an	Trans. #: 39480	
brary Lo	Title Proceedings of selected research paper presentations at the Convention of the Association for Educational Communications and Technology.	
nterli	Call # LB1028.3 .A87 1982 2nd floor circulating NOT CHCK'D OUT	
Iniversity I	Patron Hadley, Nicole Due 12/5/2013 ILL# 110778012	
ron L	Loaned To: TMS - ILL McKee Library	
Came	ILL Office Hours: Monday-Friday, 7:30am to 4pm (CST) Phone: 580-581-2382	

#### 202934

LIBRARY

PROCEEDINGS OF SELECTED RESEARCH LAWTON, OK. 73505 PAPER PRESENTATIONS

at the 1982 Convention of the

Association for Educational Communications and Technology

and sponsored by the Research and Theory Division May, 1982 in Dallas, TX



PREFACE

10

1028.3

.A87

1982

For the fourth 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 Dallas, TX. 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 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 Mr. James Sucy of the Eastman Kodak Company 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.

> Michael R. Simonson, President Research and Theory Division

#### BOARD OF DIRECTORS

#### Research and Theory Division

## of the

Association for Educational Communication and Technology

Perrin Parkhurst, President 1981-82 C.O.M., Dean's Office A-336 E. Fee Hall Michigan State University East Lansing, Michigan 48824

Michael Simonson, President, 1982-83 N31 Quadrangle North College of Education Iowa State University Ames, Iowa 50011

Carol Carrier, President-Elect 250 Burton Hall 178 Pillsbury Dr., S.E. University of Minnesota Minneapolis, Minnesota 55455

Louis Berry 1980-83 Educational Communications and Technology 103 LIS Building University of Pittsburgh Pittsburgh, Pennsylvania 15260

Ann Becker 1981-84 225 North Mills University of Wisconsin-Madison Madison, Wisconsin 53706

Alan Chute 1980-83 University of South Dakota School of Medicine 2501 West 22nd Sioux Falls, South Dakota Barbara Grabowski 1980-83 334A MSTF 10 South Pine University of Maryland School of Medicine Office of Medical Education Baltimore, Maryland 21201

<u>Richard Lamberski 1981-84</u> Department of Communications Media 127 Stouffer Hall Indiana University of Pennsylvania Indiana, Pennsylvania

James Sucy 1981-84 Education Markets Services Eastman Kodak Company Rochester, New York 14650

#### CONVENTION PAPER REVIEW BOARD

## AECT Reviewers

Ann Becker Department of Curriculum and Instruction Teacher Education Building 225 North Mills St. University of Wisconsin Madison, Wisconsin 53706

Philip Brody Department of Curriculum and Instruction School of Education Bailey Hall Lawrence, Kansas 66045

James Canelos 165 Suburban Drive State College, PA 16801

James Carey PO Box 82386 Tampa, Florida 33682

Alan G. Chute USD School of Medicine 2501 West 22nd Sioux Falls, S.D. 57105

Francis M. Dwyer 114 Mitchell Instructional Services Building The Pennsylvania State University University Park, PA 16802

Dr. Vernon Gerlach Arizona State University Box FLS/Educational Technology Tempe, Arizona 85281

Barbara Grabowski 334A MSTF, 10 S. Pine St University of Maryland School of Medicine Office of Medical Education Baltimore, MD 21201

James L'Allier 2087 Bradley St. St. Paul, MN 55117

Richard Lamberski Instructional Systems Research and Development NTS Research Corporation 2634 Chapel Hill Blvd. Durham, N.C. 27707 Dr. David Merrill School of Education University of Southern California University Park Los Angeles, CA 90007

Tom Nielsen Southeastern RMEC 1717 11th Avenue South Birmingham, Alabama 35205

Perrin E. Parkhurst C.O.M., Dean's Office A-336 E. Fee Hall Michigan State University East Lansing, MI 48824

Tillman Ragan College of Education University of Oklahoma Norman, OK 73069

Charles Reigeluth IDDE/School of Education 116 Huntington Hall Syracuse, N.Y. 13210

Mike Simonson 321 Curtiss Hall Iowa State University Ames, Iowa 50011

Robert D. Tennyson 250 Burton Hall 178 Pillsbury Drive, SE University of Minnesota Minneapolis, MN 55455

Paul Welliver College of Education Penn State University 229 S. Patterson Street State College, PA 16801

Bill Winn 738 Ed. Tower University of Calgary Calgary, Alberta, Canada T2N 1N4

Mary Ann Chezik 601 West Lamb Street Belle Fonte, PA 16823

#### AECT Reviewers

Francis E. Clark Educational Technology College of Education Texas A & M University College Station, TX 77843

William Daehling Lewis Clark State College 8th Avenue and 6th Street Lewiston, ID 83501

John Joseph Assistant to Provost Penn State University Capitol Campus Middletown, PA 17057

Dennis Sheriff Department of LEPS - Ga219 Northern Illinois University DeKalb, Illinois 60115

# PARTII

# TABLE OF CONTENTS

Evaluation Parameters for Special Education Instructional	105
by Mark Alter, Marjorie Goldstein, Francis Solano, and Patricia M. Yacobacci	100
Finding the Rose Among the Thorns: Some Thoughts on Integrating	144
by Jay F. Angert and Francis E. Clark	
Development of Aural Perception of Selected Percepts of Musical Form Utilizing Programmed Instruction by Nicholas Bridges	154
Young Researcher Award, Acceptance Presentation by James Canelos	163
Content Independent Learning Strategies and Their Relative Effectiveness on Acquiring Concept Information and Spatial	
Information When Learning From Visualized Instruction	183
Linking Teacher Theories to Teacher Practices by Carol Carrier and Karla Melvin	197
Effects of A Teleconference Experience on the Type of Concerns Expressed by Teleconference Participants	235
Communication Conditions and Media Influence on Attitudes and Information Uses: The Effects of Media Selected in	
Response to Student Interests About Mainstreaming and Disabilities	256
by Eliza T. Dresang	
Educational Technology and Teacher Competence: Identification and Preservice Assessment	278
Utilization of Media in Teaching by Secondary Classroom Teachers by Raymond M. Gilbert and Thomas L. Hennigan	311
An Analysis of the Consistency and Effects of Reported Learning Strategy Use by Third and Fourth Graders	325

