Ages" (1.10).

If, during the show, students experience the "atmosphere" of medieval times, perhaps, ensuing discussions will be more meaningful to them. The deplorable standards of living, the vulnerability to disease, the widespread illiteracy, and other fundamental aspects of "Newscast". ancestors] that period In fa aforementi previous h imagine wh names and and so on, newscasts, make the 1 really hay communica[.] living, b challenge taken its greater i how other problems, carefully strength: dealing 1 The News "Ne instruct

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to mental aspects of Medieval life are effectively portrayed in "Newscast". Students can begin to comprehend how their incestors lived, and then place the events and issues of that period in the proper context.

In fact, perhaps this program can overcome some of the aforementioned problems that students have in relating to a previous historical era. It's often difficult for them to imagine what life was like, and consequently the lists of names and dates, causes and effects, winners and losers, and so on, remain dry abstractions. In viewing the newscasts, students felt that "The TV news format helped make the historical events seem more real (as if they really happened)" (.99). If "Newscast" successfully communicates the sense that the names in their text were living, breathing human beings who struggled with the challenges of life, just like the rest of us, then it has taken its audience through the first critical steps towards greater involvement. Teenagers can begin to contemplate how other people throughout history have dealt with life's problems, and, in so doing, may begin to reflect more carefully upon themselves, their own aspirations, their own strengths, their own weaknesses, and their own unique ways of dealing with the world.

The Newscast as an Instructional Format

"Newscast From the Past" takes advantage of an instructional format that young people have become accustomed

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to learning from. Many students in this study agreed with the survey item "I generally watch at least part of a nightly to de news program several times a week" (.54). The potential of of st the television newscast as an information source has been when studied extensively in the past few decades. Well educated ratil subjects have recalled detail on approximately fifty to sinte news percent of the items on a news telecast, 9 although retention comm rates have been considerably lower for audiences tested under not non-laboratory conditions.¹⁰ Several studies have shown enjo that the visual material provided on television news program leve aids recall of information, 11 and that motion pictures are more effective in this regard than stills. 12 Viewers general "New tele overall knowledge of current events has been positively the correlated with their ability to recall specific facts lik€ included in a telecast, 13 and those that watch newscasts in grou order "to become informed" recall significantly more than *00T those who watch "casually" or "to relax." 14

inva These findings suggest that a newscast style program has inte instructional potential in the classroom. Learning gains from news broadcasts have been rather significant under ple. "supervised" conditions and classroom viewing is certainly peo supervised. Furthermore, "informed" viewers demonstrate dra higher learning gains than uninformed viewers, and attentive tel students in the middle of a history course would hopefully con already be somewhat knowledgeable about the material from ned their readings and discussions.

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program has ng gains under certainly strate attentive opefully al from Student reactions to the use of a news telecast format to depict events in world history were obtained on an number of survey items. The statement "History is more interesting when presented as if it is current news" attained a strong rating of 1.14. Is it the inherent appeal of the evening news format, with its fast paced mix of film footage and commentary that involves the student audience? This could not be the sole explanation, for the statement "I normally enjoy watching nightly news programs on TV" rated only a .32 level of agreement.

Perhaps, more significant is the novel twist that the "Newscast From the Past" series gives to this standard television format. The survey statement "I was amused at the idea of historical figures appearing on a modern medium like TV" received a rating of .99. Repeated observation of groups watching the show for the first time confirms this "novelty" factor, for the majority of faces in the audience invariably become animated as an historical figure is interviewed by a reporter.

Why should "Newscast From the Past" elicit such a pleasantly startled response from its audience? After all, people have long become accustomed to watching historical drama on television. It may be that the presence of modern telecommunications equipment in the "Newscast" scenes contributes to this phenomenon. Microphones are thrust at medieval personalities, creating an incongruity that

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probably intrigues the audience. This "reverse anachronism" upsets our established conceptions of historical reality. It has the same absurd effect as the "what's wrong with this picture" cartoons we enjoyed as children, in which one object does not belong in the situation.

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These modern devices also suggest one of the most tantalizing fantasies of the present century: time travel. From the publication of H. G. Well's classic novelette The <u>Time Machine</u> to the release of Steven Spielberg's current hit film "Back to the Future,", the concept of time travel has increasingly come to captivate the public imagination. "Newscast From the Past" implies an accessibility to the intriguing events of the past via modern technology, a magic camera through which we can peer into past eras. This idea undoubtedly has considerable appeal.

Why else might history seem more interesting when the 1 presented as if it is current news? Naturally, people the : will tend to be more interested in today's events than those stud of the distant past because they are more likely to be part affected by them. The public can become conditioned by media formats to react in certain ways, and they generally respond comp to newscasts with concern. In using this format, a "Newscast agre From the Past" may benefit from some of this mental prog conditioning. Through the reports of a news anchorman, the hist events of the past seem more immediate and compelling. thes

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g when people s than those to be oned by media ally respond , a "Newscast tal horman, the lling. In addition, the newscast format may create a context that seems more "real" to the viewer than the average docudrama. While film narrative has traditionally peen fictional, newscasts have always presented real incidents. The events portrayed on the "Newscast" programs may derive a certain degree of subconscious credibility from the fact that they are reported using all the normal conventions of a news program. This conjecture is supported by the strong agreement, mentioned earlier, with the statement, "The TV news format helped make the historical events seem more real (as if they really happened)."

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"Newscast" and the World History Curriculum

Would the "Newscast From the Past" series enhance a high school world history curriculum? The survey item "I feel that a series of programs like this would help make a unit on the Middle Ages more interesting" received a rating of 1.34, the highest score on the entire survey. High school history students would very much like to see this series included as part of their coursework.

But did they feel that the programs could effectively compliment the material in their texts? There was clear agreement (1.19) with the statement "I think that 'Newscast' Programs could conveniently be used along with the world history text my class is using." Five teachers surveyed on these two items also agreed with them (average rating of 1.00

on both this items and the previous one).

The "Newscast" series can be used in a variety of interesting ways in world history classes. But these programs would probably be best employed as an introduction to the study of various medieval centuries. They provide a stimulating overview with which to begin discussion. Since the newscasts furnish a visual sense of the times, they probably should be shown before students are asked to engage in more abstract activity, like reading or discussion. Then, hopefully, this verbal material will be grounded in some concrete perceptions of what was happening at that time.

In fact, without adequate exposure to visuals characteristic of the period, students may have difficulty forming accurate impressions of what the Middle Ages were like. This problem may be especially severe for poor readers, who have trouble understanding the text. It was interesting that a reasonably large percentage of students agreed with the survey item "The program provided some special perspectives on the time period because it portrays the era differently than the impression given in the textbook" (.55). One has to wonder what some of these pupils imagined about the medieval era before they viewed the show.

The need for visual material in history units is underscored by the strong student support (1.22) for the reading program dynamic that th stimula some st some of concept In a feeli about h includ€ their c newscas learnir worthwi actual T} provide world 1 to eff: politi the pr S

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ts is for the survey item "I prefer seeing 'Newscast From the Past' to reading about the same events in a book." The television programs communicate the events of the Middle Ages in a more dynamic way than a textbook can ever hope to. It was felt that the interest generated by the "Newscast" shows might stimulate further reading on medieval topics. However, only some students indicated that "I would like to read more about some of the events reported on the show" (.21). Conceptual Learning From the "Newscast" Series

In addition to relating interesting facts and providing a feeling for the times, a really dynamic television program about history will deal with important concepts. Items were included in the survey to explore how students perceived their own conceptualizing about history as they watched the newscasts. While these responses are not actual measures of learning, studies have shown that perceptions about how worthwhile a program has been do correlate postively with actual later achievement gains.¹⁵

There was general agreement (.95) that "The program provided some special perspectives on how dramatically the world has changed since the Middle Ages." The series seems to effectively portray how the social, economic, and political circumstances of the medieval period differed from the present situation.

Some students also felt that "The program provided some special perspectives on how some aspects of life on this

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planet never change" (.41). There are attempts within are n "Newscast" episodes implying that certain historical themes whate persist through the ages. For example, the sixteenth century audie newscast describes a jungle war in Vietnam and the seventeenth century program reports on the violence in rathe Northern Ireland between Protestants and Catholics.

There was also some support (.48) for the statement the of ho program suggested some lessons that history has to offer, approdespite the fact that these surveys were filled out by groups chron that had not discussed the program. With appropriate teacher late: follow-up, the responses to this item would probably be even part more positive.

Admittedly these questions only superficially explore time the issue of how conceptually stimulating the "Newscast" empi series may be. More specific examination of what pupils are the really learning from the series would serve as a worthwhile this research endeavor especially given the paucity of data stuć presently available to history teachers on the instructional pers effectiveness of history drama. Nevertheless, these the positive survey responses on crucial pedagogical issues aspe remains encouraging.

However, not so encouraging was the negative pupil inc: reaction (-.33) to the statement, "The newscast included some civ people whom I admire (and hope to fashion myself after)." Whi Apparently, the heroes of the Middle Ages are truly difficult upo for modern day adolescents to identify with. Perhaps they und

are not portrayed in an attractive enough light. ithin For ical themes whatever the reason, "Newscast" failed to inspire its enth century audience in this regard.

But in another important respect, "Newscast" succeeded rather admirably. It was designed to present the major nce in events happening simultaneously all over the world, a kind of horizontal slice of history. There is a need for this tatement "The approach in most world history curricula, which proceed :0 offer." chronologically for lengthy periods within a given region and out by groups later double back to cover the same time frame in another :iate teacher part of the world. Therefore, it is difficult for a ibly be even student to sense what was actually occuring at the same time in medieval Europe, Kublai Khan's China, the Indian y explore empires of Latin America, the kingdoms of western Africa, "wscast" the Islamic world, and so on. "Newscast" could fulfill pupils are this vital function in world history classrooms, and, in fact, worthwhile students agreed that "The program provided some special perspectives on what was simultaneously happening all over structional the world during a given period of history" (.70).

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This global perspective is an especially valuable aspect of the "Newscast" series. It indicates the increasing degree of contact which developed between different civilizations, over the centuries, elucidating the effects which cultures on different continents may have had upon one another. "Newscast" can contribute to a greater understanding of historically significant global trends,

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such as the spread of major religions, the rise of European imperialism, the development of multi-national business p. Tier enterprises, the first stirrings of democracy as an RC internationally significant political movement, the evolution 71 of well established global trading patterns, etc. The sector H. Hart can help establish the larger overall picture, and then the P teacher and the text can proceed to fill in the details. 1

"Newscast From the Past" was greeted with considerable J. J. Dew enthusiasm in the history classrooms I surveyed. Its use M of a television news format helps bring history to life in J. C. Hot ways the lecture or text cannot. It conveys a number of J significant historical concepts, and provides a truly V global perspective on the major trends in a given century. (The "Newscast From the Past" series should be an exciting G. Ch addition to world history classrooms across the nation.

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Using Television to Develop "The High School of the Future" and Hispani

Drew Tiene

Kent State University

The transformation of our schools into institutions Hore responsive to the needs of today's youth is an urgent challenge, fraught with innumerable difficulties. Such a formidable task requires resourceful approaches and ingenion miller, Col solutions. One such project, "The Coalition for the High faculty con School of the Future" in northeast Ohio, decided to produce . low budget videotape to generate interest in its proposals for educational reform. This television show eventually proved highly successful in communicating the purpose of the project in dynamic fashion. This article will discuss low a considerable degree of interest in the coalition was aroused by this video, and will include the results of a survey that later documented specific ways in which the video helped establish a momentum that has propelled the High School of the Future project into its second year.

This coalition consists of five high schools and four universities in the Cleveland-Akron area. It also eventually hopes to include local community groups and businesses. The project hopes to revitalize the learning experiences offered these five high schools. These "model" sites differ considerably from one another. They include a nearly all black inner city school, a virtually all white rural school, an affluent white suburban school, an urban "magnet" school, and a school with a racial mix that includes whites, blacks, professi

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Like other school reform projects of its kind that have risen throughout the country in the past few years, this utions were coalition has sought to facilitate change by encouraging ent school staff members to initiate their own plans for Such a improving educational standards (McCormack-Larkin, 1985; d ingenious miller, Cohen, & Sayre, 1985). Each school established he High faculty committees to re-examine its educational priorities. o produce a A formal proposal for improving the instructional climate roposals within the building would be drawn up, with the emphasis tually. placed upon the developing of more effective methods of ose of the preparing young people for living in our rapidly changing cuss how a society.

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as aroused While each school would be encouraged to develop urvey that appropriate strategies for its own unique circumstances, the coalition leaders offered some suggestions for reform based upon recent research on the state of the American public high school (Boyer, 1983; Goodlad, 1984; Sizer, 1984). Curriculum revision whould be initiated by the teachers eventually themselves. An emphasis upon communications skills would be strongly advised. An expanded teacher contract plan might be considered, to improve salaries and to engage teachers in professional activities through the summer. Team teaching efforts would be encouraged, to reduce some of the isolation of the job and to stimulate an exchange of ideas. Career ladders would be considered, so teachers could advance professionally to positions of instructional leadership.

Administrators would become active facilitators of Positive Its lead change, rather than guardians of the status guo. Finally, improved dynamic new technologies for developing instruction would be (Hall et acquired and effectively employed. In the spring of 1984, vould it the coalition's leadership deliberated as to how they could professe post effectively present these recommendations to prospective surround participants. The possibility of producing a "video needed, proposal" arose, and it seemed a dynamic way to communicate Televis ideas, to publicize the project, and to motivate (Frank participants. careful

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The Advantage of a "Video Proposal"

The objectives of the High School of the Future Project charist were both ambitious and ambiguous. The project needed an Because identity, in a sense, and a carefully conceived video could establ: belp give it one. The television medium can deliver material was fe in very realistic and meaningful ways (Comstock, 1980). Its the ti visual component adds a communication dimension that s transcends what a public speaker can convey. In identifying leader problems to be redressed, actual examples can be shown. In suppor recommending solutions, the possibilities can be staged and media taped. Participating personnel can appear in the context of videot their own institutions so the viewer actually sees who is repeat involved and where this project will be conducted. A tape bluow can provide a "visual survey" of the project, so interested recei parties can judge its potential merits for themselves. possi

The coalition wanted to involve as many people as addit possible, who were associated with each of the five sites. discu

of Positive Finally, on would be of 1984, they could prospective deo

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eeded an ideo could ver material 1980). Its hat identifying shown. In staged and context of who is A tape nterested ves.

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the leadership felt strongly that high schools could only be concoved if all concerned parties worked together for change (Hall et al., 1984; Pincus & Williams, 1979). This team would include teachers, administrators, students, university professors, parents, and members of the communities surrounding each high school. To attract the support they needed, project leaders felt a videotape would be ideal. relevision can be a powerfully motivating medium (Frank & Greenberg, 1980; Pearl, 1982). Sequences can be carefully planned to portray the project in an extremely positive light. Husic can subtly manipulate the emotions. A charismatic sounding narrator can be guite convincing. Because the success of the project depended so heavily upon establishing a broad base of support in its early stages, it was felt a persuasive videotape should be produced, despite the time and expense that might be involved.

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Some practical considerations also led the coalition's leadership to commission the tape. In the effort to enlist support for the project, many meetings would be held. A media production is ideal for nultiple presentations. A videotape would save project spokesmen from having to repeatedly explain their goals at meeting after meeting. It would also "standardize" the presentation so that all groups received the same information about the project, preventing possible misconceptions and miscommunication later on. In addition, the program would serve as a focal point for discussion between interested parties about the project
providing a "common ground" around which issues could be particip debated and deliberated.

The geographically dispersed nature of the project site each sch presented another problem for the coalition. The five the supI schools were scattered across an area of Ohio ranging free an insti the ghettos of Cleveland to the rolling farmland east of key figu Akron, a distance of approximately fifty miles. Travel time enthusia between sites could become both time consuming and expensive remarks Once again, distribution of tapes could eliminate some of points | this difficulty. could, 1

This particular collection of five high schools was in persuas many ways a microcosm of the nation's schools as a whole innovat

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. If these particular schools could successfully even leader into model "High Schools of the Future" the applicability of presenc their cumulative experiences would be considerable indeed. credibi However, if it ever hoped to become a viable, cohesive entit In that drew strength from its diversity, the coalition would pight s and ger need to involve the various sites with one another. Up to of facu this point, these five schools had very little contact with technol one another. A videotape seemed ideal for showing audiences throughout the project what each of the sites was like. It Educati on for could help begin the process of establishing a network between schools by, in a sense, visually introducing them to consist one another. possesi

The videotape also had the potential to introduce key

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marticipants. Interview footage with school principals and wighly respected teachers might influence faculty members at each school. There is considerable evidence to indicate that the support of opinion leaders is critical to the success of an institutional change project (Rogers, 1983). In this case, key figures would be identified and then asked to voice their enthusiasm for the project on tape. Their nost appropriate remarks would then be edited into the program at various points throughout the show. In this way, perhaps the tape could, to some degree, shortcircuit the lengthy interpersonal persuasion process generally involved in the adoption of innovative ideas (Mancuso, 1969). As it turned out, the videotape production team was fortunate enough to obtain interview footage with John Goodlad, a nationally recognized leader in the high school reform movement. Goodlad's presence on the tape lent the whole project some valuable credibility.

In the spring of 1984, it appeared a "video proposal" might serve as an effective means of clarifying project goals and generating some initial enthusiasm. Consequently, a team of faculty members and graduate students in the educational technology department of Kent State University's College of Education proceeded to produce the program. Production went on for several months, with the vast majority of costs consisting of in-house expenses. Kent State University possessed all the equipment necessary to produce the tape. The faculty members involved were already on salary and the

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students worked on the tape as part of their assistantships. Ί 1.23 By July of 1984, a seventeen minute program entitled "The His 1 School of the Future" was ready for viewing and was shown to -1.12 potential funding agencies. That September, it was disseminated to all five schools, where it was shown on 1.24 repeated occasionsm including teacher meetings, parent .78 meetings, student assemblies, and workshops. How successful was this program in achieving its objectives? .93 Survey Findings: How Successful was the Tape?

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A survey was distributed to each of the five schools in .96 the coalition. It was completed by the members of each school's leadership team, a group of teachers selected by .93 their fellow faculty members to write a proposal for changing 1.30 aspects of their school. The fifty-seven responses indicate 1.20 1.12 some definite opinions about the impact of the television .80 .54 program on the project in its early stages.

"High School of the Future" Vileo Survey Results video . +2 = strongly agree +1 = agree consid 0 = neutral -1 = disagree has he -2 = strongly disagree

Rating Survey Item

ended	Ethe	e of	awar	ople	e per	ed make	helpe	has	otape	The vide	1.26
elabor	exister	its	of	know	not	would	wise	other	who	project,	
	a nature	the	hout	10 3	Deol	forms	atu in	otive	offe	The tape	93

- of the project.
- I feel the tape helps clarify certain aspects of the .57 project's "mission" which might otherwise have remained ambiguous or misunderstood.
- 1.25 The show conveyed the impression that improving our high schools is an important undertaking.

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stantships. led "The sp	1.23	The show portrayed the High School of the Future project in a very positive light.
as shown to as	-1.32	An audiotape of the narration would have been almost as effective as the videotape in conveying information about the project.
own on	1.24	Visuals made the narrative material more interesting.
arent	.78	Comments on tape by project participants were especially convincing because they should understand
successing	Con-	the situation at their own schools.
	.93	These remarks by involved staff helped establish the impression that some changes in public high schools are necessary.
schools in	.96	The interview footage with staff from each school belowd convey a sense of commitment on the part of all
f, Pach		five schools.
ected by	.93	The tape made me feel my school is part of something larger, which extends across this part of the state
for changing		The scenes of the U.S. space program suggested.
es indicate	1.30	the future
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What do these survey results indicate about the power of video to publicize? It turned out that there was, in fact, considerable agreement with the statement that "The videotape has helped make people aware of the project, who otherwise would not know of its existence" (rating of 1.26). On openended parts of the survey, project participants were free to elaborate, and the following statements were recorded.

"The tape was used effectively in workshops to introduce the public to the project."

"At the first workshop where the tape was shown, a high degree of interest was sparked and continues now." "We have had positive involvement from representatives

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of several groups, after they reviewed the tape." Thus, there was strong evidence that a primary objectives of change, the tape was accomplished; to expand awareness about the statem€ project in hopes of involving large mobers of participants our his in the coalition. conside

Did the medium of television provide a clear statement that th of goals that effectively articulated its purposes? It inprov appears to have been generally successful in this regard portra also. A average score of .93 was recorded for the statement. cositi "The tape effectively informs people about the nature of the succes project." A .57 was received in response to the item, "I with g feel the tape helps clarify certain aspects of the project's were: mission which might otherwise have remained ambigious or misunderstood." A lower score on this last item was not surprising. The goals of the project were deliberately stated in general terms, so that individual schools could interpret then as they saw fit. Several anecdotal responses initi indicated that the program provided teachers with a cogent summary of what the project hoped to accomplish and even succe implied that the show may have served to solidify the Cominu But h coalition.

"It shows the whole program...its was crisp, clear, and videc appro to the point."

How ("The coalition concept was conveyed well." theil "The scope of the project seemed so vast to me. Effer needed a 'cohesive device' (the tape) to bring my

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statement, re of the en, "I project's us or s not tely could responses cogent even he

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Did the videotape effectively argue the necessity for change, in its efforts to motivate participants? The statement "The show conveyed the impression that improving our high schools is an important undertaking" received considerable support (1.25 rating). Convincing participants that this particular project could be a viable approach to improving the system was also critical. The item "The show portrayed the High School for the Future project in a very positive light" was rated at 1.23. The video was clearly successful in portraying the project as a meaningful one, with good intentions. Some survey comments on this issue were:

"The tape effectively conveyed the desperate need for change."

"It had appeal for all who are concerned with the future of education."

Thus, survey responses supported the informal feedback initially received that "The High School of the Future" tape successfully contributed to publicizing the project, communicating its basic goals, and building support for it. But how was it able to do so? What specific capabilities of video contributed to this success? What production approaches were used to accomplish the tape's objectives? How can educators interested in developing similar tapes for their own projects achieve similar results? Effectively Presenting Innovative Ideas Through Video

Many items on the survey dealt with production issues interview suture." one strength of the television medium is, of course, its ability to present dynamic visuals. The strength of a view and teache aditing al presentation at meetings, in comparison with a public address, lies primarily in its ability to provide this visual expressed material. To test the significance of this visual component. appropriat several relevant questions were included in the survey. One "testinon: hypothesized, "An audiotape of the narration would have been commitmen almost as effective as the videotape in conveying information The . intended about the project." This statement was strongly disagreed in reacti with (-1.12). The item "The visuals made the narrative tape by p material more interesting" was, on the other hand, strongly because t agreed with (1.24). Viewers also agreed with the statement schools" "The visuals included in the program enhanced the show by establish providing specific instances of what the narrator was schools a discussing" (.95). Apparently, the visual aspects of the staff fre show were absolutely critical to its success. These results the part help explain the enthusiasm expressed by coalition leaders feel my : over the tape's effectiveness as an opener at meetings about all acro: the project. Several written comments alluded to the It significance of the role played by visuals in communicating support. to coalition members what the project was all about:

"A good visual overview of the project." "It showed the diversity of schools involved." "It is easier to convey the general aims of the project through visuals." consider

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As mentioned, there was a considerable amount of

interview footage included in "The High School of the on issues. suture." Coalition leaders, including both administrators and teachers, expressed their aspirations for the project. of a video editing allowed the producer to select the most articulately expressed comments and to insert them into the show at this visaal appropriate moments. The result was often a meaningful Contronent, "testimonial" for the project, which gave an impression of rvey. She commitment, unity, purposefulness, and optimism. have been

The questionnaire sought to verify whether, in fact, the information intended image came across. General agreement was recorded isagreed in reaction to the following statements: "The comments on tape by project participants were especially convincing strongly because they should understand the situations at their own statement schools" (.78), "These remarks by involved staff helped establish the impression that some changes in public high schools are necessary" (.93), "The interview footage with staff from each school helped convey a sense of commitment on se results the part of all five schools" (.96), and "The tape made me feel my school is part of something larger, which extends ings about all across this part of the state" (.93).

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It appears that videotape can effectively present the support of key opinion leaders, something that has been considered critical to the success of any institutional change project. Normally, these kinds of endorsements would be delivered around the school building over a period of weeks, or even months. Videotape streamlines this process, so that large groups can be immediately exposed to these

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statements of support. This video approach may thereby help accelerate the change process.

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Possibly the most interesting finding on the entire I hop survey was that viewers were definitely affected by a "visual reported, metaphor" included in the show. To suggest the future, a onprogram ca winute introductory segment was prepared, using MASA footage. initiation in which the viewer "travelled" to the moon and back, then televisior witnessed the Jaunching of the space shuttle. The idea was video tecì to immediately remind the viewer that technology is advancing Televisio rapidly and that the future is filled with potential changes less expe of enormous magnitude. These technological triupphs also looking, exemplified the kind of achievement that upcowing generation for group of students will hopefully aspire to. Furthermo

It was hoped that audiences would be encouraged by such footage, to consider where their high schools were heading and how they would need to adapt to the rapid transfor atim of our society. Survey responses did, in fact, indicate that the space metaphor was very effective. Teachers responded that "The scenes of the U.S. space program suggested the future" (1.30), "technology" (1.20), and "achievement" (1.32). These shots also suggested to a lesser degree, "the frontier" (.80) and "patriotism" (.54). When asked to elaborate on this issue, the following reactions were recorded:

"The tape makes you realize the future comes quickly." "Schools are heading for frontiers unknown." "Students must be prepared to meet the future."

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"New horizons to explore and new challenges to meet." "The future is now ... it inspires we."

I hope that responses like these, along with the data

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caged by such ere beading canafornation indicate that s responded jested the ver.ent" degree, "tie sked to s were

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reported, have convinced many readers that a television program can contribute significantly to the successful MASA footage, initiation of an institutional change project. Today, television is becoming an increasingly cost-effective medium. video technology is advancing at a remarkable rate. Television portapaks are becoming lighter, easier-to-operate, less expensive, and of higher quality. Obtaining respectable looking, worthwhile footage has become economically feasible for groups which previously found the cost prohibitive.

> Furthermore, an inexpensive editor, like Panasonic's R-500 (@ \$100.00), can be connected between two half-inch recording units, so a program can easily be assembled from raw footage.

A respectable television program can be produced guite parsimoniously these days, especially if there is a person on your staff who is skilled in television production. Once developed, a video has large potential audiences, especially given the rapid proliferation of videocassette recorders in both institutions and homes. We are in the midst of a "video revolution" and those interested in promoting a special project should consider taking advantage of this dynamic medium.

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Teachers' guides and general information about the "Newscast From the Past" series can be obtained from:

James Ullrich Director of Instructional Television P.O. Box 7158 KLRU-TV Austin, TX 78713 (512) 471-4811

TITLE:

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TITLE: OLD WINE IN NEW BOTTLES: SUBLIMINAL MESSAGES IN INSTRUCTIONAL MEDIA

AUTHORS: MARGARET TREIMER MICHAEL R. SIMONSON

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TITLE	Old Wine in New Bottles:	Subliminal Messages in	"W. of food viewing disappe
	Instructional Media		This sc ming," by rugh daily se, the vid syted on th sudio mes
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53	NO31 Quadrangle Iowa State University Ames, Iowa 50011		blishers of rie one's c s the progra be companie bese tapes e s for these
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Platters laden with fried chicken and potatoes, spaghetti smothered in tomato sauce, cream cupcakes and chocolate bars spin slowly round on the screen. Oddly enough, these treats aren't displayed to tempt you. They appear as reminders of foods you should avoid eating.

"Watch now, and start to say good-bye to the wrong kinds of foods," says the silky-voiced female narrator. "With daily viewing, you will watch your desire for fattening foods simply disappear."

This scene was from the twenty-two minute videotape, "Weight Loss Proraming," by Hypnovision, that was designed to help viewers lose weight grough daily viewing. Besides providing basic information on diet and exeruse, the video used visual and aural subliminals. The visual messages were fashed on the screen for one-thirtieth of a second at regular intervals and be audio messages were compressed, mixed with music and transmitted just wiow the threshold of normal hearing.

Subliminal perception (or stimulation) describes any word, image or gund that is not perceived within the "normal" range of consciousness, but gues an impression on the mind. This involves words or pictures that are fished so quickly that the eye cannot transmit them to the conscious brain, words at such a volume that they evoke no conscious memory.

This past year a variety of products have appeared on the market that are the mystique of subliminals and promise improvement in a variety of meas. Audio tapes, with the subliminal messages transmitted below the preshold of audible sound, offer to transform the listener's life. Stimuech, Inc. has a device that interfaces a computer with a television allowing te viewer to receive subliminal messages while watching TV. Greentree ishers offer a computer program that allows the computer operator to rite one's own subliminal messages. These messages are flashed regularly a the programmer continues on with other computing tasks. Several videoupe companies produce videotapes like the one described above. Most of ore tapes encourage replacement of bad habits with healthier ones. The is for these products emphasize that the subliminal programs will help King about dramatic results with minimal effort. This presents an attractive roposition to the consumer. However, whether they do what they claim is Wen to debate. Many mental health professionals and psychologists do not aree as to whether subliminal communication is effective in changing human whavior and attitudes. Second, these subliminal products have been introaced to the market, yet they have not been clinically tested. Silverman, smost investigator in the use of subliminal stimulation to direct manipuition of behavior, believes that companies that sell subliminal products Rsigned to affect bahavior should set up a research unit that tests their Moducts (Levy, 1984). Currently, there is no documentation of any testing these products to determine the effectiveness of their subliminal messages.

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Purpose of Study

The purpose of this research was to conduct a study to determine if viewing a commercially prepared videotape containing written and aural subliminal messages was more effective at producing weight loss than a videotape containing the same content but with no subliminals.

"Weight Loss Video Programming," by Hypnovision, the videotape selected for this study, endorsed no particular diet or exercise plan, and made no requirements of the viewers other than the willingness to change diet and exercise habits and to watch the videotape daily for thirty days. It was felt that, while weight loss was not a traditional focus of educational research, the availability of this particualr videotape would give insights into the effectiveness of subliminal messages that might have a direct relationship to traditional educational needs. Subjects were measured to see if changes occurred in these areas:

1) BEHAVIOR

Food Intake Recall (FIR)--measured by one day food recall at the end of the testing period. This analyzed the subjects' food intake for nutrients and calories. The FIR was used to compare the amount of intake of high calorie, low nutritional foods.

Weight and Skinfold Test (WST)-- measured at the beginning and end of the testing period. Skinfold tests reveal and approximate percentage of body fat. All skinfold tests were performed by the same physical education instructor who was experienced in administering skinfold tests. To increase accuracy. three measurements were taken at each skinfold testing and these scores were averaged. Subjects were also weighed at the beginning and end of the experiment on the same scale, by the same person.