Research in Progress II: Preliminary Data From a Group- Administered Procedure to Identify the Spontaneous Learning Strategies of Children	338
by Michael J. Hannafin	
The Effect of Mode of Visual Presentation(Motion vs. Still) on the Brain Wave Production of College Students	352
High School Students' Attitudes Towards the Media Program- What Makes the Difference?*	360
A Theoretical Model for Understanding the Visual Event by John A. Hortin	376
The Relationship of Cognitive Style to the Frequency of Proctor/ Student Interactions and Achievement in a PSI Course	396
How Are ITV Users Different? by Paul F. G. Keller and Kerry A. Johnson	404
Inside the Black Box: Making Design Decisions for Instruction by Stephen T. Kerr	409
<pre>Instructional Media, Attitude Change and Field Dependence by Ms. Terryl R. Kloock, Dr. Michael Simonson, and Stephen Cook</pre>	439
Believers, Skeptics and Dropouts by Constance A. Mellon	453
A Model for Critical Dialogue: A Study for Enhancing Student	
Response To Visuals	469
Eye Movement As An Index of Learning by Larry L. Nesbit	478
The State of the Art in Rate-Modified Speech: A Review of Contemporary Research	483
Test Score Results by Sex and Perceptual Type When Background Music Accompanies Film, Filmstrip, and Lecture Presentations	519
The Computer Threat to Educational Technology by Ronald G. Ragsdale	543

Why Use Media Materials In University Instruction? - Personal Beliefs of Selected Professors	548
The Impact of Mediated Instruction on the Formation and Change of Attitudes	561
Cueing and Anxiety in a Visual Concept Learning Task by Philip M. Turner	581
Presence of Observable Conditions of Positive Self-Concept in Elementary School Media Centers: A Descriptive Study	621
Status and Trends in Visual Information Processing by Bill Winn	638
The Differential Employment of Cognitive Skills As A Function of Increasing Iconic Stimulus Complexity	671

# PART I

# TABLE OF CONTENTS

A Futuristic Projection for the Program of Systematic Evaluation 2 by Francis M. Dwyer
Finding the Rose Among the Thorns: Some Thoughts on Integrating Media Research 6 by Jay F. Angert and Francis E. Clark
The Instructional Effect of Stimulus-Explicitness in Facilitating Student Achievement of Varied Educational Objectives 15 by Thomas C. Arnold and Francis M. Dwyer
An Exploratory Study of the Relative Effectiveness of Realistic and Non-Realistic Color in Visual: Instructional Materials 21 by Louis H. Berry
A Psychological Rationale for the Experimental Application of the Dwyer Stimulus and Criterial <u>Materials in Instructional</u> <u>Theory Research</u> 27 by James Canelos
The Effects of Review and Practice Techniques on Learning from Prose Material 33 by Mary Ann Chezik and Francis M. Dwyer
A Multifactor Analysis of the Instructional Effect of Type of Instruction, Testing, Recall and Order of Testing 40 by Hermes Teixeria De Melo and Francis M. Dwyer
Considerations for Sustaining Instructional Design Research Using an Integrated Learning System 46 by Barbara Grabowski
The Effect of Varied Visual Cueing Strategies in Facilitating Student Achievement on Different Educational Objectives 54 by Thomas Jennings and Francis M. Dwyer
The Instructional Effectiveness of Integrating Abstract and Realistic Visualization 60 by John H. Joseph and Francis M. Dwyer
The Instructional Effect of Color in Immediate and Delayed Retention 64 by Richard J. Lamberski
The Effect of Organizational Chunking and Retrieval Strategies in Facilitating Learning and Recall of Cognitive Learning Tasks 69 by Susan D. McBride and Francis M. Dwyer

Eye Movement as an Index of Learning by Larry L. Nesbit	75
Level of Reading Comprehension and Achievement With Visualized Instruction	81
The General Impact of the Dwyer Materials on the Acquisition and Retention of Information About the Heart	90
The Differential Employment of Cognitive Skills as a Function of Increasing Iconic Stimulus Complexity	98

PART I

# TITLE: A Futuristic Projection for the Program of Systematic Evaluation

AUTHOR: Francis M. Dwyer

A Futuristic Projection for the Program of Systematic Evaluation

Francis M. Dwyer 140 Chambers Building The Pennsylvania State University University Park, Pennsylvania 16802

The program of Systematic Evaluation of variables associated with visua learning was initiated in 1965. The general objective of the Program was to investigate the impact of different variables associated with the effective and efficient use of visual materials in the teaching-learning process. To achieve a level of programmatic research it was necessary that continuity angeneralizability exist between and among the different experimental studies. Consequently, considerable effort was expended in designing and developing an experimental package of research materials which would serve as the prototype throughout a program of systematic evaluation. A specific unit of cognitive content was identified, learner achievement objectives stated, four individua criterion tests (measuring different educational objectives) developed and a 2,000 word instructional script was prepared.

Over the years the instructional impact of numerous variables associated with the design and use of visual materials in the teaching-learning environment have been investigated in a variety of presentation formats: television synchronized slide-audiotaped instruction, visualized programmed instruction, regular textbook type of instruction (visualized), etc. To date approximatel 40,000\* college students and 8,000 high school students have been involved in the Program of Systematic Evaluation which has come to represent the most comprehensive and systematic attempt to identify those variables associated with visualized instruction which are most effective in facilitating student achievement of specified learning objectives.

Over one hundred experimental studies (1965-1982) reporting the results of this research program have been published by the author and his colleagues in a dozen different journals in the United States, Germany and Great Britain. Conclusions obtained from these studies have indicated that the present method of selecting and using visual materials are grossly ineffective and wasteful and that, in many cases, for specific educational objectives visualization of content material is no more effective than the same instruction without visual zation. Specifically, the results indicate that the use of visual materials to complement oral/print instruction is not equally effective in all instructional environments. Effectiveness and efficienty in visualized instruction being primarily dependent upon (a) the amount of realistic detail contained in

\*These figures do not include those subjects involved in action type research activities (utilizing the instructional and evaluation materials developed in the Program) leading to more sophisticated instruction and training programs which have been conducted and/or sponsored by the Armed Forces, private and commercial consulting firms, medical and nursing institutions, financial institutions, communication corporations, airlines, governmental agencies, etc.

the visualization used; (b) the method by which the visualized instruction is presented to learners (externally paced vs. self-paced); (c) learner characteristics, i.e., intelligence, prior knowledge in the content area, reading and/or oral comprehension level, etc.; (d) the type or level of educational objective to be achieved by the learners; (e) the technique(s) used to focus student attention on the essential characteristics in the visualized materials, e.g., cues such as questions, arrows, motion, verbal/visual feedback, overt/ covert responses, etc.; and (f) the type of test format (evaluation procedure) employed to assess student information acquisition, e.g., for certain types of educational objectives visual tests have been found to provide more valid assessments of the amount of information learners acquire by means of visualized instruction.