ATTITUDE

Food and Exercise Attitude Test (FEAT)--administered at the beginning and end of the testing period to measure the effectiveness of the subliminal messages on the tape: "EAT LESS", "GET ACTIVE", "CALM", EAT SLOW", "YOU CAN DO IT". The attitude test items were chosen from existing food attitude test items that were relevant to the subliminal messages and that fell into the following categories: eating for internal reasons, eating for external reasons, oral control, basic diet and exercise behavior. The subjects responded to the twenty FEAT questions on a five-point Likert scale (r = 0.72).

Treatment groups

 The experimental group consisted of viewers who watched the twenty-two minute Weight Loss videotape with subliminal messages. This group was composed of those subjects randomly selected and placed in the yellow and orange groups.

 The control group consisted of viewers who watched the twenty-two minute Weight Loss videotape without subliminal messages. This group was composed of those subjects randomly selected and placed in the blue and green groups. potheses:

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ched the es. This group the yellow

e twenty-two group was blue and The general hypothesis was that subjects receiving subliminal stimuli in a postive, emotionally arousing way would be able to stop a related and indesirable type of behavior (by mirroring) with greater success than subjects not receiving those messages.

 Subjects viewing the videotape with the subliminals will show a reater weight loss than those viewing the videotape without subliminals.

 Subjects viewing the videotape with the subliminals will show a reater loss in percentage fat than those viewing the videotape without subliminals.

 Subjects viewing the videotape with the subliminals will show a better attitude toward eating healthier foods and exercising than those viewing the videotape without subliminals.

4) Subjects viewing the videotape with the subliminals will record fewer instances of high calorie, low nutritional food intake than those viewing the videotape without subliminals.

5) Subjects viewing the videotape with the subliminals will be able to maintain the weight loss for a longer period of time than those subjects viewing the videotape without subliminals.

Experimental Design:

Campbell and Stanley's (1963) experimental design number four, the Randomized Pretest-Posttest Control Group Design, was used in this study. Students were randomly selected for treatment groups, a pretest was given and preliminary measurements were taken. After the treatments were administered, a posttest was given and final measurements were taken. The import of the treatments was determined by subtracting subjects' pretest scores from posttest scores. The appropriate test for significance at the .05 level was then applied to ascertain if the difference was greater than what might occur due to chance. For this experiment, this design was considered superior to others (Campbell and Stanley, 1963).

Dependent Variables:

- Measure of subject's attitude toward food and exercise (FEAT).
- Measurement of subject's behavior toward food and exercise by change in weight and percentage of body fat.
- Measure of subject's behavior toward food and exercise by incidence of high calorie-low nutritional food intake (FIR).

Independent Variable:

- Videotape viewed by subjects:
 - A. Videotape on weight loss containing subliminals.
 - B. Videotape on weight loss not containing subliminals.

Subjects:

Subjects participating in this study were undergraduate and graduate students, and staff from Iowa State University who responded to advertisements in the campus newspaper or to flyers posted in buildings on the campus during Spring Semester, 1985. Those interested attended one of three orientation sessions. The orientation sessions were conducted to explain the study, to explain the participants' responsibilities and to answer questions.

Subjects' responsibilities were: 1) to get a signed medical clearance, 2) to take the FEAT pretest, be weighed, and be given the skinfold test, 3) to view an assigned videotape twenty-five times within a thirty-seven day period, 4) to return and be reweighed, be given the skinfold test, and take the FIR and FEAT posttest. If subjects met those requirements they were paid twenty dollars. Medical clearances were obtained at the campus health service at no cost to the participants. Fifty-nine subjects started the study and fifty-one fulfilled all the requirements.

The Videotape:

The videotapes used in this study, "Video Weight Loss Programming", were developed in 1983 by John Koenig of Hypnovision. Two videotapes were used: one with visual and audio subliminals (the commercially available version), and one without subliminals. Each videotape was twenty-two minutes long and the perceptible content of each videotape was the same. In order to accomodate the fifty-nine subjects viewing the tape daily, Hypnovision provided eight copies of each version. To equalize videotape wear and hinder subjects' knowledge of the type of tape they were assigned to, each subject was issued a color-coded card. Those with blue and green cards were control subjects. They watched the videotape without the subliminals. The yellow and orange groups (experimental subjects) watched the videotape with the subliminals. Tapes were viewed at the university library.

The content of the videotapes was basic, accepted information on diet, exercise and weight control. The videotape opened with scenes of running water while the narrator urged relaxation. Plates of donuts, candy bars and fried chicken revolved on the screen, and the viewer was told to resist these foods by saying, "No Thank You." During the course of the videotape viewers were told to eat slowly, take small bites and chew thoroughly. They were instructed to drink up to eight glasses of water and exercise daily. Several types of exercises were demonstrated as the subliminal audio message, "YOU CAN LOSE WEIGHT NOW" was repeated 200 times during the music sequence. The visual subliminals were one frame edits that were flashed every five to ten seconds at a speed of one-thirtieth of a second. This was below most people's ability to perceive them. These messages were "EAT LESS", "GET ACTIVE", "CALM", "EAT SLOW", and "YOU CAN DO IT". Both videotapes stated that they contained subliminal messages and the messages were printed on the screen during the introduction. Both videotapes began with scenes of flowing water and viewers were told to relax. As the name of the company implied, the videotape attempted to put the viewer in a relaxed state so that the information and the subliminals presented would have more of an effect. of the

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The idea of whether individuals can be affected by their environment conscious awareness has fascinated many for more than two thousand Spence (1961) described the mechanism by which unconscious stimuli ffect behavior. According to Soence, memory traces are organized in the cious into semipermanent aggregates called schemata. A schema is an mization of ideas, memories, and concepts that are linked through associ-Subliminal activation of a schema occurs when a word or image enters inconscious and becomes attached through association to the general Because of the emotional content of the stimulus and because memories ideas already comprising the schema are meaningfully related, the subliminal lus activates the entire schema.

Signal-detection theory (Swets, Tanner and Birdsall, 1961; Tanner and 1954) has explained how unconscious stimuli can be processed without actious awareness. Signal detection theory assumes all signals impinging an organism contribute to a continuum of sensory activity and experience. Signals increase the probability of raising the excitation level to a at where the organism will report the signal's presence. The organism es decisions regarding attending and responding on the basis of decision is, that are based on the comparison of incoming signals relative to the es of the organism. Since all signals are processed, all information its within the organism. Certain information is attended to and consciousexperienced while the rest does not gain conscious recognition. Hence, experiences are filtered out before they reach consciousness because are not recognized as signals, yet they are still processed.

While the controversy over subliminal perception has continued on wratical and empirical grounds, there has also been public response to the minimal effect. In 1957, this controversial phenomenon came to the pubs attention when patrons in a movie theater in New Jersey were subjected 'HUNGRY? EAT POPCORN", and "DRINK COCA-COLA" messages flashed on the men every five seconds throughout a film. General sales figures over a tweek period, compared with previous sales, increased 57.5%, and Coca-h sales by 18.1% (Brooks, 1958). Use of this technique drew immediate ative responses from the public. People did not want their subconscious mis influenced.

The foremost investigator in subliminal stimulation in psychology has m Lloyd Silverman (1976). Silverman's study of psychoanalytic dynamic fivation relationships involved the tachistoscopic presentation of wishated verbal and pictorial stimuli for provoking unconscious wishes submally. Psychoanalysts have posited that different symptoms of abnormal Parior are related to different unconscious conflicts and that symptoms the viewed as symbolically expressing aspects of the particular under-My conflict.

Several studies have suggested that both situational and individual ferences are related to the strength of subliminal effects. Fisher and (1959), and Fiss (1966), found that when subjects were in a state of ued passivity, subliminal effects were maximized. Dixon (1971) suggested t subliminal effects were more likely to be found when subjects were in state of arousal. In this case, attention was unselective and cognitions t intuitive, global and unbound by logical constraints. On the other hand, here is of arousal tended to diminish subliminal effects. Subliminal stimulation has been explored in the area of learning and education. Five general areas where subliminal perception might be applicable to education were in the areas of problem solving, cognitive learning, motivation, elaborative thinking and perception (DeChenne, 1981-82).

Zuckerman (1960) had subjects produce stories after viewing the subliminal messages "WRITE MORE" or "DON'T WRITE". Their ability to produce stories mirrored the message they received subliminally. When presented with supraliminal messages that were easily recognizable, "WRITE MORE" and "DON'T WRITE", the performance of subjects at producing stories were not affected by the messages they received. Zuckerman felt this was an example how a subliminal stimulus could by-pass processes of conscious intent and revealed that it might be impossible to resist the instruction of imperative subliminal messages that were not consciously experienced.

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Smith, Spence and Klein (1959) tested to see if word meaning alone had a subliminal influence on conscious thought. When the words "ANGRY" and "HAPPY" were exposed subliminally and were immediately followed by a clear supraliminal figure (a blank, expressionless face), the subliminal words influenced impressions of the latter. Descriptions of the face were pleasant in "HAPPY" pairings and unpleasant in "ANGRY" pairings.

Parker (1982) found that subjects who were normal college students who received subliminal stimulation "MOMMY AND I ARE ONE" and "MY PROF AND I ARE ONE", in conjunction with teaching and counseling, received significantly higher grades than similar students who received the control stimulation "PEOPLE ARE WALKING". Parker agreed with Silverman that subliminal stimulation had an adaptive enhancing effect on behavior.

Experiments in education that did not reveal dramatic positive results of subliminal stimulation included studies by Severance and Dyer (1973) and Grant, Blohm and Ledford (1981). Severance and Dyer found that the presence of a subliminal color interfering word did not affect color naming. They further questioned if subliminal effects were restricted to those that produced emotionally laden responses, since words like red, blue and green were neutral and lacked emotional meaning.

Grant, Blohm and Ledford (1981) investigated the effects of subliminal stimuli on the development and improvement of execution of racquetball ceiling shots, and increased racquetball participation. Results showed that females could possibly be affected by visual subliminal stimulation to a greater degree than males, and questioned if filming subjects' performances and presenting it to them subliminally would better arouse them and lead to improved learning of this psychomotor skill.

These studies reveal two types of effects that can be produced by subliminal stimuli: the mirroring effect and the effect of arousal and learning from emotionally laden stimuli. These are related to habit breaking and habit forming behavior.

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d by and t breakAttitudes are seen as enduring predispositions that are not innate but learned. Thus, even though attitudes are not momentarily transient, they susceptible to change (Zimbardo, Ebbesen, and Maslach, 1977). In 1931, stone demonstrated the impact of film on attitudes. By using two films, depicting the Chinese favorably and the other unfavorably, Thurstone d it was possible to produce either positive or negative changes in stude toward Chinese people (Thurstone, 1931).

Though media are mere carriers of information and do not directly incence learning under any condition (Clark, 1983), there are approaches and chniques using media that seem to maximize desirable attitudinal outcomes. conson, at Iowa State University, has been investigating the topic of inructional media and attitude change for the past several years (1979, 1980, si). He outlined six guidelines that can promote certain attitudinal scomes in learners. The guideline most relevant to this study was guideret six that stated: Learners who experience a purposeful emotional involveet or arousal during instruction are likely to have their attitudes changed the direction advocated as the purpose of the mediated message.

It has often been reported that an efficient method for changing behavior cold be to change one or two underlying general dispositions or attitudes. Astinger's (1957) theory of cognitive dissonance is based on the idea that run beings demonstrate a great desire for consistency and congruity in their ditudes and behaviors and, conversely, find conflict between what they know is what they do disturbing and discomfiting (Zimbardo, Ebbesen, and Maslach, 27).

Festinger (1964) suggested that, when opinions or attitudes are changed rough the impact of persuasive communication, this change is unstable and il disappear unless an environmental or behavioral change can be brought but to support and maintain it. The data show that the occurrence of ravior change does not depend upon the prior occurrence of an attitude tange, or vice versa. Greenwald (1966) contended there was no automatic dationship between attitude and behavior; rather, they may be independently termined by the environment. Normally, the environment will produce in rsons parallel effects on belief and behavior, so these concepts will tear to be correlated. In special situations, such as persuasion following ropposing commitment, the environment exerts differential pressures on the fand behavior and then they appear to be uncorrelated (Greenwald, 1966).

Subliminal stimulation is a phenomenon that has been shown in some stances to influence basic drives, though the strength of these effects en to be related to situational and individual differences. Subliminal frects are maximized when subjects are in a state of relaxed passivity. The levels of arousal tended to diminish subliminal effects. Subliminal simulation might influence learning, and two effects produced by subliminal final were the mirroring effect and the effect of arousal and learning immemotionally laden stimuli. Media can be used to change attitudes. Learners who experience a purposeful emotional involvement or arousal are likely to have their attitudes changed in the direction of the mediated message. Change in attitudes does not necessarily mean a change in behavior.

Results:

Hypothesis 1: Subjects viewing the videotape with the subliminals will show a greater weight loss than those viewing the videotape without subliminals

The descriptive statistics shown in Table 1 indicated that the subjects assinged to the weight loss videotape with subliminals weighed less initially (x = 139.47 lbs.) than those assigned to the weight loss videotape without subliminals (x = 141.53 lbs.). After weighing at the end of the treatment, a change in weight was obtained by subtracting initial weight from weight after treatment. The data in Table 1 indicated that the viewers of the videotape with the subliminals lost an average of 1.84 pounds compared to the control group which lost an average of 2.66 pounds. Hypothesis 1 was not accepted.

Hypothesis 2: Subjects viewing the videotape with the subliminals will show a greater loss in percentage body fat than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 2 indicated that the subjects assigned to the weight loss videotape with subliminals had a greater percentage of body fat initially, though they weighed less (Table 1) than subjects assigned the weight loss videotape without the subliminals. After skinfold measurements were taken at the end of the treatment, the change in percentage of body fat was obtained by subtracting initial percentage body fat from perentage body fat after treatment. Table 2 indicated that the viewers of the videotape with the subliminals lost an average of .41 percent body fat compared to the control group which lost an average of .53 percent body fat. Hypothesis 2 was not accepted.

Hypothesis 3: Subjects viewing the videotape with subliminals will show a better attitude toward eating healthier foods and exercising than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 3 indicated that the subjects randomly assigned to the weight loss videotape with subliminals scored lower initially on the FEAT pretest than those assigned to the weight loss videotape without subliminals. After administering the FEAT posttest, the change of attitude was obtained by subtracting pretest scores from posttest scores. The data reported in Table 3 indicated that the viewers of the videotape with the subliminals showed an improved attitude toward food and exercise of 11.18 points compared to to viewers of the videotape without the subliminals that showed an improved attitude toward food and exercise of 7.37 points. However, the difference between the two groups was not statistically significant, and hypothesis 3 was not accepted.

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Table 1. 1-tast: Viewers of weight loss videotage with sub-limitate ve viewers of weight loss videotage with-out sublimizer in weight loss $\{\mathbf{R}_{j}\}$ A. Descriptive statistics Wal Sectors Localment After Waight loss # * 1.M 18 Videotape with mbliminals # * 139.47 * * 137.63 50 . 22.33 #D + 33,30 50 · 2.91 8 . 27 27 s = 2.66 Ib Viewers of Videotape Vithout Publicinate # + 141.53 # * 138.87 80 - 15.67 30 · 14.85 10 . 3.12 8 * 24 R. t-tast . 50 t value t prob **Broop** Nean Viewers of 27 1.04 Ib loss 1.91 vith mublisinals .95 145 Viewers of videotape vithout mutificals 2.66 Ib lass 3.13 24 "ws - not statistically significant. Table 2. t-tests viewars of veight loss videotaps with and limitals we viewars of veight loss videotape with out subliminals in loss of percent body fat (R_3) A. Descriptive statistics Percent body fat Before treatment After body fat Long Viewers of Videotape Vith Publiciasis x = 30.90 x + 30.09 # * .41 less 80 . 8.02 80 . 4.05 H + 17 . . 17 # = 28.10 a + 27, 97 × - .53 Victoria of 80 . 4,76 80 - 7,00 88 - 2.29 # - 34 H + 34 # + 34 B. t-test ж Nean 59 t value t prob denup. Viewers of Videotape Vith Publisiants 27 .41 1000 1.93 • .19 Viewers of Videotape Vithout Fublicinat 34 533 Lass 1,19 Table 3. t-tests Viewers of weight loss videotage with mub-limites we viewers of weight loss videotage with-out mublichals in food and assetize stillade thange (H₂) A. Descriptive statistics PEAT protest PEAT posttant AttLtude change Viovers of videotape vith mubliminate . . 13.18 # = 58,19 8 + 67.37 80 · 7.45 80 . 1.43 50 . 9,26

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*Wigher scores indicate a more positive attitude. *** - not statistically significant. Hypothesis 4: Subjects viewing the videotape with the subliminals will record fewer incidents of high-calorie, low-nutritional food intake than those viewing the videotape without subliminals.

The descriptive statistics shown in Table 4 indicated that the subjects assigned to the weight loss videotape with subliminals reported an average intake of 3.15 servings of high-calorie, low-nutritional foods, during the 24-hour period of April 30 - May 1, after treatment, compared to the control group who reported an average of 2.21 servings. Hypothesis 4 was not accepted.

Hypothesis 5: Subjects viewing the videotape with the subliminals will be able to maintain the weight loss for a longer period of time than those subjects viewing the videotape without subliminals.

The descriptive statistics shown in Table 5 indicated that a random sample of eight subjects assigned to the weight loss videotape with subliminals reported a gain of .31 pounds 10 days after treatment (May 10, 1985) compared to a loss of .53 pounds from a random sample of nine subjects assigned to the weight loss videotape without subliminals. The change in weight was obtained by subtracting the weight after treatment on May 1, 1985 from weight on May 10, 1985. Hypothesis 5 was not accepted.

In order to attempt to determine why the hypotheses were not supported by the data, in post hoc research, a Pearson correlation was utilized. This was to determine if any relationships existed between the variables (Table 6). Statistically significant correlations were as follows:

 Change in weight (difference in weight between initial weighing and weighing after treatment) was inversely correlated to change in attitude (difference in attitude toward food and exercise between pretest and posttest). Specifically, as weight change decreased, the change in attitude was more positive. This result was opposite of what was expected.

 Change in weight (difference in weight between initial weighing and weighing after treatment) was correlated to FIR (Food Intake Recall). As weight change (loss) increased, the incidence of high-calorie, lownutritional food intake increased. This result was opposite of what was expected.

 Age was correlated to change in body fat (difference in percent body fat between initial measurements and measurements taken after treatment), as age increased, body fat percentage changed more.

The first two relationships were unexpected and difficult to explain. When a Pearson Correlation was performed only on the experimental group that viewed the videotape with the subliminals, the correlation between change in weight and change in attitude was not significant. Further examination is suggested. The third relationship of increase in age to increase of body fat was not too surprising. The majority of older subjects involved in sedentary jobs did not have as much available time to exercise as the college students. Also, older women tend to eat less rather than increase exercise for weight control.

ne subliminals will od intake than the that the subject: orted an average oods, during the red to the control s 4 was not accepted subliminals will time than those that a random ape with sublimi. (May 10, 1985) ne subjects The change in nt on May 1, 1985 e not supported by ilized. This was les (Table 6). ial weighing and : in attitude :est and posttest). ude was more al weighing ake Recall). rie, lowof what was in percent body treatment), as to explain. al group between urther examito increase cts involved e as the n increase

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"Change in weight - difference in weight between initial weighing and weighing after treatment.

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^bChange is attitude - difference is attitude toward food and esercise between present post FEAT test.

"Dange in body fat - difference in pertant body fat between initial skinfeld memoranets and memoranets taken after treatment.

"FIR (Food Intuin Recall) - inclidence of consumption of high-calarie, low-matritional Cood. After completion of treatments, subjects were given a questionnaire to complete. Questions were concerned with the effectiveness of the videotape that was viewed. Results were recorded in Table 7. The questions asked and a summary of responses are recorded below:

1. Do you believe you saw the tapes with the subliminals?

Ninety-three percent of subjects assigned to the videotape with subliminals believed they viewed the tapes with the subliminals, compared to twenty-one percent of the subjects assigned to the videotape without subliminals.

Do you feel the tapes are effective?

Seventy-four percent of subjects assigned to the videotape with subliminals felt the tapes were effective, compared to sixty-seven percent of the subjects assigned to the videotape without subliminals.

How did the tapes help?

Both groups reported the same top five responses; twenty-four percent in each group said that the tapes made them more aware of the foods they ate. Other responses indicated the tapes made them feel relaxed, helped them eat less, and motivated them to exercise more and to drink more water.

4. Would you like to continue watching the tapes?

Fifty-six percent of the subjects assigned to the videotape with subliminals respondend yes, compared to thirty-three percent of the subjects assigned to the videotape without subliminals.

5. Would you consider buying the tape if you have a VCR?

Forty-two percent of the subjects assigned to the videotape with subliminals said they would buy it, compared to thirty percent of the subjects assigned to the videotape without subliminals.

Other comments you might have about the experiment:

Both groups reported that the repetition of daily viewing became boring, but the videotape would be good to view before eating. All other comments are recorded in Table 7.

According to these responses, the viewers of both groups were generally aware if they were or were not receiving the subliminal messages. However, the viewers assigned to watch the videotape with subliminals were more favorable to the continuation of this type of weight loss program. The majority of both groups felt the videotapes were effective. When asked how the tapes helped, the most popular response for both groups viewing the videotapes was that it made them aware of what they ate. The importance of awareness was stressed throughout the content of the videotape. innaire the videotions asked

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The remainder of the responses from both groups were quite similar. The viewers of the videotape with subliminals received the subliminal message "CALM", although viewers of both groups said the tape relaxed them. Another subliminal message was "EAT LESS", yet both groups said the tape helped them eat less (ranked third). The subliminal message "YOU CAN DO IT" was flashed visually, plus the audio message "YOU CAN LOSE WEIGHT NOW" was compressed and transmitted with music on the videotape with subliminals. There was one difference, however. The comment that the tapes encouraged them was mentioned more by the viewers of the videotape without subliminals than by the viewers of the videotape with subliminals. This might mean that the subliminal messages were too similar to the preceptable content and were repetitious of that content, so that possibly the subliminal messages were rendered ineffective.

One can only speculate as to why no statistically significant results were produced. The repetition in the content of the videotape might have rendered the subliminal messages ineffective. Each videotape contained the same content of basic diet and exercise information which stressed that the viewer should eat less, exercise more, eat slower and relax. The subliminal messages were precisely the same, and thus, were repetitious of the videotape's content, and this reduced their effectiveness. It is also possible that subliminal persuasion and behavior change do not work.

Recommendations for Further Study:

There are four major recommendations for those who would replicate or improve this study. One is to improve the FEAT pre- and posttest to improve its reliability and ensure its validity. The second recommendation is to start the study earlier in the school year to allow sufficient time for reweighing, one, two, and three months after treatment.

The third recommendation would be to recruit participants who have access to kitchen privileges. This would allow participants to more easily apply what the videotapes advocated.

The fourth recommendation is to conduct this same study with the same tests and measures, but use an entirely different perceptable topic, such as one dealing with relaxation. Have on group view the videotape without subliminal messages and one group view the videotape with subliminal messages of "EAT LESS", "EAT SLOW", "GET ACTIVE", and "YOU CAN DO IT". After obtaining measures of the subjects' attitudes and behaviors toward food and exercise, there would be a clearer understanding of the effectiveness of the subliminal messages, regardless of the subject of the videotape.

Summary of Conclusions:

This study found that a commercially prepared videotape containing written and aural subliminal messages was not more effective at producing weight loss in viewers than was a videotape containing the same content but without the subliminals. reatly exage

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Exterman, M. The effects of subliminal and supraliminal suggestions on verbal productivity. <u>Journal of Abnormal and Social Psychology</u>, 1960, <u>60</u>, 404-411. Please place an (X) under the column which applies best to each of the numbered statements. All of the results will be strictly confidential. Most of the questions directly relate to food, eating and exercise. Please answer each question carefully. Thank you.

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IITLE: EDUCATIONAL COMPUTING INSERVICE DESIGN: IMPLICATIONS FROM TEACHERS' CONCERNS RESEARCH

RUTHOR: JOHN F. WEDMAN

Educational Computing Inservice Design:

Implications from Teachers' Concerns Research

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Educational Computing Inservice Design:

Implications from Teachers' Concerns Research

Abstract

Barch

1.

This paper provides an overview of an ongoing research effort studying teachers' concerns about educational computing. Two studies are reported. The first study identified teachers' concerns about educational computing and monitored how these concerns changed during an inservice activity. Concerns theory hypothesizes that the concerns of innovation users are developmental, beginning with self-oriented concerns, evolving through implementation-oriented concerns, and progressing to other-oriented concerns. The research findings were not consistent with the hypothesis, suggesting that the nature of the inservice and/or the characteristics of the innovation (i.e., educational computing) may affect changes in concern. The second study evolved out of the first and examined teachers' concerns about educational computing by focusing on specific educational uses of the technology (e.g., CAI, word processing, interactive video). The research findings indicated that different uses of computer technology elicit different concerns about the technology. The findings suggest that inservice designers dealing with educational computing should recognize educational computing as an "innovation bundle" and concentrate on specific applications of the technology, rather than addressing the technology whole-cloth.

Educational Computing Inservice Design: Implications from Teachers' Concerns Research

Before teachers can take full advantage of computer technology, they must modify their instructional practices to accommodate the technology. Stevens (1980) stated that two major factors affect implementation of educational expertise with computers and computing: teachers' attitudes toward computers. Most inservice . teachers' attempts focus on increasing teachers' computer expertise while paying little attention to teachers' attitudes toward the technology. Such an inservice emphasis is understandable given: 1) the growing amount of information about educational computing; and, 2) the limited amount of information regarding teachers' attitudes toward educational computing. Thus, a research base focusing on teachers' attitudional responses to computer technology needs to be established. This paper reports on two studies of teachers' concerns about educational computing. The paper reports the patterns of concerns teachers had about educational computing, describes how these patterns changed during an inservice effort, and examines the relationship between teachers' attitudes toward educational computing and specific applications of computer technology.

Literature Review

Computer-related inservice design is in its infancy; the professional literature frequently fails to provide either evidence of effectiveness or a theoretical framework to support the design suggested. This is particularly evident in the affective dimension of inservice design where little attention has been given to the adult learner in a change endeavor involving computer technology.

The awareness that inservice usually involves adult learners is an important, although frequently ignored, dimension of inservice design (Orlich, 1983). Knowles (1970) described adult learners as human beings who draw heavily upon <u>past experiences</u>, are more <u>problem-centered</u> than content centered with immediacy of application a high priority, and are highly <u>self-directed</u>. These learner characteristics are manifested in inservice programs as learner concerns.

Teachers, as adult learners, bring a variety of past experiences to a learning situation. Podemski (1981) observed that many teachers have had limited experience with educational computing and have, instead, relied upon, and made a commitment to "non-computerized" materials and teaching techniques. Teachers having limited experiences with computing may reflect concerns related to simply gaining awareness about educational computing.
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y of past 1981) erience lied upon, rials and periences imply The problem-centered characteristic of the adult learner is expressed, in the area of educational computing, as a strong concern for more effectively meeting the needs of students (Stevens, 1982). Also, concerns regarding the effect of educational computing on the day-to-day management of the new technology may be more significant to some teachers than the acquisition of technical expertise (Jarchow & Hunter, 1983). If an inservice program does not address the concerns that are relevant to the teachers, then some teachers, as adult learners, may redirect their attention away from the inservice and perhaps away from educational computing.

4

Understanding how adult learners respond to innovations and how responses change as a result of inservice efforts has been systematically researched using the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973). The CBAM suggests that inservice efforts may be less than optimally successful because inservice designers fail to consider where teachers are in the process of acquiring new attitudes, understandings, and skills relative to the given innovation (Loucks & Hall, The model suggests that when adult learners engage 1977). in a new learning endeavor, they pass through predictable stages of concern. These stages reflect a developmental movement from a lack of awareness concerning an innovation to a general seeking of information, to personal, management, and consequence concerns, and finally to concerns regarding collaboration and further innovation. Brief definitions of the stages of concern are shown in the Appendix.

While the CBAM is generally accepted in the inservice design and change process literature, the model has received limited use in designing or researching educational computing inservice efforts. Bartel (1984) and Wedman and Strathe (1984) used the stages of concern framework to design faculty development programs, but did not formally assess concerns. Wedman and Heller (1984) described teachers' concerns before they entered an inservice effort but did not investigate how these concerns changed during an inservice effort. Thus, the purpose of Study #1 was to test the changes in concerns as hypothesized by the CBAM. Specifically, Study #1 assessed teachers' concerns and described the effect of an inservice effort on their concerns about educational computing. Study #2 evolved out of Study #1 in an effort to understand better the unpredicted results of the earlier study.

Methods & Findings: Study #1

The participants in Study #1 were classroom teachers who had voluntarily enrolled in a university-offered course, "Microcomputers in Education," for which they paid their own tuition. Sixty-five were females (71%); twenty-six were males (29%). Forty-four taught elementary SCC grades (48%); seventeen taught middle/junior high grades COL (19%); twenty-six taught high school (29%); four taught gri grades K-12 (4%). The teachers varied in years of teaching experience (one to forty-four years) and amount of computer experience (novice to computer science instructors). Both thi 1e' pre and post data were collected from 91 of the 104 participating teachers. COL

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The course was offered at six different sites across a central midwestern state during the fall of 1982 thru the Spring of 1984. Each offering was in response to requests from administrators and teachers for computer-related inservice. The course consisted of 30 hours of classroom instruction and several out-of-class assignments. The actual duration of the inservice course varied from two weeks (five hours per day, three days per week) to eight weeks (three and 3/4 hours per day, one day per week). The course placed emphasis on transferring course content to the teachers' own practices. The same content was used in each course and included such topics as microcomputer operation, elementary programing, software selection, evaluation, and utilization, and simple authoring systems.

The Stages of Concern Questionnaire (Hall & Rutherford, 1976) was used to measure teacher's attitudes toward educational computing. The items on the questionnaire represent the seven stages of concern; five items comprise the scale for each stage. Estimates of internal consistency (alpha coefficients) for stages rance from .64 to .83. Hall and Rutherford (1976, pp. 12-20) describe several studies which indicate the SoCQ is a valid measure of the hypothesized concerns.

The SoCQ was administered to all teachers enrolled in the six offerings of the course. The preassessment was conducted during the first class meeting prior to any discussion of the course or its content. The subjects were told that the results of the questionnaire would be used to evaluate the effectiveness of the course.

The SoCQ was scored using the SoCQ Quick Scoring Device (Hall & Rutherford, 1976). The Quick Scoring Device converts raw scores to percentile scores for each stage of concern. A higher percentile score is associated with greater concern intensity. Pre and post data were then prepared (compiled and averaged) for comparison of teachers' concerns for each site and for the entire group.

For interpreting SoCQ results, Hall and Rutherford (1975) suggest that "...due to the nature of the questions being asked, identification of trends and patterns in the data seems more valid than conducting a series of tests of statistical significance." (p. 8) Following this suggestion, each teacher's pre and post SoCQ percentile

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e questions ins in the of tests of .s 'centile scores were graphed thus forming "concerns profiles." The compiled data for each site and the entire group were also graphically represented.