The text, <u>Strategies for Improving Visual Learning</u> published in 1978 summarizes and integrates the research findings obtained from the Program to that date. The text emphasized the interrelatedness of variables associated with the effective use of visual materials, and it attempted to draw trends from prior research relative to the effective design and use of visual media. In this respect, it presented the concept of visualized instruction, not as an isolated phenomena, but as an interrelated constituent process operating at varying levels of complexity--the elements of which acquire significance only in the context in which they are used.

In an attempt to provide an integrated and comprehensive treatment of the variables associated with visualized instruction, the text cites more than 650 articles depicting research results, insights, and conclusions of more than 625 researchers representing numerous scienficic disciplines.

Since the inception of the Program, more than 200 lectures describing the findings and implications of this research have been presented by the author and his colleagues at the international, national, regional, and state levels. These lectures stressed the effectiveness and efficiency which can be contributed to the learning environment by properly designed and developed visualized instructional materials. Techniques and procedures for establishing specific guidelines for the development and use of visualized materials have also been described. Additionally, in an attempt to communicate the practical implications of the results of this research program more than 50 articles have been written for the practitioner and published in non-refereed journals.

The conceptual orientation and experimental materials developed in the Program of Systematic Evaluation has provided the basis for three M.S. degrees and twenty-five Ph.D. degrees at The Pennsylvania State University. Similar research, employing the same experimental materials has been conducted at the University of Virginia, Michigan State University, Kent State University, Ohio State University, Texas A&M University, Boston University, University of Pittsburgh, and Newcastle upon Tyne Polytechnic (Great Britain).

At the present time visualization is being used extensively at all levels of education in an attempt to improve the quality of the teaching-learning process. Current projections for the future call for increased use of a variety of new electronic (visual) mediating systems of instruction (interactive) microcomputers, video disc systems, telecommunications, satellite and educational television, etc.) to be infused into both traditional and non-traditional

instructional strategies. This increase in the use of the visual medium will be in addition to conventional multi-media systems (slide-audiotape, film, pictures, videotape, overhead transparencies, visualized texts and workbooks, etc.) already considered to be integral components of effective instructional strategies. Within these varied instructional strategies the use of the visual medium has been optimized to assist learners in acquiring, transmitting and applying information.

In response to this need for guidelines leading to the effective use of visualization in the teaching-learning process the research within the Program continues. Each year a few doctoral students at The Pennsylvania State University select this area for their thesis dissertation work, the experimental instructional materials are being put on video disk at the University of Maryland, the experimental materials have also been put on microfiche so that they would be accessible to the Plato system at the University of Edmontor a study out of Concordia University (Quebec) will be conducted shortly using the Telidon System--the Canadian proposal for Videotex Systems. In addition, a series of studies utilizing these same instructional materials have been scheduled for the Fall at Ohio State University.

The future of the Program and its potential for resolving specific instructional problems seems bright. We would welcome your active participation in the Program to make its impact "brighter" and more immediate.

#### References

Dwyer, F. M. (1978) <u>Strategies for Improving Visual Learning</u>. State College, PA: Learning Services, Box 784.

TITLE: Finding the Rose Among the Thorns: Some Thoughts on Integrating Media Research

6

AUTHOR: Jay F. Angert Francis E. Clark

- FINDING THE ROSE AMONG THE THORNS: title SOME THOUGHTS ON INTEGRATING MEDIA RESEARCH
- Jay F. Angert, Coordinator Francis E. Clark, Director authors • Technical Training Educational Technology Corporate Patents and College of Education Technology Management Texas A&M University Hughes Tool Company College Station, TX Houston, TX 77001

### Background to the Problem

77843

Through the years there have been frequent calls for research syntheses or integrations (Broudy, 1970, 1972; Clark & Angert, 1980; Kuhn, 1962; Petrie, 1976; Randhawa, 1978). Narrative literature reviews have been quite prevalent in media research, as exemplified by Reid and MacLennon's (1967) review of 350 instructional media comparisons, and Schramm's (1977) review of "big" and "little" media, to name but a few.

Several researchers, most notably Dwyer (1978), also have synthesized in a qualitative fashion the results of research on the realism/relevant cue controversy. As is typical of narrative literature reviews, many of the conclusions which have been drawn on this subject are vague and lack quantitative precision (Clark & Angert, 1981). The series of studies undertaken by Dwyer (1978) and colleagues is unique for its consistency, numerous replications, and longevity in investigating pictorial stimulus complexity as it relates to static instructional visuals. Since guidelines for instructional visual design rely heavily on the conclusions drawn by Dwyer and possibly on the conflicting conclusions about pictorial effectiveness drawn by Samuels (1970) and others, and since none of the reviews of this body of research have employed sampling methodologies which would ensure the inclusion of most of the relevant studies, a quantitative review of pictorial effectiveness was deemed to be a useful adjunct in guiding future instructional design and empirical efforts.

Meta-analysis (Glass, 1977) is the most recently developed methodology for accomplishing quantitative research integration. Meta-analysis

research is not new to media research integrations. As one example, Cohen, Ebeling, and Kulic (1981) published a meta-analysis of 74 studies of visual-based college instruction. Unfortunately, media variables in this study were still conceptualized in terms of presentation modes or technologies. A statistical integration of pictorial complexity, with variables defined in terms of iconic symbols and coding elements, was still needed.