Examination of the preassessment profiles revealed that for most teachers entering the inservice course, lower level, more self-oriented concerns, were typically most intense (see Figure 1). These informational and personal concerns reflected interest in the general characteristics of the innovation and the relationship between one's role and the demands of change. In addition, however, it was observed that approximately 1/3 of the participants displayed a "two-humped" profile with high intensity concerns in both information and collaboration (See Figure 2). This profile was reflective primarily of those individuals who had considerable computer experience prior to the inservice effort.



Figure 2.

Preassessment concerns profile, "two-humped," Study #1.

Figure 1.

Preassessment concerns profile, entire group, Study #1.



imp. Analysis of the postassessment profiles (see Figure 3) cla: revealed several unexpected patterns. While the work of not Loucks and Hall (1977) has suggested a developmental suf: progression in concerns changes, intermediate concerns man (i.e., management) typically remained lower in intensity. con In addition, it was noted that the intensities of higher bec level concerns (consequence, collaboration, and refocusing) edu increased although lower level concerns, evident in the and preassessment profiles, did not change markedly, somewhat adv in contrast to the progression suggested by the CBAM model. int It should also be noted that the postassessment profiles pro resembled the "two humped" profile commonly found among the one experienced individuals. COD



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Postassessment concerns pro app entire group, Study #1. of

Discussion: Study #1

The preassessment profiles in Study #1 suggest that inservice providers must be cognizant of the heterogenity of teachers' concerns about educational computing. Inservice experiences for many individuals need to address self-oriented concerns while experiences for other individuals need to address both self-oriented and other-oriented concerns.

The surprisingly low intensity of implementationoriented concerns at both the pre and postassessment points raises several questions. The low intensity may be suggestive of the nature of the inservice effort itself which encouraged but did not require teachers to actually

ee Figure 3) e work of ental! oncerns intensity. of higher refocusing) t in the , somewhat CBAM model. profiles nd among the

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implement educational computing activities in their classroom. Or, perhaps implementation-related concerns did not become intense because the teachers were not given sufficient time to fully implement the innovation and manifest implementation-related problems and the associated concerns. It may also be posited that, while teachers became comfortable with the elementary aspects of educational computing (e.g., system operation, use of drill and practice software), they also became aware of more advanced aspects of the technology (e.g., word processing, interfacing with other devices). Thus, the postassessment profiles may be actually depicting concerns about more than one aspect of educational computing. This explanation is consistent with the multi-faceted nature of educational computing and served as the impetus for Study #2 which examined how teachers' concerns vary when different aspects of educational computing are considered. It was predicted that, if teachers' concerns do vary, then more familiar applications will be associated with more advanced stages of concern.

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Methods & Findings: Study #2

In Study #2, the SoCQ was used to assess teachers' concerns about different aspects of educational computing. Five elementary schools (E-1...E-5), one middle school (M S), and one high school (H S) from a midwestern school district volunteered to participate in the study. Teachers at the schools completed one of four randomly selected versions of the SoCQ, each version focusing on a different application, specifically, computer assisted instruction (CAI), computer managed instruction (CMI), interactive video (IV), and word processing (WP). The teachers were also asked to complete an open-ended concerns question for the particular application. Table 1 lists the schools involved in Study #2 and indicates the number of teachers completing each version of the SoCQ. Concerns profiles were constructed for individual teachers and groups of teachers responding to the same application of educational computing.

Table 1. SoCQ Questionnaire Version by Schools

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rogenity	SoCQ	E-1		E-2		E-3		E-4	1	E-5		MS		HS	5	Totals
o address	CAI	4	1	4	1	5	1	5	1	3	1	8	1	12	1	41
d	CMI	5	1	4	1	5	1	5	1	3	1	6	1	14	1	42
tion-	IV	4	1	4	1	6	1	4	1	3	1	7	1	10	1	38
ent points	WP	6	1	4	1	6	1	6	1	2	1	8	1	16	1	46
itself actually	Totals	17	1	16	I	22	1	20	I	11	1	29	1	52	1	167

Initial examination of the four sets of group profiles (by application) revealed that when teachers consider different aspects of educational computing, different types of concerns are NOT evident (see Figures 4a-d). This finding appears to suggest that teachers' concerns about educational computing are essentially the same, regardless to the particular application being considered. Closer examination of the concerns data revealed, however, that such is not the case.





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When the individual profiles are examined, a different picture becomes evident. By examining the individual profiles, and noting which concern has the highest intensity, a simple matrix of concerns by applications can be created. (Note: In those cases where two concerns had the same intensity, the open-ended data was used to help classify the profile.) Such a matrix, shown in Table 2, can be used to identify, for a given application, the percentage of teachers having a particular concern as most intense. Three patterns are noteworthy. First, the percentage of teachers having intense awareness concerns was lower in CAI than in other applications. Second, the percentages were more widely distributed in CAI than in other applications. Finally, a large majority of concerns about interactive video were in the awareness stage.

Table 2. Concerns x Application Matrix

Application

Concern	1	CAI	I	CMI	1	IV	1	WP	I
Awareness	1	42%	1	60%	1	70%	1	59%	l
Information	I	35%	I	26%	I	23%	I	29%	1
Personal	I	15%	. 1	12%	I	7%	1	8%	1
Management	1	88	I	2%	1		I	48	ī
Consequences	١		١		I		I		1
Collaboration	1		I		I		1		Ī
Refocusing	I		١		I		I		1

Note: Cell entries indicate, for a given application, the percentage of teachers whose concerns were most intense for a particular stage of concern.

Discussion: Study #2

The variation in teachers' concerns about different educational computing applications was not evident in the composite group profiles. Yet, when the concerns data was considered on an individual basis, important differences became evident. Teachers' concerns about educational computing do vary, depending on which application is being considered. This finding seems to support the notion that educational computing is an "innovation bundle," that is, a collection of several specific innovations each of which elicit potentially different concerns. The finding is also consistent with the results of Study #1 in that the two-humped profiles may have actually been representations of concerns about more than one innovation. Study #2 also suggests that inservice designers, evaluators, and researchers need to focus on specific aspects of educational computing rather than on the entire innovation

Conclusion

H.

This paper reported on two studies examining teachers concerns about educational computing. Collectively, the studies suggest that educational computing is an innovation bundle rather than a single, unitary innovation. If educational computing is an innovation bundle, then the problem for inservice designers is, in part, one of "unbundling" the innovation. Care should be taken, however, to not mistake the end result of such an analysis as a blueprint for designing inservice. Some instructional design theories, for example, Reigeluth's (1979) elaboration theory, suggest that instruction should be organized in a general to specific structure. Educational computing content readily lends itself to such a structure. An inservice program designed to expose teachers to several aspects of educational computing could serve as the "epitome." Later inservice efforts would then concentrate on more specific aspects of educational computing. As the inservice begins to focus on more narrowly defined applications, the inservice designers should then begin to collect and use concerns-related data as part of their audience analysis.

References

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Appendix

Definitions of Stages of Concern About the Innovation.

Stage	Title	Definition
0	Awareness	Unaware of or unconcerned about the innovation.
1	Information	Concerned about the general characteristics of the innovation.
2	Personal	Concerned about the relationship between one's role and the demands of the innovation.
3	Management	Concerned about the management and organization of the innovation.
4	Consequences	Concerned about the impact of the innovation on student outcomes.
5	Collaboration	Concerned about working with others using the innovation.
6	Refocusing	Concerned about something better than the innovation.

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TITLE: GRADUATE STUDENT CONTRIBUTIONS TO AECT AND TO THE FUTURE OF EDUCATIONAL TECHNOLOGY

AUTHOR: PAUL W. WELLIVER

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Graduate Student Contributions to AECT	A
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A Summary of a Presentation for a Session	ASSU
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Las vegas, Nevada - January 19, 1966	bele
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It is a common and generally accepted feeling among many graduate	180
students that they are necomers to a profession and therefore they should	80.
be seen and not heard, sit obediently at the feet of experts to catch pearls	4. P
of wisdom, and generally play a subserviant role within a professional	861
association. This perception is just not true of AECT!	Y
	add :
This is not to deny that there is a great deal to gain from "rubbing	that
elbows" with the scholars and leaders in the field by associating with	quiti
them at AECT functions. These contacts should be approached, however,	inhit
with the assurance that, as graduate students in a rapidly evolving field.	enri
you have a great deal to contribute to that growth and change. I will try to outline a few of the ways in which this can be done.	
	5. G
 Introduce a fresh viewpoint and perspective. 	A
. You must be ewere that you are growing up and maturing in the	the j
computer reportion. Many of the established leaders in our field came fill	long
of the lentern clide generation. These two groups think differently. This	met
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are able to pick up where they left off and epproach instruction from a	deve
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significantig unierent perspective.	120
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2. Challenge tradition

A lot of what has been done in education made good sense at the time and under the circumstances in which it was developed. A background, a foundation, a tradition are all necessay elements of a field. But they can not be permitted to dominate a field - particularly the one in which we work. You are in the best position to suggest alternatives to some of these traditions and require that all of us examine the basic premises and assumptions upon which we operate. Be prepared to fail and be wrong but don't let that inhibit you from venturing in new directions.

3. Provide a balance.

As you challenge tradition, recognize the basis and value of that tradition. In so doing, help the profession to achieve an appropriate balance between residual elements of the past, which continue to provide value, and the exciting new dimensions of cutting-edge technololgies. The concept of balance is important. Leaning too far in either direction often causes a system to topple and fall.

4. Provide vitality to the profession.

You, with your youth and new perspective, are in a unique position to add a spark of vitality to professional gatherings. This is not to imply that an assembly of mature professionals is necessarily dull. Indeed, quite to the contrary! But your seniors in this field are both enriched and inhibited by the past. You, unshackled by much of what came before, can enrich wisdom with openminded enthusiasm.

5. Get involved and serve.

came out y. This atic that you om a Actually this is not primarily something that you can do for AECT and the profession. Rather, as you contribute your time and energy it is, in the long run, something that the profession can do for you. It is difficult for me to conceive of an individual being able to make significant progress professionally without this type of involvement. The personal relationships and networks that are achieved are invaluable as your career develops. I can not even estimate the number of times that I have needed

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information or assistance when I have been able to pick up the telephone and call someone who I met through my professional involvement The more involved you are, the more people that you meet and the more you develop that network of support. It is a very positive version of the old saying that it isn't what you know but who you know.

Develop a special network among other graduate students.

A few years ago a major effort was initiated to develop a network of graduate students. All graduate programs were contacted, a student representative was identified at each one, and a regular newsletter was circulated. Unfortunately, it was a time when AECT was absorbed in a lot of other priorities and the effort was abandoned after about a year. I think that the time is now right for such an project and would challenge you to initiate a graduate student network. I would be glad to provide some background from the past effort to assist in getting the idea underway. In fact, at one time it was even suggested that such a group might seek division status in AECT. One wag even proposed that it be known as the Division of Graduate Students or DOGS. He felt that it was an appropriate acronym in light of the life that he was leading in graduate school!

AECT has a tradition of planning activities which will bring together the experienced professional along with the younger newcomers to the field. You are the ones who provide one of those two important dimensions to our profession. I invite and urge you to capitalize on this significant professional role. DILE:

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TITLE:

EMERGING TRENDS IN EDUCATIONAL TECHNOLOGY RESEARCH

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SUTHOR: WILLIAM WINN

Descript Grands in Educational Machaology Dess	chara
Emerging Trends in Educational Technology Research	-lim
Bill Winn	
University of Washington.	a nun
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AECT Annual Convention	TR
Las Vegas, January, 1986.	191 0
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The topic of this paper, or something very much like it, has become a fixed feature of the program of AECT conventions. Whether this means that the planners of each year's program do not pay attention to what has been presented on previous occasions, whether each attempt at addressing the question has failed, or whether there is a genuine and sincere concern that we constantly ask each other what researchers in educational technology should be doing, is not clear.

This year's examination of the issue attempts to answer four had over-arching questions. The four questions are:

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- i. What is the nature of inquiry in Educational Technology?
- ii. What do we need to find out?
- iii. How do we go about it?

iv. What do we do with our findings?
 Less cryptically, these questions point to a need to examine: why can we do research in our area and what the characteristics of that the research might be; the types of research questions we should and incomposition of the asking; what are the most appropriate methodologies nor for finding answers to our research questions; and what are the

search

characteristics of a report of research that make it "good" and utlimately suitable for publication. Let me repeat, however, that a number of wiser heads than mine have tackled these questions before and have come to conclusions that are generally in agreement with those that I shall present. The reader might wish to consult these sources. (Torkelson, 1977; Salomon, 1978, 1979; Wilkinson, 1980; Clark, 1983; Gerlach, 1984; Heinich, 1984; and pany others).

h like it, has The Nature of Inquiry in Educational Technology. ntions. In a recent address, Lee Shulman (1985) observed that program do arguments about the modes of inquiry that are common in the vious social sciences are almost totally absent in the "hard" sciences. uestion has By and large, physicists, chemists, astronomers and the like take oncern that we methodology for granted. They agree about how research should be tional done. There are two reasons for this. The first is that the social sciences are younger than the natural sciences and have to answer four had less time to arrive at a consensus over methodology. The second is that the factors that social scientists study are more hal complex and less clear cut than those studied by their

counterparts in the "hard" sciences.

Shulman's observation would be reason enough for beginning this paper with a look at the nature of inquiry in our

discipline. But the matter does not end there. If one looks

Carefully at the literature, one is left with the impression

that, with some notable exceptions, the matter of the nature of

inquiry in our field has never been addressed adequately. We do

Not have a clearly-defined "philosophy of science" to guide us.

examine: why ics of that e should and nethodologies hat are the

The exceptions will be familiar to most of you. They include som grequ of the central ideas set down by Heinich (1970, 1984) about the prac nature of Educational Technology, the discussion of the role of enjoy prescriptive theory by Reigeluth (1983) and by Clark (1983). The issue is also addressed less directly by Jonassen (1984) in his thin philosophical analysis of mediation, Brody (1982), who describes do. I a "functionalist" agenda for research on pictures, and Streibel area, (1985, & in press) in his critical analysis of educational seth computing. Notice that I have not listed any of the numerous tech: papers at previous conferences dealing with naturalistic research from methods. This does not mean that these papers have no value. They tech certainly do. But they do not delve deeply enough to define the some nature of inquiry in our field. The

The purpose of inquiry in any discipline is simply to find one things out. We find things out for a number of reasons, not least theo among which is that we are by nature curious. This, of course, in to s a terrible truism, which is why we tend not to dwell upon the buil point when we initiate people into research. But the desc satisfaction of curiosity is supremely rewarding, and from this of i satisfaction comes the enjoyment one gets from doing research. It scie is sad that so many graduate students feel that doing research 1 drudgery, or worse, and that, largely because of this, they do not sati , more once they have their dissertation out of the way. (Maybe, 45 prac Clark (1978) implied, this is also the attitude of their the supervisors, in which case they are at a double disadvantage). that But the fact remains that research is very satisfying, whether 1 Pro leads to a significant contribution or not. Put another way Edu there is nothing wrong with doing research for its own sake.

y include son frequently our obsession with coming up with "significant" or 34) about the "practical" results makes us devalue the work that we really ? the role of enjoy, and turns us away from doing more.

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The curiosity that inquiry satisfies is curiosity about why (1984) in his things are the way they are, and why they behave the way they who describes do. Research therefore becomes a quest for explanations. In our and Streibel area, this might involve explanations of why one instructional sethod succeeds where another does not, why some delivery technologies are thought of as more reliable or easier to learn .istic research from than others, why administrators will spend money on some no value. The technologies and not others, why smart students learn better from to define the some instructional methods than less able students, and so on.