2

#### The Purpose

It was felt that the use of meta-analysis procedures, as described by Glass (1977), would add quantitative precision to future hypotheses and also would help reaffirm the linkage between communication theory and educational technology. Although Glass has suggested that this methodology is particularly well suited for resolving controversies arising from conflicting research results, the philosophical position which guided this investigation was that research integration is best considered a form of exploratory rather than confirmatory research. Accordingly then, the purpose of this study was to generate hypotheses based upon identified differences among the coded variables resulting from a research integration. This integration was limited to the body of research utilizing static iconic visuals in instructional materials. The major research question that guided this investigation concerned the differential instructional effectiveness, as measured by cognitive dependent outcomes (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956), attributable to illustration iconicity. The influences of subject grade level, stimulus exposure control, and time of testing were examined with respect to this effectiveness.

## Procedure

## Locating Reports of Research

Bibliographic search procedures used to locate pertinent studies involved both automated information retrieval and manual searching of

selected indices and references known to contain extensive pictorial citations. Computer searching of selected data bases within the DIALOG network was performed on two occasions. Four data bases were searched: Educational Resources Information Center (ERIC), Psychological Abstracts, Sociological Abstracts, and Dissertation Abstracts. A total of 558 potentially relevant citations was derived from automated retrieval methods. The automated search procedures were augmented by a manual search of data-based indices, annual meeting and convention programs, and selected references. Upon completion of both the automated and manual search procedures, an initial sample pool of 720 research reports was identified.

3

## Sample Selection

The pool of 720 research reports was reduced to a final sample of 121 data sets (from 151 separate reports of research) by means of a three-tiered screening procedure. Each of the 720 reports was obtained and read in full. These screening procedures resulted in the elimination of non-experimental reports, of research not concerned with iconic treatments or cognitive achievement, and of research with abnormal subjects, inadequate picture descriptions, faulty research designs, or insufficient data.

#### Sample Coding

Four major variables of interest to this study (illustrations, pacing, grade level, and achievement) were coded. Treatment illustrations were coded independently with respect to five physical pictorial attributes: production, shading, context, embellishment, and chroma. Pacing referred to the locus of control over subjects' exposure to treatment illustrations, with "external" coding referring to group-paced (experimenter-controlled) instruction, and "internal" coding reserved for selfpaced (programmed) materials. Grade level was coded in three ways. Kindergarten through college and non-college adult grade levels were

coded independently and with respect to two different categorization arrangements. Achievement was coded in two ways, based upon the time of retention testing.

4

## Quantifying and Equating Study Outcomes

The ultimate purpose of the meta-analysis procedures in the present study was to achieve a quantitative aggregation of findings from the various reports of research. To this end, a basic index of achievement effect, called <u>d</u> (Cohen, 1969) or effect size (Glass, 1977) was first calculated for every treatment group comparison. All told, 2,607 effectsize measures were generated from the available data.

### Data Analysis Procedures

Data analysis was performed in three distinct stages. The first stage completed the establishment of the data set through an aggregation of both effect-size and pseudo effect-size values (Glass, 1977). The second stage of the analysis sought to identify potentially significant main effects and interactions among the numerous levels of the coded variables. Since the 47 levels of the 11 independent variables contained far too many main effects and interactions to examine each individually, multiple linear regression was used to pare these comparisons to a manageable level. Individual effect-size values served as the units of analysis. The third data analysis stage involved using Tukey's jackknife method (Glass, 1977) to calculate a grand mean and separate means for main effects and significant interactions.

## Results

By using the jackknife technique to average the 2,607 effect-size values across all studies and all variables, a grand jackknifed mean effect-size of .51 was derived. This figure indicated that the post-test achievement score of the average subject receiving some form of illustrated treatment was about one-half standard deviation higher than the post-test achievement

score of the average control group member receiving only the verbal treatment. This jackknifed mean was nearly identical to the grand mean effect-size of .52 reported in Clark and Angert (1981).

5

The effect-size statistic is more appropriately considered to be a measure of practical significance than statistical significance, and accordingly, all mean differences between levels of main effects and interactions were interpreted in terms of practical significance. Cohen's (1969) operational definitions of small, medium, and large effect-size differences were applied to the results. A  $\underline{d}$  = .2 represented a small difference in means, d = .5 a medium difference, and d = .8 represented a large difference.

Final results were presented in the form of tables of jackknifed mean effect-sizes for all main effects and for six potential interactions. The effect-size values were interpreted in terms of the size of the mean differences between the predictor variables and verbal control groups, and in terms of the size of the mean differences between levels of the coded variables. The size of the mean differences was equated with levels of practical significance as suggested by Cohen (1969).

Jackknifed mean differences favored colored over black and white illustrations, and illustrations within a context over those out of context, at a small significance level. Medium significance level mean differences were found to favor externally paced over internally paced illustrations, and unembellished drawings over embellished drawings. Insignificant mean differences were noted between shaded and unshaded illustrations, and between immediate and retention testing and between modes of representation (photo versus drawing). The 7-12 and 9-12 grade level groupings attained the highest mean effect-size value. In general, illustration effectiveness increased from K-12 and dropped off markedly for college level subjects. Potential interactions were noted and reported for grade level versus time of testing, grade level and pacing, grade level and chroma, pacing and embellishment, pacing and representation, and representation versus chroma.

Results of the study suggested that:

 Illustrations were most effective with secondary level subjects, a condition not altered significantly by differences in pacing, chroma, or time of testing.

 Externally paced illustrations were more effective than internally paced illustrations, a condition not significantly affected by differences in mode of representation, embellishment, or grade level.

 Colored illustrations were more effective than black and white illustrations, a condition especially noticeable with chirographic pictures, and with college and non-college adult learners.

 Mean differences between modes of representation (in favor of chirographic) were significantly more pronounced for externally paced illustrations, and for colored illustrations.

In general, the results obtained in this study were consistent with the previously reported results of a meta-analysis dealing solely with the past research of Dwyer and colleagues (Clark & Angert, 1981). Since the present investigation was not conclusion-oriented, no definitive statements regarding the realism/relevant cue controversy could be derived. These results do, however, provide a means for forming future hypotheses based upon a quantitative aggregation of past research.

## Selected References

7

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. Taxonomy of educational objectives, handbook 1: Cognitive domain. New York: David McKay Co., Inc., 1956.

Broudy, H. S. On knowing with. In H. S. Broudy (Ed.), Proceedings of the philosophy of education society: Studies in philosophy and education. Edwardsville, Illinois: Southern Illinois Univ., 1970, pp. 89-103.

- Broudy, H. S. The real world of the public schools. New York: Harcourt, 1972.
- Clark, F. E. & Angert, J. F. Inadequacies in media research. Instructional Innovator, 1980, 25(1), 36-37.
- Clark, F. E., & Angert, J. F. Instructional effectiveness of illustration iconicity. Paper presented at the annual meeting of the Southwest Educational Research Association, Dallas, Texas, January 1981.
- Cohen, J. Statistical power analysis for the behavioral sciences. New York: Academic Press, 1969.
- Cohen, P. A., Ebeling, B. J., & Kulik, J. A. A meta-analysis of outcome studies of visual-based instruction. Educational Communications and Technology Journal, 1981, 29, 26-36.
- Dwyer, F. M. Strategies for improving visual learning. State College, Pa.: Learning Services, 1978.
- Glass, G. V. Integrating findings: The meta-analysis of research. Review of Research in Education, 1977, 5, 351-379.
- Kuhn, T. S. Structure of scientific revolutions. Chicago: Univ. of Chicago Press, 1962.
- Petrie, H. C. Do you see what I see? The epistemology of interdisciplinary inquiry. Educational Researcher, 1976, 5(2), 9-15.
- Randhawa, B. S. Visual trinity: An overview. In B. S. Randhawa & W. E. Coffman (Eds.), Visual learning, thinking, and communication. New York: Academic Press, 1978, 191-211.

- Reid, J. C., & MacLennon, D. W. Research in instructional television and film. Washington, D. C.: U. S. Government Printing Office, 1967.
- Samuels, S. J. Effects of pictures on learning to read, comprehension, and attitudes. *Review of Educational Research*, 1970, 40, 397-407.

Schramm, W. Big media, little media. Beverly Hills, Ca.: Sage Publications, Inc., 1977. TITLE: The Instructional Effect of Stimulus-Explicitness in Facilitating Student Achievement of Varied Educational Objectives

AUTHOR: Thomas C. Arnold Francis M. Dwyer

The Instructional Effect of Stimulus-Explicitness in Facilitating Student Achievement of Varied Educational Objectives

## Thomas C. Arnold Francis M. Dwyer The Pennsylvania State University

#### ABSTRACT

00 00

The purpose of this study was to investigate the relative effectiveness of specific media attributes on student performance on criterion tests measuring different levels of understanding. Specifically, it attempted to identify which of two levels of stimulus explicitness in visuals was most effective in facilitating student achievement on criterion tests of knowledge, comprehension, and total understanding for students possessing two different levels of entering behavior. One hundred seventy-one subjects participated in the study. The twoway ANOVA procedure was utilized to investigate the existence of interaction between entering behavior and level of stimulus explicitness. Results indicated that a significant relationship existed between entering behavior and performance on post-criterion tests; no relationship existed between stimulus explicitness and achievement on the criterion tests; and insignificant interactions were found to exist between entering behavior and instructional treatment.

A number of educational researchers (2, 4, 6, 7) commenting on teaching effectiveness have indicated that current media research has not incorporated instructional techniques based on sound instructional and/or psychological research. A great many of the studies seem to be primarily concerned with conducting evaluative comparisons to support the use of one form of media in preference to another, while providing little insight concerning the effectiveness of attributes inherent to a particular medium. Recently educators have encouraged the development of research designs which would not only evaluate the relative effectiveness of different media but would also identify instructional strategies by which given types of learners would achieve optimally. One of the theoretical orientations which has emerged as a result of this trend was designed by Salomon (6) and is used in this study. His theory of stimulus explicitness attempts to present an understanding of how the use of media influences learning. Since this theory was influential on the design of this study, a brief synopsis is warranted.

# Theoretical Orientation

It is Salomon's belief that for stimuli to be effective in learning they must affect mental processes in the learner relevant to the task being learned. The stimulus explicitness theory assumes that one of the most fundamental functions of visual stimuli is to inform, that is, to reduce uncertainty and thus increase the learner's probability of achieveing a correct response releva to the learning task. He further suggests that the instructional effectiveness of a given type of visual stimulus in reducing uncertainty is contingent upon the prior existence of aroused uncertainty in the individual.

Different types of visual materials contain varying amounts of realistic detail which, in turn, can be considered to represent varying degrees of stimulus explicitness. For example, if in a learning situation the individual does not experience any uncertainty, his behavior might depict what is normally called the boredom syndrome--daydreaming, doodling, etc. However, if the stimulus materials used in the instructional situation generate some uncertainty the learner may be motivated to search for additional information in order to reduce this uncertainty. If too much uncertainty is introduced into the learnir situation, it may cause the learner to react negatively towards the stimulus materials and reject the purposes for which they were originally designed.

This assumption finds support in the theory and from information theorists (3, 5, 6) who report that as the amount of information in the stimulus increases the uncertainty generated by the stimulus decreases. Figure 1 illustrates this relationship between uncertainty and stimulus explicitness.

In this continuum the amount of uncertainty in a stimulus is a function of the amount of information conveyed by the stimulus. As the amount of information in a visual increases, the uncertainty generated by the visual decreases. In terms of information theory this could be interpreted to mean that visuals possessing higher degrees of explicitness should have a greater potential for reducing entering uncertainty, thus increasing the probability that a greater amount of learning will occur.

#### Objective

The purpose of this study was to evaluate the predictability of Salomon's stimulus explicitness theory by investigating the instructional effectiveness of two types of visual stimuli each possessing different degrees of stimulus explicitness. Specifically, the purposes of this study were to: (a) explore the research potential of the stimulus explicitness theory as a model for guiding research on visualized instruction; and (b) determine the instructional effectiveness of visual materials possessing different degrees of stimulus explicitness and also their effect on students possessing different entering behavior.

Unweighted means were used in the ANOVA procedures since the study was exploratory in nature and there was no reason to expect that one treatment would be more effective than the other. The ANOVA used was adapted to handle unequal N's; furthermore, the number of students in each cell was not greatly disproportionate so that the variance would be seriously affected. Bartlett's test for homogeneity was on the pre-test scores, and in no case did the observed values reach the critical value for a .05 level test. Thus, it appeared that the students receiving the different treatment could, in fact, be considered to have been drawn randomly from populations with common variance.