The explanations that researchers find for such phenomena will, mply to find one hopes, fit together in non-contradictory ways into a body of sons, not least theory which, in turn, will direct us towards what explanations of course, is to seek after next. This is the familiar cycle of research .1 upon the building theory from which research hypotheses are derived, and is described in any research methods text. The result of this type nd from this of inquiry is <u>descriptive</u> theory that is typical of the natural g research. It sciences (Simon, 1981).

ng research is A number of scholars in our field find even greater is, they do most satisfaction when the explanations they find are applicable to ay. (Maybe, as practical problems. In these cases, the purpose of research is their the generation of <u>prescriptive</u> theory. It is this type of theory advantage). That guides the decisions that instructional designers make, a g, whether it process that is the pivot around which the whole field of her way, Educational Technology turns. As Reigeluth (1983) has stated, wn sake.

prescriptive instructional theory consists of an integrated set pecia of principles that state which methods to use given certain teing outcomes to attain and conditions under which instruction is to experi occur. Simply put, these principles take the form: "If x and y mehc then do z". For example, if you want students to be able to resear solve word problems involving fractions (outcome), and if the applic students know how to perform the four basic arithmetic operation mnece on fractions and have high fluid ability (conditions), rigor prescriptive theory might point to using an inductive method with types lots of feedback. A number of scholars in our field have drawn 2 together bodies of prescriptive theory from research that are of this a value to instructional designers. These include all of the cresc1 authors in Reigeluth's (1983) volume, the work of Fleming and should Levie (1978), and the prescriptions for designing concept lessons profes offered by Merrill and Tennyson (1977). Sunan,

Inquiry in our field, then, serves three purposes: it here. satisfies our curiosity about the way things are; it leads to the (Schore discovery of explanations about what happens when people learn, becis interact with technologies, and so on; and it allows the "plau: development of prescriptive theory that can inform decisionmaking. It does, however, have one other important presc characteristic, which Shulman (1981) described as having method or orderliness. Regardless of which particular research paradiga you subscribe to -- experimental, historical, ethnomethodological, phenomenological, evaluation -- all inquiry in Ed

that is worth anything is rigorous. What this means varies from this paradigm to paradigm. However, scholars of every kind should be (Tork able to point to examples rigorous of inquiry within their

itegrated set epecializations. It is terribly wrong to think of one paradigm as 1 certain reing necessarily better, than another. But, as we all know, some ruction is to experimental researchers look down upon naturalistic inquiry as "If x and y comehow less rigorous and inferior, while some naturalistic : able to researchers scorn experimental research for lacking and if the applicability. Such divisive squabbles are counterproductive and tic operations unnecessary. It is far better to accept different standards of 15), rigor (see, for example, Guba, 1981) and acknowledge that all ve method with types of good research make a contribution to our field. have drawn At the risk of belaboring the point, I would like to take h that are of this argument one step further. Increasingly, we read that of the prescriptive theory and design are unnecessary, and that we leming and should rely upon the expertise of teachers and other oncept lessons professionals "in the field" to make instructional decisions (see

Sunan, 1983). However, the same standards of rigor must apply ses: it here. The ability of expert professionals to "reflect in action" t leads to the (Schon, 1983) must not be thought of as a pretext for sloppiness. eople learn, Decisions based upon experience, intuition, hunches and s the "plausible reasoning" (Hunt, 1982) need to be just as sound and lecision- carefully deliberated as decisions based upon a more formal

ving method rch paradigm who

What do we need to find out?

A number of scholars have reviewed the progress of research all inquiry in Educational Technology over the years, and have been able, from varies from this historical perspective, to point to the gaps in what we know I should be (Torkelson, 1977; Clark, 1983; Gerlach, 1984). This approach has their

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also led to the conclusion that we have not been asking the right main: research questions, that we have not been trying to find out we work it is really important to know.

The development of research in our area is generally istu acknowledged to have followed the following stages:

1. Media comparison studies, in which the effectiveness of appropriate in the importance of the importance of the compared to that of another medium or to important in the second of the importance of time because there is nothing intrinsic in the media by part which instruction is delivered that can possibly affect how and diff what people learn.

2. Media attribute studies. Here, researchers attempted to tech identify specific attributes of the different media which made futu them unique and which might account for differences in outcomes when different media were used to teach. Again, there are bad conceptual and methodological difficulties with studies of this in kind which preclude their contributing much of value to theory. and

3. Aptitude-Treatment Interaction research. Snow and Salous pec (1968) pointed out a long time ago that differences in student Ve aptitude and ability would "mask out" main effects in media COI research, and that they should be included as factors in research te designs in our field. A great many studies have now been or conducted using the ATI paradigm, often claiming to find *1 interactions, although, again, there are many methodological 26 problems that make the majority of these studies suspect 21 1 (Cronbach and Snow, 1977).

4. Learning strategies research. While not within the

king the rice "mainstream" of educational technology research, a great deal of find out what work is now being conducted on the strategies students use to

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to imong others.

tearn (Brown, 1981; Brown, Campione and Day, 1981). Just because student has ability in a particular cognitive skill does not sean that the ability will be used to learn when it is stiveness of appropriate to do so. The use of strategies by students is an important area for researchers in our field to address.

5. Research on students' attributions. Salomon (1981, 1982, a complete 1983, 1984) and Clark (1983) both state that the importance of a the media by particular instructional technology derives from the value and ect how and difficulty attributed to learning from it by students. Again,

this research is not yet thought of as "mainstream" educational ttempted to technology research. However, it points towards an important which made future development.

in outcomes This evolution of research illustrates both the good and the e are bad, the productive and the less productive, in what we have done ies of this in the past. Generally, the more recent research is more valid to theory. and describes things more accurately, (although there are still / and Saloac people doing media comparison studies, in spite of the fact that in student We know they are a waste of time). Also, this type of research is media conclusion oriented, and represents only part of what educational ; in research technologists do. We have a considerable tradition of decision oriented research, which is conducted under the rubric of "Instructional Development". From our past research, we have logical learned some useful things about how student characteristics are related to different instructional methods, though this information is too fragmented to qualify as an instructional

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theory. We are beginning to discover the relationships are task, student characteristics, methods and strategies that students actually use. We have a clearer, though by no mean complete picture of the cognitive processes that underlie learning associated with memory, attention, recall, imagery problem solving, and so on. On the other hand, for all our efforts, we have no theory that relates media or technologies. learning (nor, some might say, is such a theory potentially interesting nor even possible). We have very poor procedures making instructional decisions based upon the most recent cognitive research. All of the design models I can think of m built upon behavioral premises and principles. Such prescrimtheory as we have is so incomplete as to appear incoherent at times, and is made up of instructional principles that might "local" validity, but which, by and large, are not particulate robust or generalizable.

From this, it is possible to identify some things we shall be finding out. Whether these will develop into future trends: remain pious hopes remains to be seen. We shall look first at general research areas, and then at several more specific typ of question.

Prescriptive Instructional Theory.

We must continue to conduct conclusion-oriented research² uncover prescriptive instructional principles which will fit together in a coherent and stable theory. In spite of a great clamor to the contrary (Phillips, 1983; Eisner, 1984), there ³⁵ still a need in education for both principles derived from experimental research and heuristics derived through gualitat³⁴

hships among egies that by no means underlie 11, imagery, or all our technologies technologies technologies trecent otentially procedures is t recent n think of an ch prescriptim icoherent at that might hm t particular;

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knowledge about the factors that are <u>necessary</u>, not merely sufficient, to bring learning about (Clark, 1983). In practical terms, this requires the study of basic cognitive processes, human abilities, learning strategies, and attributions of learners' successes and failures to the various methods and technologies we employ when we teach. These factors are highly interdependent, and deserve study in contexts where that

eodes of inquiry (see Howe, 1985). Indeed, there is increasing

1982) and Artifical Intelligence (Feigenbaum, 1985) that both

mowledge are necessary for the development of the levels of

expertise required for the successful execution of higher

avidence from Philosophy (Schon, 1983), Cognitive Science (Hunt,

experimentally verifiable factual knowledge and intuitive tacit

cognitive processes. An "expert" uses experience and intuition to

fill in what theoretical principles do not deal with. Likewise,

an expert system relies on a knowledge base, derived from public

knowledge, and a set of heuristics, derived from human experts,

establish as complete a prescriptive theory of instruction as

can be made up for by capturing the heuristic knowledge of

experts. This research requires that we continue to seek

possible, on the understanding that its inevitable incompleteness

Our research must therefore attempt to discover, verify and

interdependence is not destroyed, and even becomes the object of the study itself.

Decision Oriented Research.

in order to function.

Heinich (1984) has made the point that the most important qualitative

type of research for educational technologists to conduct is the educatic which leads to solutions to practical problems within contexts is system 1 which the complexity of the "real world" has not been "controlle "systems for" as it is in experimental research. The emphasis is on the resulted application of knowledge to solve problems, and loudly echos the if follo definition of "Technology" upon which our field is built to unit of (Galbraith, 1969).

There are, I believe, three aspects to this kind of research being g: that need to be considered. The first of these is the development selected and validation of procedures for conducting decision-oriented clarifie research. The procedures that we have to do this -- our provide instructional development and design procedures or "models" -organist have by and large been developed intuitively. As Gerlach (1984) selecter has pointed out, with rare exceptions, they have not been Student: submitted to the kinds of empirical testing that we require of learnin the postulates of theory. Gerlach would have us study the terribl' behavior of educational technolgists themselves, requiring that the way design models become independent variables in research studies. educati In this way, we would be able to ascertain whether, and which, Theory, design procedures result, ultimately, in superior student complex performance. We have not yet answered the research guestion: does the com following a design or development model lead to superior on self instruction? instruc

Second, we need to develop ways of studying complex systems open sy without having to dismember them. Precisely what needs to be done in this regard is less clear. However, the concepts and studies methodologies of General System Theory (Bertalanffy, 1968) would Set a p serve as a good place to start. By and large, I believe that

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"front-end" analysis and field testing, with little guidance of research being given at the decision-making stage where methods are development selected to match the conditions and outcomes that the analysis has oriented clarified. The real purpose of System Theory, however, was to 12 provide ways of managing great complexity, originally in living odels" --organisms. The decisions through which instructional methods are ach (1984) selected require that we deal with such great complexity. seen Students are very complex, and the multivariate nature of aquire of learning and instruction simply cannot be dealt with by our the terribly naive "system approach". What we need to find out is how .ring that the ways for dealing with complexity, suggested by those few 1 studies. educational technologists who have really understood System d which, Theory, can be applied in practice to the making sound, though ent complex, instructional decisions. The work of Heinich (1970) on stion: does the complexities of the management of instruction, of Pask (1984)

or on self-organization in complex systems involving students and instructors, and of Winn (1975) and Beckwith (1984) on ex systems Open system models of learners, is instructive in this regard.

to be Finally, we need to treat ID projects very seriously as case s and studies. Obviously, the primary purpose of an ID project is to 68) would get a problem solved as efficiently and effectively as possible. that

However, we lose a great deal of valuable information every time 1981; Bi that those in charge of a project fail to describe it in the somethi: literature. I have argued elsewhere (Winn, 1981) that ID is a and how valid and valuable form of research. By the standards that are educatio applied to experimental research, ID falls short when it of who comes to generalizability of findings. Because ID projects set example out to solve local one-shot problems, and because few variables instruc if any are controlled, one might argue that the experiences would expert: be so specific to that one case that they could not possibly be the met of interest to other developers. But it is a question of whether the stu the mug is half empty or half full. Looking at it the other way method around, there are certain common elements in every ID project: argue t there is a "client", a need, a goal, a set of objectives, a decided solution, try-out and implementation. How each of these is hand, i handled differently under different circumstances is very than de instructive, especially when one considers that the developer learner seeking "methods" which might help in a particular project will interme certainly be intelligent enough to adapt the suggestions of a learnir fellow developer to fit his own needs more precisely. The case ST But in seems to be the best way to accomplish this, and educational W) technologists should be encouraged to use it. Tesearc

The following specific research needs and questions are not control presented in any particular order. They encompass both carrier conclusion- and decision-oriented research. 1985; 1985; 1

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Metacognition.

There is increasing evidence that students are capable of whethe monitoring their own cognitive performances and of making is ant deliberate changes in the strategies they use to learn (Brown,

n every time 1981; Brown, Campione and Day, 1981). This is generally seen as t in the comething to be desired, for it allows students control over what t ID is a and how they learn. There is, however, a Catch-22 as far as s that are educational technologists are concerned. It involves the question 1 it of who knows best, the designer-instructor or the student? For jects set example, if an instructional designer chooses a particular / variables instructional method on the basis of prescriptive theory, fiences would expertise, or what has worked in the past, then it is assumed that possibly be the method is indeed the best, given the circumstances. Now, if of whether the student monitors his performance and decides that another other way method would be better, who is right? On the one hand one might) project: argue that if students "interfere" with what an "expert" has ves, a decided is best, then design is a waste of time. On the other se is hand, if students do indeed know more about what is good for them very than designers can possibly know on the basis of their meagre eveloper learner analysis, then design helps students take the oject will intermediate step between complete novicehood and mastery of ons of a learning strategies. In either case, design becomes unnecessary. The case st But in the latter instance, the reasons for this are positive.

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research into the relationships among prescription and learner control of instructional methods. Some work has already been carried out on this problem (Carrier, Williams and Davidson, 1985; Tennyson, Christensen, Walsh and Hajovy, 1985) in the study of computer-assisted learning. However, we need to find out whether the prescription of methods by designers or instructors is antithetical to or facilitative of metacognitive skill in

What comes out of this conundrum is the apparent need for

(Brown,

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students. In this way it should be possible to identify at what from a point a student should be allowed to make metacognitive decision effici rather than abide by prescribed ones. it is Perceptions of Media and Technologies.

The work of Salomon (1981, 1982, 1983, 1984) on attribution self -: of qualities to media by students has opened up a new area that educational technologists should study. The suggestion is that vario the effects and effectiveness of different media and delivery techn technologies are determined mostly by how the students perceive presc them. This includes whether the medium is considered to be "easy study or "hard", whether the student thinks it is worthwhile putting redia any effort into it, and so on. In addition to Salomon's work, teach Krendl has studied the effect of "set" (Krendl and Watkins, 1983) in wh and "preconceptions" (Krendl, 1985) on television viewing. the c Salomon (1985) has turned his attention towards similar question part involving computers. These studies serve as models for others to the t follow. cond'

Technological Constraints.

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While it has been established (Clark, 1983) that it is Optin instructional methods that have an influence on learning rather than media or delivery systems, the efficiency with which methods 1976 can be used is frequently constrained by the technologies 1969 available for the delivery of instruction. Thus, while Clark has deci the claimed that a teacher can use any method that a technological medium can, it might not be very efficient for the teacher to do Opti Vor} so (see Petkovitch and Tennyson, 1985). For example, it is ledi theoretically possible for a teacher to have 54000 overhead transparencies on file in a classroom, which the teacher selects

ify at what from as needed. However, to do this is impractical, and far less ive decision efficient than using a videodisk for the same purpose. Likewise,

it is far less practical to have students commute hundreds of piles to class each week than to have them study pre-packaged attributions self-instructional materials in their homes.

w area that We therefore need to find out about the efficiency of on is that various combinations of instructional methods and delivery technologies in order to add a practical dimension to deliverv ts perceive prescriptive theory concerning instructional methods. A recent to be "easy study by Wager (1986) appears, at first glance, to be yet another le putting media comparison study. In it he compares CAI and television for n's work. teaching army teletype operators. However, he was not interested atkins, 1983) in whether one technology taught the soldiers more or better than the other. His concern was in cost effectiveness, and a large ewing. lar questions part of his data consists of detailed costing out of teaching via or others to the two technologies. This is a very useful type of study to conduct, and we need to do more of them with a variety of methods

and delivery systems.