## Results

Three conclusions were derived form the data obtained in this study:

3

- There was a significant relationship between entering behavior and performance on criterion tests. Those students whose prior experience and knowledge of the content material were high performed more effectively than those with low entering behavior regardless of the type of visual illustration they received.
- No significant relationship was found to exist between the level of stimulus explicitness and achievement on the criterion tests. This was interpreted as meaning that visuals possessing either of the stimulus explicitness levels were equally effective in improving achievement of identical objectives for each of the entering behavior groups.
- No significant interactions were found to exist between entering behavior and type of visualization.

## Summary and Discussion

The purpose of this study was to investigate the relative effectiveness of specific media attributes on student performance on criterial tests measuring different levels of understanding. More specifically, this study was designed to gather data to ascertain which of two levels of stimulus explicitness in a series of visuals provided for the most effective instruction as measured by achievement on criterial tests of knowledge, comprehension, and total understanding for students possessing two different levels of entering behavior.

The theoretical rationale for this study was Salomon's theory of simulation. Thus, while gathering data for purposes of investigating the above problem, it was also the objective of this study to investigate that portion of Salomon's theory that pertained to the role of visuals in the instructional process. The assumption of the theory's having application to this study implied that research in involving application to this study implied that research in involving the stimulus-explicitness dimension of visuals should provide educators with the means to determine how effective a specific visual is. That is, research associated with this dimension should provide data to determine how much cognitive activity occurs as a result of exposure to a specific kind of stimulus presentation by a particular learner.

These two objectives are related in the following manner. The stimulusexplicitness dimension in a visual is a function of the amount of information conveyed by the visual and the ability of the information to reduce the learner's uncertainty, thereby increasing his probability of learning whatever message that visual was designed to convey. The theory postulates that data gathered from research associated with this dimension should indicate the degree that cognitive processes are activated after exposure to this stimulus attribute. Stated in reference to this study, if the stimulus-explicitness property of a visual affects the probability of reducing aroused uncertainty, then different levels of stimulus explicitness should activate different cognitive processes. If this were the case, than at Bloom's cognitive levels of terminology, and comprehension, one would expect that different visuals wou differ in their effectiveness to improve learning measured at these cognitive levels. In other words, according to the assumptions of the theory one would expect high entering behavior students receiving less stimulus explicitness in visuals to perform as effectively at the same cognitive levels as low entering behavior students who received visuals possessing a higher level of stimulus explicitness. This assumption is predicted on the concept that high entering behavior students initially experience lower levels of uncertainty and consequently require less explicitness to achieve an equal probability for successfiunderstanding. Conversely, if given the higher levels of explicitness in visuals, high entering behavior students should experience a reduction in their probability to attain high achievement because they are not receiving the optimum form of instruction.

Applying these expectations to low entering behavior students, one could expect those receiving the optimum form of instruction to perform better on the achievement tests for each cognitive level that those receiving the less optimal instruction. That is, low entering behavior students receiving visuals possessing low levels of stimulus explicitness would experience a reduction in their probability to attain as high an achievement score than if they had received the more optimal instruction possessing visuals with the higher level stimulus explicitness.

The data collected for this study did not support these assumptions in Salomon's theory of stimulation. More specifically, an analysis of the finding failed to produce any significant interactions between the stimulus-explicitnes level in visuals and the entering behavior of students on the criterion tasks.

#### Conclusions

Three major conclusions can be made with some degree of confidence concernation the experimental problem.

- For students identified as having either high or low entering behavior there were significant differences between their mean scores on each of the post-criterion tests. Though one could argue that these differences are valid because the groups possessed significant differences in entering behavior relevant to the instructional material, other interpretations seem to be warranted. Analyzing these significant differences in terms of Salomon's theory of stimulation, it would appear that the two treatments were not effective in increasing a student's probability for learning in the direction predicted by the theory.
- 2. In regard to the two treatment groups, there were no significant differences between the mean scores of the first treatment group (those receiving visuals having low stimulus explicitness) as measured from each of the post-criterion tests. This could be interpreted to mean that visuals possessing either of the two levels of stimulus explicitness were equally effective in enhancing achievement on identical objectives for each of the entering behavior groups.

- 3. In regard to the presence of interaction effects between entering behavior and instructional treatment, the data showed that there were no systematic effects on performance on the criterion tests due to a combination of a particular entering behavior with a particular method of instruction. This conclusion also contests that segment of Salomon's theory postulating that this form of interaction should occur.
- Dwyer, F. M., <u>A Guide for Improving Visualized Instruction</u>, The Pennsylvania State University Learning Services, State College, PA, 1972.
- Funk, C. E., "Instructional Efficiency with Biological Objects in a Task Requiring Dichotomous Identification Keying Techniques," unpublished doctoral dissertation, The Pennsylvania State University, 1971.
- Garner, W. R., <u>Uncertainty and Structure as Psychological Concepts</u>, Wiley, New York, 1962.
- Lutz, J. E., "Instructional Efficiency with Three-dimensional Objects in Tasks Requiring Identification Keying Techniques," unpublished doctoral thesis, The Pennsylvania State University, 1970.
- Moser, G. W., <u>The Use of Information Theory to Study Human Learning</u>, symposium paper presented at the 1973 Annual Meeting of the National Association for Research in Science Teaching, March 29, 1973.
- Salomon, G., "What Does It Do to Johnny? A Cognitive-Functionalistic View of Research on Media," in G. Salomon and R. E. Snow (eds.), <u>ViewPoints</u>, Bulletin of the School of Education, Indiana University, Spring, 1970.
- Travers, R. M. W., ed., <u>Second Handbook of Research on Teaching</u>, Rand McNally, Chicago, 1973.

TITLE: An Exploratory Study of the Relative Effectiveness of Realistic and Non-Realistic Color in Visual Instructional Materials

21

AUTHOR: Louis H. Berry

#### AN EXPLORATORY STUDY OF THE RELATIVE EFFECTIVENESS OF REALISTIC AND NON-REALISTIC COLOR IN VISUAL INSTRUCTIONAL MATERIALS

#### Louis H. Berry, Ph.D. Assistant Professor of Education Program in Educational Communications and Technology University of Pittsburgh Pittsburgh, PA 15260

## PROBLEM STATEMENT

The primary purpose of this study was to compare the relative instructional effectiveness of two forms of color cueing in visualized instruction. Immediate acquisition as well as delayed retention effects were examined. The specific research question on which the study was focused was:

When visual complexity, in terms of color cues, is held constant, does the degree of realism significantly affect the instructional effectiveness of visuals?

#### RELATED LITERATURE

Two major theoretical orientations deal with the question of realism and complexity in learning from visual materials.

The first, a group of theories collectively referred to as "realism theories" by Dwyer (1967) include the iconicity theory of Morris (1946), Dale's (1946) cone of experience and the surrogate fidelity theory of Gibson (1954). All of these theories are predicated on the assumption that the more realistic an instructional device, the more effectively it will facilitate learning. This assumption is based on the notion that the more realistic materials will present more visual cues to the learner and thus, give him more information with which to work. Justification is provided by the basic theory of stimulus generalization and the concept of cue summation.

A conflicting orientation suggests that the "realism theories" do not accurately describe how visual instructional materials function in learning, and in fact, may be in direct contradiction to the true situation.

Broadbent (1958, 1965) has described the human information processing system as a single-channel, limited capacity system. This system functions much like a filter in that, in times of high information reception, not all information perceived is immediately processed and stored. Rather, the system filters out all information beyond its capacity and holds this "overflow" for later processing. The overflow may possibly block other incoming, relevant information. Jacobson (1950, 1951) further supported this contention and indicated that only a small percentage of all information perceived is effectively stored and utilized by the nervous system.

Working from the theory of Broadbent, Travers (1964) focused specifically on the question of realism in instructional materials. He suggested that, to deal with a complex environment, the nervous system must simplify inputs and perceptions. To achieve this end, Travers described a process known as "compression." In describing this phenomenon, he indicated that to maximize the instructional effectiveness of visuals, it may be necessary to discard some elements of a visual which contain little information. This position is supported by empirical research conducted by Cherry (1953), Attneave (1954), and Dwyer (1972).

The studies reported by Dwyer represent the single, most comprehensive group of studies in this area. He found strong evidence to indicate that the most realistic visuals are not necessarily the most effective in promoting student learning. The relevance of visual realism to the use of color is readily apparent. Color in a great many visual illustrations can represent a significant contribution to the realism depicted in those visuals.

Research related specifically to the use of color has, similarly, been inconclusive. In a number of studies investigating the use of color in instructional visuals (VanderMeer, 1952; Kanner and Rosenstein, 1960; and Katzman and Nyenhuis, 1972) it was generally concluded that color has no significant effect on learner achievement.

Other studies, however, have reported conflicting data. Color was found to be a significant design factor in research conducted by Bourne and Restle (1959), Saltz (1963), Underwood (1963), and Dwyer (1972).

The distinction between visual complexity and realism is, however, an important one when color is considered. Complexity in visual displays may merely imply an increase in the total number of available cues. Realism, on the other hand, implies that real-life associations with information already held in memory store are elicited by the realistic stimulus.

Relative to the increased effectiveness of color, two explanations appear possible First, color may provide an additional dimension of realism which results in the learner attaining a more complete or realistic image of the event or object; second, color may function only as a coding or cueing device which facilitates storage and retrieval of the image or information. If the former alternative is true, then a realistic color visual should facilitate retention of material to a greater degree than a non-realistically colored visual. If the latter alternative is true, then all types of color visuals should function equally well in facilitating retention of material.

A problem overlooked in the literature deals with the task of designing equivalent materials to test the color hypothesis. The very nature of the color visual militates against attainment of equivalence. Specifically, the use of color in a visual adds a much greater number of visual cues to the display, resulting in a greater amount of available information as well as an increase in processing time.

#### STIMULUS MATERIALS

The materials employed in this study consisted of an instructional unit on the human heart, developed by Dwyer (1967), and presented by means of slides and audio tape. Each program contained a series of visuals intended to complement the same oral script. Two sets of visuals were prepared in realistic color and two sets were produced in non-realistic color by means of photographic reversal. The remaining two sets were prepared in black and white and non-illustrated formats, respectively.

Photographic reversal was used as a means of producing visual materials in which the total number of visual cues were held constant while the degree of realism (color-realistic or non-realistic) could be manipulated.

Measurement of achievement was accomplished by the use of five tests developed by Dwyer for the evaluation of student achievement in the areas of drawing, identification, terminology, comprehension and total understanding.

## PROCEDURE

The data for this study were obtained from 224 college students enrolled in the Instructional Media 411 course at the Pennsylvania State University.

During orientation sessions to the course, all S's were requested to complete two pretest instruments, the Otis Mental Ability Test (Form FM) and a general pretest in the content area.

Subjects were randomly assigned to one of six treatment groups. These treatment groups received the same oral presentation; however, each of the six groups received their own respective type of visual illustration. These groups represented (1) verbal/non-illustrated; (2) black and white shaded drawings; (3 and 5) realistic color drawings; (4 and 6) non-realistic color drawings.

Immediately after participating in their respective instructional treatment, S's were administered the battery of achievement tests. Six weeks later students net again for the delayed posttest battery.

## STATISTICAL ANALYSIS

A one-way analysis of covariance was selected as a means of analyzing the data. Pearson Product Moment Correlations were conducted between each of the immediate and delayed acievement posttests and the two pretest measures. In all instances, the Pearson <u>r</u> correlation coefficient was significantly different from zero at the .01 level. Accordingly, these two pretest measures were selected for use as adjusting variables in the analysis of covariance.

In those cases where a significant F-ratio at the .05 level was indicated by the analysis of covariance, further analyses were conducted between all possible pairs of adjusted means via Tukey's WSD Test.

#### RESULTS

The analysis of the immediate test scores via analysis of covariance produced the following F-ratios: Drawing (2.94), Identification (3.01), Terminology (3.02), Comprehension (0.35) and Total Test (3.15). Four of these F-ratios (Drawing Test, Identification Test, Terminology Test and Total Test) were significant at the p < .05 level.

Multiple comparisons between adjusted means were made in each instance where a significant F-ratio was obtained. In every case, Group V (realistic color) was found to be significantly superior to Group I (non-illustrated group) at the p < .05 level.

Analysis of the data obtained from the six treatment groups on the five delayed (6 weeks) posttests produced the following F-ratios: Drawing Test (0.91), Identification Test (0.82), Terminology Test (0.26), Comprehension Test (0.92) and Total Test (1.07). All of these values were non-significant at the .05 level of significance.