: it is Optimization Methods.

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ting rather The roots of instructional design, some claim (Glaser, hich methods 1976), lie in Simon's book <u>The Sciences of the Artificial</u> (Simon, gies 1969). Here, Simon describes design as a process whereby decisions are optimized on the basis of the demands of a task and hological the constraints that are imposed upon its performance. Icher to do Optimization procedures, such as statistical decision theory, t is Work very well in some sciences, like engineering and maybe rhead aedicine. However, as Glaser has mentioned (1976), they only work er selects

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in Education in "trivial" instances. This is because, as we saw rescr above, education is concerned with complex, multivariate re "in processes that we do not yet fully understand, let alone control was te However, this does not mean that more precise procedures for levelc instructional decision-making should not be sought after. The instru speed and capacity of today's computers makes it possible to handle those very complex multivariate situations that const: instructional decision-making is involved with. Some work has in se. begun on this problem, again in CAI research. Tennyson and his resea: colleagues (Johansen and Tennyson, 1983) have developed the funct Minnesota Adaptive Instructional System (MAIS) which has some of basis the attributes of a complex instructional decision-maker. The prede algorithms involve, among other things, the calculation of of strat probabilities using Bayesian statistics. We need other algor mathematical models of this type to help us optimize succe instructional decision-making. We ne

"Expert" Design Systems.

Everyone is talking about "expert systems". These are addi: computer programs in which has been captured the intuitive tacit knowledge of experts, expressed as decision rules through the agency of "knowledge engineers". We need to find out whether it is feasible and practical to capture the expertise of vays instructional designers in this way and create expert systems lang that do instructional design. lang

This would be relatively easy to do. But the next logical the step is less simple. If we can create expert instructional design Angl systems, it should be possible to create CAI systems that design Sink themselves as they interact with students. In other words, the

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prescriptive principles embodied in an instructional theory would "invented" by the system as it "got to know" each student it was teaching. In effect, a separate theory of instruction would develop for each student, offering the ultimate in adaptive Instruction.

Significant steps have already been taken towards constructing these self-designing systems. They are to be found in self-improving intelligent tutoring systems, developed by such researchers as Kimball (1982) and O'Shea (1982). These systems function by changing instructional strategies, either on the tasis of how well the student is doing or arbitrarily at predetermined intervals, and seeing whether or not the change in strategy improves or degrades the student's performance. The algorithm is, once again, based upon probability. Based upon the success of the strategy, it is either retained or changed again. We need to find out how effective such self-improving systems . are, and to develop more sophisticated algorithms for the modification and retention of instructional strategies. uitive tacit Presentation Formats.

rough the With the advent of intelligent tutoring systems (Sleeman and whether it Brown, 1982) comes the need for developing a whole variety of Mays of displaying information to students. To date, the natural : systems anguages that have been used in intelligent CAI have been verbal langauges, like English, French and Russian. However, research on t logical the effectiveness of graphics (Winn, 1986), pictures (Levin, ional design Inglin and Carney, 1986) and videotex (Winn, Ellis, Plattor, that design Sinkey and Potter, 1985) in instruction has firmly established ords, the

that other ways of presenting information are now as feasible to to co use as text, and are often more effective. The problem is that is rigor order to get information from a knowledge base in a computer, be garli it constructed from decision rules, a network of propositions or one of many logics, into a form that the student can comprehend with requires routines that themselves follow particular sets of nethc rules. In the case of verbal language, these rules are the argun language's syntax. There is no syntax for the non-textual resea representation of knowledge. A number of scholars have attempted shoul to describe grammars of pictures and graphics (Doblin, 1980; Szlichcinski, 1980). However, we simply do not know enough about quant how pictures and graphics convey meaning to enable us to write Smit] decision rules for CAI with the same power and precision as the feel: rules we have when screen presentations are textual. There is a prope tremendous amount of research to do in this area before we can clas: begin to exploit these forms of representation to their fullest. in o

There are, of course, other things we need to find out. But our any report of "future trends" must limit itself to the most like diff to be manageable. I believe that the items just mentioned are pretty "sure bets" for the future of research in our field. expe

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Methodology

A section on methodology is expected in a paper such as know this. However, given the plethora of papers and articles on the expe methodology of educational research that have appeared recently, suge what I have to say on the matter will probably be redundant. I cont will therefore be brief.

First we must remind ourselves that, whatever method we use

s feasible to to conduct our research, we must apply it with discipline and lem is that i rigor. The arguments in support of this contention were made computer, be earlier, besides which they should be obvious.

>positions or Second, let us not forget that our discipline is concerned .comprehend with both conclusion- and decision-oriented research. The sets of aethodologies for each differ, as we all know. Again, recall the are the arguments made above that instructional development is a form of extual research, and that the data instructional developers gather ave attempted should be reported.

in, 1980; As far as the current debate about qualitative versus enough about quantitative methods is concerned (Phillips, 1983; Eisner, 1983; us to write Smith, 1983; Miles and Huberman, 1984), I am bothered by the ision as the feeling I get that proponents of each class of method are . There is a proposing <u>alternatives</u> to rather than <u>complements</u> to the other fore we can class of method. Given the eclectic nature of research questions neir fullest. in our discipline (and in Education generally), we must have at find out. But our displosal a whole battery of methods to deal with the the most like different types of things we need to find out.

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There are a number of ways in which

field. experimental/quantitative and naturalistic/qualitative Nethodologies can complement each other. Howe (1985) has stated that "quantification extends, refines and crosschecks qualitative such as Mowledge" (p. 10). On the other hand, it is now common for tles on the experimental researchers to do what Bronfenbrenner (1976) ad recently, Suggested ten years ago to improve the ecological validity of lundant. I controlled experiments: talk to the subjects afterwards about

What they learned, how they did it, what they thought of the though we use
experiment, and so on. So we should try to use quantification, by observate appropriate, to sharpen our interpretation of qualitative printou data, and to use what we might call "post-experimental ronths. debriefing" of subjects in controlled experiments to find out (see Gu more about the subjects and how they learned.

The work of Winn and Everett (1979) and McIsaac, Mosley and compute Story (1984) illustrates one way to do the former. In these and the studies, factor analysis and multidimensional scaling were obtain€ applied to subjective ratings of pictures in order to make then II more interpretable. This type of study is, of course, sethod "reactionary" in the sense that it still purports to enjoy a trends measure of experimental control. However, it is not a big step non-ex] from there to what Howe suggested -- the application of relevant our are guantitative techniques to data gathered through observation. of met

To date, I have observed that educational technology many o researchers have spent far more time telling us why we should be guanti using naturalistic methods than they have doing naturalistic need t studies. Maybe this is because we are still a little bit afraid resear that these studies are less likely to be published. Or maybe it techni betrays our "behavioral" roots and the accompanying belief that Work t all of the behavior that is of interest is amenable to data. quantification. Be that as it may, there is certainly not the activity in educational technology research as there is in research in teaching and learning in classrooms, for example.

However, I believe that naturalistic inquiry has just as important a role to play in Educational Technology research as it does in other areas. A study by Eastman (in press) serves as a model of the kind of work I have in mind. Eastman gathered data

fication, by observing students working with comouters and computer Jalitative printouts in a language arts class over a period of several sonths. Her application of the techniques of naturalistic inquiry find out (see Guba, 1981) to safeguard the validity of the results is exemplary. Her results shed much light on how students think of iosley and computers, and how this affects the ways in which they use them. these and the type of information she reports could not have been Were obtained in an experimental study.

make them In sum, then, I believe that the future trends in sethodology in Educational Technology will generally follow the enjoy a trends in Education as a whole. That is to say, we shall see more big step non-experimental studies being conducted. However, I feel that of relevant our area is probably more reactionary in switching to this type rvation. of methodology than other areas in Education because we more than logy many other scholars have our roots in the observable, e should be guantifiable phenomena so popular with behaviorists. However, we alistic need to develop ways of bringing naturalistic methods to bear on bit afraid research questions of interest to us, and especially to develop maybe it techniques in which qualitative and quantitative methodologies lief that Work together rather than against each other in the gathering of data.

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Publication of Results.

Once again, so much has been said about how to get research recapit published that I will be brief to avoid redundancy. There are, of sure th course, a few, obvious, general rules. Following these by no interes means guarantees publication. But failing to follow them does sound s guarantee that the paper will not be published. ruestic

First, make sure that you follow the style manual specified As in the journal's "Guidelines for authors". Even established researc scholars often fail to do this, and editors find it most someth: irritating.

Second, make sure that the topic and type of paper are are a : suitable to the journal. You would be surprized if you knew how you mu many manuscripts submitted to ECTJ are about topics that have superv nothing to do with Educational Technology, however broadly you is ter define it. Also, send scholarly papers to scholarly journals and aspect less scholarly ones to journals that publish non-scholarly been a articles. I reject many good papers because they are not knowle scholarly. Often these end up in other journals, as they should. It is But sometimes authors are discouraged by a rejection and do not propos send their papers to a second, more suitable, journal. This means within that a good article that has something to say never does get into read ; press, and we are all the poorer for it.

Make sure that you meet all of the journal's technical that : requirements. If they ask for four copies, send four copies. If and d it is to be typed on 8 1/2 by 11 paper, type it that way. Never consi send little notes to editors in which you explain why you did not to us follow the technical or stylistic requirements set out by the diffe

journal.

The last matter is of more substance, and in a sense et research recapitulates a lot of what has been said in this paper. Make there are, of sure that what you are reporting or writing about will be of interest to the readers of the journal, and will be respected as hem does sound scholarship. This has requirements that concern both the question that you write about and your methodology.

1 specified As far as the first point is concerned, you should pick lished research topics that contributes to current knowldedge, not to ost something that ceased to be of interest and importance years ago. clearly, media comparisons are no longer worth publishing, nor er are are a number of other topics. In order to meet this requirement, u knew how you must keep up with what is going on in the field. All of us who hat have supervise graduate students have had to deal with the student who oadly you is terribly excited about a particular research question or ournals and aspect of theory, not realizing that the guestion has already larly been answered, or that the piece of theory belongs to a body of not mowledge that is no longer considered to be valid or valuable. hey should. It is sometimes hard to persuade such students that their and do not proposed study has no value, and if completed, will contribute This means nothing and will certainly not be published. So, stay current and ies get into read as much as you can.

nical opies. If iy. Never you did not by the

The same applies to your methodology. Do not use designs that have been superseded by more sophisticated and robust ones. If And do not use techniques of analysis that are no longer for considered to be acceptable. A frequent mistake, for example, is i not to use multiple t-tests instead of range tests when a significant difference has been found by analysis of variance with more than

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two groups. Similarly, do not use parametric tests on ordinal te in data. That is another frequent flaw in manuscripts that I see, jiber' There are a number of these pitfalls, and you should be vigilant when and knowledgeable enough to avoid them.

You must also make sure that you have something of liber consequence to say. Your ideas may be current and the methodology in resimpeccable. But if the results of your empirical study, or the resear arguments you make in a position paper leave the reader with a rethours "So what?" feeling, then you have not really presented anything quite that is worth publishing. (After reviewing one such study, an hope is ECTJ reviewer wrote, "What a waste of subjects!" To me, that sanustions says it all.)

Finally, a publishable manuscript has to have an internal logic to it. By this, I mean that the hypotheses of an experimental study must be clearly derived from the literature review; that the design must allow one to test the hypotheses: that the techniques used to analyze the data must be appropriate to the design; and that the conclusions must follow from the results. There is nothing worse than hypotheses that appear out of the blue, apparently at the whim of the author, except perhaps for conclusions that are equally unattached to anything that bas preceded them. The same spirit should also be present in reports of non-experimental research. The arguments should flow well and the points should follow one another with an obvious logic.

Conclusion

In conclusion let me just remark on the impossibility of

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meculating with any accuracy about "future trends", whether they in Physics, Literature or Education. One is tempted to take iberties, as I believe Frank Ogden did recently (Ogden, 1985) when he predicted that, if current trends in "high tech."

ng of tudy, or the eader with a nted anything h study, an To me, that

continue, people will marry robots. I have tried not to take such iberties, but rather reflect upon what I see beginning to happen the methodology in research in our field and in kindred areas. I believe that the research questions that I have suggested we need to answer, and the methods we need to develop and use to answer them, do anticipate mite accurately directions in which the field will move. And I tope that the simple suggestions for preparing publishable manuscripts will be of some assistance in getting answers to our research questions into the literature for all to share.

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TITLE:

LEARNER ENVIRONMENT FIT: UNIVERSITY STUDENTS IN A COMPUTER ROOM

AUTHOR:

ANDREW R. J. YEAMEN

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Learner-Environment Fit: University Students in a Computer Room Andrew R. J. Yeaman Educational Computing, University of Maine--Presque Isle Presque Isle, ME 04769-2888

A paper presented to the Research and Theory Division of the Association for Educational Communications and Technology, Las Vegas, Nevada. January, 1986.

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Abstract

The theory of person-environment fit predicts unhealthy strain caused by a mismatch between factors external to the individual and those that are internal. In the study reported here, the theory of personenvironment fit was applied to assess student well-being in a university computer room. A qualitative approach was chosen for this study and a conceptual framework was constructed using Miles and Huberman's technique (1984). A script of questions and probes was prepared from the conceptual framework. Twelve volunteers from a computer literacy course were interviewed. Both objective and subjective data about physical and psychosocial stressors were obtained. Some insights into learner-environment fit are already available. although the results reported here must be regarded as preliminary. Early data cuts suggest educational computing tasks. while less frequent and of shorter duration, may be more intense than pink collar VDT work. Denial or repression may have been a part of the student view in accepting complexity. These defence mechanisms may also indicate a learner role effect which explains student reactions to visual and susculo-skeletal stressors. Better understanding of learner-environment relations is being developed through monitoring interventions such as teaching students how to reduce computer stress.

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Learner-Environment Fit:

University Students in a Computer Room

Research on human behavior in work situations has generated a theory describing the relationship of people and their surroundings stu (Harrison, 1978; Kasl, 1978, p. 33-35; Kulka, 1979). The theory of bein person-environment fit predicts unhealthy strain caused by a mismatch of between factors external to the individual and those that are ob internal. Stressors may be physical or psychosocial. Each can as function objectively or subjectively, operating independently or co dependently of the person's perceptions as shown in Figure 1.



Figure 1. Diagram of person-environment fit components.

The person-environment fit theory is advocated for the study of Visual Display Terminal (VDT) work (National Research Council, 1983, p. 173-193). The goal in that instance is improving the congruence between human characteristics and the computerized workplace. Unhealthy stress is explained as the result of unsuitable environmental conditions created by the rapid implementation of new information technologies. In the study reported here, the theory of person-environment fit was applied to an assessment of student well-being in a university computer room, towards developing better understanding of learner-environment relations in general.

Two separate site analysis studies preceded the investigation (Yeaman, 1983; 1985). They were rational in nature in that they compared educational computing facilities with a checklist synthesized from standards and guidelines for VDT work. Several physical, objective aspects of the environment appeared inadequate for the students' range of physiological characteristics. The checklist identified lack of adjustment in keyboards and screens; inappropriate chairs, footrests, desk height, leg room and keyboard height; reflective glare from screen and keyboard; and direct glare from bright lights and windows in the field of view. Objectively established psychosocial stressors were the intrusive sounds of voices

ironment Fit

and printers and the lack of visual privacy. Based on application of that checklist and informal observations of students, recommendations were made for improving microcomputer learning conditions in both settings.

student-environment relationship was not known. An obvious difference

between academic and workplace computing is the shorter exposure time

objective physical and psychosocial stress and the stressors would be assigned weaker subjective perceptions; that the affect of deficient

computing environments upon students would be less than upon workers.

of learners. Therefore, it was expected that there would be less

Student impressions had not been assessed and the strength of the

erated a roundings theory of a mismatch are h can tly or 1.

Method

Due to the complexity of the issues, a qualitative approach was chosen for this study. Strong arguments have been made for this mode of investigative thought in the field of educational communication and technology (Kerr & Taylor, 1985). A reductionist and intrusive measure of stress such as before and after levels of catecholamine and adrenocortical excretion would be limited to only producing data on the objective person physical dimension. Quantitative paper and pencil self-report scales were ruled out due to the importance of sample size in epidemiological surveys on VDT work(Helander, Billingsley & Schurick, 1984).

Following informal observations of several academic computing facilities, a conceptual framework was constructed using Miles and Huberman's technique (1984), see Figure 2. It particularly reflects the learner-environment relationship in delineating components for analysis that are both objective and subjective. The dimensions were corroborated by the Wisconsin-NIOSH industrial study conducted by Sauter, Gottlieb, Jones, Dodson & Rohrer (1983).



Eigure 2. Dimensions of the conceptual framework.

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A script of questions and probes was prepared from the conceptual framework. The script was used to conduct structured interviews with university students using the microcomputers in a single computer room. The students reported on the dimensions illustrated in Figure 2.

Because the human factors research literature indicates three predominant symptoms of VDT stress--visual, musculo-skeletal and psychological (National Institute for Occupational Safety and Health. 1981; Sauter et al., 1983) -- they were the focal point for evaluation. Both objective and subjective data about stressors were obtained. Objective data included such information as height, weight, corrective eyewear, previous computing experience and time of day each student usually went to the computer room. Subjective data, based on student experiences in the computer room, included such information as feelings of visual and physical discomfort and psychological aspects such as the degree of complexity perceived in completing assignments. Questions about experiences in the computer room preceeded potentially. sensitizing questions about feelings of well-being. Regarding the acceptability of verbal reports as data (Nisbett & Wilson, 1977). cautions against confabulation included the acceptance of verbose responses rather than offering the repondents a fixed set of alternative answers (Ericsson & Simon, 1980).

Twelve participants were interviewed. They were all enrolled in a computer literacy course and volunteered to be in the study in exchange for an extra credit incentive offered by their instructor. There were five women and two men from the afternoon section and two women and three men from the evening section of the class. They varied in age from 19 to 35 with 10 students between 19 and 22. None of the interviewees were previously aquainted with the investigator.

The computer room used by the students in this study was originally a small classroom and it had undergone renovation to become a place for academic computing. Briefly, its features were a single door, two rows of suspended fluorescent lights and two unshaded windows. Power strips had been installed and a black workbench erected against three walls. At the time of this investigation, the workbench supported three Apple II+ and two Apple IIe microcomputers, two Okidata dot matrix printers, a Televideo 925, a Lear Siegler ADM-INU, a DecWriter, a manual typewriter and an electric typewriter.

Individual students working on computer literacy assignments were the primary visitors to the facility and the subjects of this study. Length of use varied from 20 minutes to 8 hours with most students word processing papers or writing programs. They used Magic Window for word processing, Apple BASIC for programming and VisiCalc for spreadsheet exercises. Students from programming classes were the next largest group of people to be found in the room. Other people occasionally present were university clerical workers and professors. Adults and children from the community came in on the evenings and weekends more than any other time. The handful of hacker-like C

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ents were study. jents lindow for the eople essors. and students on the campus preferred to be with the Commodore 64 in the physics lab. That was the place Apple II software was kept and three were employed in checking it out a few hours each day. There was only one hacker-like student frequenting the computer room at the time of the investigation. Unable to take the Pascal class due to a schedule conflict, he taught himself and then proceeded to create a russian typing tutor so he could master the cyrillic keyboard.

Preliminary results

Visual Stress

Objective

Three of the Apple II+ microcomputers had Amdek color monitors which made text appear fuzzy due to horizontal smear. This was particularly apparent when in the 80 column mode. Screen angle was not adjustable. Brightness, contrast and color controls were concealed behind a door immediately below the screen. The fourth Apple II+ had a an older model Heath Zenith green screen with black level and contrast knobs on the front. The image on this screen intermittently rippled and blurred. Sometimes a waving grid pattern appeared too.

The Apple green screens on the Apple IIe microcomputers presented alphanumeric characters considerably sharper. They were adjustable for tilt by pushing on the top or bottom of the screen. Brightness was controlled by a knob on the side. The contrast knob was on the back and not readily accessible.

All the screens reflected the overhead lights and created reflective glare. Two screens reflected extreme glare from the windows: This was particularly strong due to snow outside four months of the year. At night the windows acted as mirrors, reflecting the fluorescent lights. There were no curtains or shades. Keycaps and chrome security locks created highly contrasting reflective glare at every station.

No one was instructed in adjusting the position of screens to reduce reflective glare and increase visual comfort and efficiency. Nor was anyone told about adjusting screen brightness and contrast to suit personal preference. There were no copyholders and drafts of papers and programs were usually laid flat--which induced off-angle reading.

When working with the microcomputers, the students faced the wall at all times: there was nowhere to look away and focus on distant objects for vision relief. Five of the students interviewed wore glasses and another five wore contact lenses. All of those 10 students were myopic. In addition to being nearsighted, two said they had correction for astigmatism. None of the students reported having

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uncorrected visual problems. None were taking tranquilizers, a of medication which can produce visual fatigue symptoms through changes was in oculomotor functions.

Subjective

Eight students reported visual discomfort such as red, bloodshot, tired eyes. Four students experienced visual discomfort within the first hour of microcomputer use or less. Three more had eye problems within two hours or less.

Only one student thought the screens too bright or too reflective act but other students added qualifying statements: "Unless it is a color aic screen and that bothers me." "The older models." "Not the screen--- wor sometimes the light coming through the windows will cause glare on the screen."

Ten students never adjusted screens for tilt, contrast or brightness. One adjusted tilt, "To see the bottom of the page." One adjusted contrast, "To make it easier to look at." Nearly all students were vague about the location of any accessible screen controls. There was confusion over there function and sometimes denial of their existence. One student mentioned switching to a 40 character line with bigger letters to make the screen easier to read when using the word processor.

Gender differences became apparent when the students were asked about how reading from the screen felt. Men gave short replies such as "Pretty good." "Okay." and "Very comfortable but my eyes get po tired." " Women replied: "Sometimes the words are blurry." "I have ba to read things twice. After a while they run together -- sort of th blurry." "After a while it becomes fuzzy to look at." "There are tw different types of screens and sometimes I have to strain to read the kn dots." "Would like a bigger screen so I could put more on a line." "If SU proofing, single spacing is difficult to read. I lose part of the text of as I'm scrolling along--it's frustrating." c1

Analysis

The short time for the onset of eyestrain is anomalous. In comparison, a survey of daily VDT users in a large Swedish insurance company resulted in 55% complaints of optical discomfort (Ericsson Information Systems AB, 1983, p. 63). Contrary to expectations these data suggest educational computing tasks, while less frequent and of shorter duration, may be more intense than the pink collar VDT work which is the usual object of investigation. The unsatisfactory quality of some of the screens for reading text may also be a contributing agent.

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In surance csson ns these and of T work ry Student responses were occasionally self-contradictory. Instead of saying they personally experienced a problem, descriptive evidence was provided which indicated a problem. The male responses were unusually brief in these situations but one succinctly illustrates the paradox: "Very comfortable but my eyes get tired."

Musculo-skeletal stress

Objective

Students varied in weight and in height: from 103 to 220 pounds and from 4 feet 11.5 inches to 6 feet 3 inches. These were accommodated by one size fits all microcomputer stations. Some of the microcomputers were positioned right above the steel legs of the workbench that supports the microcomputers and students sat with restricted knee and leg movement. A general indication of insufficient leg space was the scuff marks around the room where the wall had been kicked by students trying to stretch their legs out. The Apple II home row was 30.5 to 31 inches above the floor. This keyboard height caused many students to sharply bend their elbows and wrists and is higher than any trade union guideline for workstation design, see Ericsson Information Systems AB, (1983, p. 146). The Apple II keyboards were not adjustable or moveable in any way. No footrests were available for shorter students. The chairs had arms attached and were not at all adjustable.

Subjective

On the subjective level, 8 of the 12 reported at least some postural discomfort in either neck, hand, wrist, fingers, shoulders, back or a combination of locations. However most apparently attributed this to what they were doing not, to the furniture. For example, only two people said the chairs were uncomfortable. Complaints of bruised knees were made by one man and by one woman in reference to the steel support legs. Without prompting, three students commented on the lack of copyholders--which they had learned to use in high school typing classes--and said they propped up pages with a book.

Analysis

There was some physical misfit between the objective person and the objective environment because one size does not fit all. This is particularly important to consider when assessing microcomputer learning stations as the equipment severely constrains posture, as opposed to working with print materials that can be moved around. In reference to the steel struts supporting the work surface, the poor positioning of the microcomputers made matters worse. They could not be easily moved as the security devices were attached with permanent glue. However, using those particular microcomputer stations does contain an element of minor hazard. It is revealing that the students' subjective views seldom identified physical aspects of the

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environment for improvement. With the exception of the students with bruised knees, they took responsibility for any musculo-skeletal discomfort experienced upon themselves.

Psychological Stress

Objective

New technology is often viewed as too complicated and difficult to comprehend. In this situation, the learners were required to master small details to make computing work for them. These fine points were often limitations imposed by the software and hardware and irrelevant to the larger learning intended.

Subjective

During their interviews 11 of the students never directly SEVE admitted that the computers and the computing tasks might be too complex. Nevertheless, a poor person-environment fit is likely since nine reported incidents when they could tell that other students were enic upset or annoyed. Students were unable to make their programs run. the They lost termpapers and programs in the microcomputers and were be i unable to save or retrieve work which took hours to type in. They prof reacted by muttering, exclaining out loud, banging a fist on the table over and crumpling or tearing up their paper print out. faci

Analysis

Denial or repression may have been a part of the student view in of c accepting complexity. These defence mechanisms may also indicate a more learner role effect which would aid in explaining the student suppressions to visual and musculo-skeletal stressors. Denial or sele repression are also suggested by the National Research Council stat (1983, p. 177) to account for a subjective-objective fit relationship about "weakened by a person's subjective distortions."

envi Six students took responsibility for any problems on themselves with statements such as: "If you have the time to put in--basically-witt no, they're not too complex." "You must take time to get acquainted. stat You just can't sit down and do it." "I'm not a brain when it comes to col1 computers. It's a basic computing class--could be more complicated." ex ar A student moderated his response by identifying complexity brought perc about by technological transition: "I'm used to Radio Shack computers hore auth so I find it hard sometimes." lear

Only one student said yes, that the computers and computing tasks situ were too complex. She placed the responsibility outside of herself by in the identifying subtle differences between operating the Apple IIe and env: Apple II+ microcomputers and the inconsistency of software commands Rode for performing the same function. fit

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Discussion

Student learning behavior and well-being were evaluated on the basis of three criteria. These were the symptoms of VDT stress usually found in the work place: visual stress, musculo-skeletal stress and psychological stress. Environmental contributors to these forms of computer stress were assessed by two techniques. The first was objective observation such as measuring the height of keyboards above the floor. The second was rational application of established knowledge such as comparing that measurement with ergonomic recommendations in the human factors literature. Relevant information from the personalogical dimension was collected through interviews. For instance, self reports of physical measurements showed the facility was used by people with a wide range of characteristics. Responses to questions and probes regarding specific stress issues and instances were collected. Analysis has begun and the results of several cuts of the data are reported here.

How computer learning experiences are viewed by students is enigmatic but a position is being built. There is real evidence of the three types of computer stress: student computing activities may be far more stressful than the experience of computer workers. Unlike professionals, the students have high pressure to perform. low control over their tasks, less autonomy and less support in terms of efficient facilities. All three areas investigated revealed real problems. Screens with sharply visible letters and numbers were not often available and all screens had reflective glare. The learning stations were cramped like cockpits in military airplanes. The hands on aspect of computing in demanding attention to trivia was an impediment to the more important, conceptual learning intended. Despite providing supporting evidence for each from of computer stress, students were seldom critical. In favoring satisfaction over dissatisfaction, their statements perhaps reflected more what students would prefer to think about their educational experiences.

Personal characteristics cause individuals to reflect personenvironment fit differently and so may group characteristics. Workers with more creative, less repetitive VDT jobs and higher socioeconomic status voice less complaints (Smith et al., 1981, p.397). This white collar group aspect might provide more meaningful comparisons when examining university students: a learner role effect. Student perceptions may be muted by their role: perhaps students tend to be more accepting of what they receive becauses instructors are The learner role may cause students to believe their authorities. learning experiences are set up in the best way possible: that situations are permanent and cannot be improved. There is some support in the person-environment fit literature for this. A study of personenvironment fit conducted with 2,020 high school students by French. Rodgers & Cobb (1974) has been re-analyzed by Kulka (1976). Poprer fit was reported by girls than boys, which also lends credence to the gender differences suggested here. Kulka also identified a tendency

for goodness of fit to increase for older cohorts. University students may extend that and cover up the occurrence of misfit.

Conclusion

Some insights into learner-environment fit are already available, although the results reported here must be regarded as preliminary. They are the consequences of gathering rich, complex data not yet fully analyzed. Better understanding is being developed through ongoing observations and informal questioning of students. Monitoring the effects of intervention such as teaching students how to reduce computer stress are part of this.

A preventive ergonomics approach is taken which has several components, including sensitization to the issues of daily work with computers. These are readily demonstrable as the computer room has not been modified except for conversion to all Apple IIe microcomputer equipment and Appleworks integrated software. Some examples follow: Students are shown how to adjust screens to match contrast and brightness to their personal preference and how to tilt screens to minimize reflective glare. They are encouraged to get up, walk around and engage in stretching exercises and not stay rigid in one seat. Frequent rest breaks are also suggested.

Psychosocial dimensions are handled in a similar way. Caporael identifies two important components in learning to use a computer (1985, p. 187-188): trial and error learning and computing as a social activity. Trial and error learning is reduced by several strategies: Students are encouraged to save their work every 15 minutes at least to avoid accidental loss. Recipe sheets are prepared with instructional design principles to guide beginners through the basic steps of using a word processor, a spreadsheet and a database. New strategies have also been adopted to reinforce the social transfer of information: There are more large screen demonstrations in class time. There are also more orientation labs as part of class. Students are encouraged to work together on class projects in twos or threes. Above all, students are encouraged to take responsibility for their learning upon themselves and practice Ellis' philosophy (1978):

I feel determined to strive to use whatever power I have to change the unpleasant stresses of life that I can change, to dislike but realistically accept those that I cannot change, and to have the wisdom to know the difference between the two. (p.203).

Ergonomic recommendations for business computing facilities have been applied towards the objective assessment of microcomputer learning environments (Yeaman, 1983, 1985) but subjective dimensions also need to be considered in research on educational computing. Students' reported feelings need to be checked against what they perceive happening to other students and contrasted with objective dimensions of the conceptual model, shown in Figure 2, through direct observi useful learnii learnii relati

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ity observation. The application of person-environment fit may be useful in developing guidelines for the improvement of computer learning facilities. Just as computer learning experiences should increase student well-being and learning performance, so should any learning experiences, and further analysis of learner-environment relations may provide a fruitful theory for that interaction.

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