A summary of those presentations most effective in facilitating learner achievement on each test is presented in Table I. Table I: Treatments Most Effective in Facilitating Achievement on Each Achievement Test as Compared with the Non-Illustrated Treatment.

Achievement Test	Immediate Posttest	Delayed Post
Drawing Test	Realistic Color Presentat	ion -
Identification Test	Realistic Color Presentat	ion -
Terminology Test	Realistic Color Presentat	ion -
Comprehension Test	_	-
Total Test	Realistic Color Presentat	ion -

#### DISCUSSION

A number of conclusions can be drawn from the analyses obtained in this study.

- Different visual materials incorporating different degrees of visual comple or different types of cueing devices are not equally effective in facilitat student achievement relative to different instructional objectives.
- The data suggest that in those cases where visual materials were significant more effective than instruction without visuals, realistic color cued visual were most effective in facilitating student achievement.
- 3. The data further indicated, in those cases where color visual instructional materials were superior to verbal materials, that realistic color materials were more effective than non-realistic color materials. Since the overall number of visual cues presented in any corresponding pair of color visuals (realistic and non-realistic) were the same, it must be concluded that the increased effectiveness of the realistic color materials was due to the factor of realism rather than increased visual complexity.

This conclusion does not, however, support the principle of cue summation. Cue summation suggests that merely increasing the number of available cues would improve achievement. In this study, the relative number of visual cues was held constant across each color treatment, yet differences in achievement in favor of the realistic color group were observed.

It can generally be concluded, therefore, that the concept of realism is, to a limited degree, an important factor for consideration in the design of visual instructional materials. It can further be concluded that realism in a visual display is a factor which should be considered in addition to the total number of visual cues presented. In terms of the design of instructional materials, this would mean that teachers and designers should avoid the use of non-realistic colors or shadings in visuals unless they serve a specific purpose, such as to make parts or objects more distinct from one another or from a background.

 Evidence further suggests that while visual materials used to complement instruction facilitate immediate retention of information, these effects disappear after six weeks.
## SELECTED BIBLIOGRAPHY

Attneave, F. "Some Informational Aspects of Visual Perception", <u>Psychological</u> Review, 1954, <u>61</u>, pp. 183-193.

5

- Bourne, L. F., Jr., and Restle, F. "Mathematical Theory of Concept Identification", <u>Psychological Review</u>, 1959, <u>66</u>, pp. 278-295.
- Broadbent, D. E. Perception and Communication. New York: Pergamon Press, 1958.
- Broadbent, D. E. "Information Processing in the Nervous System", Science, 1965, 3695, pp. 457-462.
- Cherry, C. E.. "Some Experiments on the Recognition of Speech With One and Two Ears", Journal of the Acoustical Society of America, 1953, 25, pp. 975-979.
- Dale, E. Audiovisual Methods in Teaching. New York: Dryden Press, 1946.
- Dwyer, F. M. "Adaption Visual Illustrations for Effective Learning", Harvard Educational Review, 1967, 37, pp. 250-263.
- Dwyer, F. M. <u>A Guide for Improving Visualized Instruction</u>. State College, PA: Learning Services, 1972.
- Gibson, J. J. "A Theory of Pictorial Perception", <u>Audiovisual Communication</u> Review, 1954, <u>2</u>, pp. 2-23.
- Jacobson, H. "The Informational Capacity of the Human Ear", Science, 1950, 112, pp. 143-144.
- Jacobson, H. "The Informational Capacity of the Human Ear", <u>Science</u>, 1951, <u>113</u>, pp. 292-293.
- Kanner, J. H., and Rosenstein, A. J. "Television in Army Training: Color Versus Black and White", Audiovisual Communication Review, 1960, 8, pp. 243-257.
- Katzman, N., and Nyenhuis, J. "Color Versus Black and White Effects on Learning, Opinion and Attention", <u>Audiovisual Communication Review</u>, 1972, <u>20</u>, pp. 16-20.
- Morris, C. W. Signs, Language and Behavior. New York: Prentice-Hall, 1946.
- Saltz, E. "Compound Stimuli in Verbal Learning: Cognitive and Sensory Differentiation Versus Stimulus Selection", Journal of Experimental Psychology, 1963, <u>66</u>, pp. 1-5.
- Travers, R. M. W. "Transmission of Information to Human Receivers", Educational Psychologist, 1964, 2, pp. 1-5.
- Underwood, B.-J. "Stimulus Selection in Verbal Learning". In C. Cofer (ed.) <u>Verbal Behavior and Learning: Problems and Processes</u>. New York: McGraw-Hill, 1963.
- VanderMeer, A. W. <u>Relative Effectiveness of Color and Black and White in In-</u> <u>structional Films</u>. Technical Report No. SDC 269-7-28, Port Washington, <u>New York: Special Devices Center, Office of Naval Research, 1952.</u>

Table I: Treatments Most Effective in Facilitating Achievement on Each Achie ment Test as Compared with the Non-Illustrated Treatment.

Achievement Test	Immediate Posttest	Delayed Post
Drawing Test	Realistic Color Presentation	n –
Identification Test	Realistic Color Presentation	n –
Terminology Test	Realistic Color Presentation	n –
Comprehension Test	-	-
Total Test	Realistic Color Presentation	a –

#### DISCUSSION

A number of conclusions can be drawn from the analyses obtained in this study.

- Different visual materials incorporating different degrees of visual compl or different types of cueing devices are not equally effective in facilits student achievement relative to different instructional objectives.
- The data suggest that in those cases where visual materials were significa more effective than instruction without visuals, realistic color cued visu were most effective in facilitating student achievement.
- 3. The data further indicated, in those cases where color visual instructiona materials were superior to verbal materials, that realistic color material were more effective than non-realistic color materials. Since the overall number of visual cues presented in any corresponding pair of color visuals (realistic and non-realistic) were the same, it must be concluded that the increased effectiveness of the realistic color materials was due to the factor of realism rather than increased visual complexity.

This conclusion does not, however, support the principle of cue summation. Cue summation suggests that merely increasing the number of available cues would improve achievement. In this study, the relative number of visual cu was held constant across each color treatment, yet differences in achievement in favor of the realistic color group were observed.

It can generally be concluded, therefore, that the concept of realism is, t a limited degree, an important factor for consideration in the design of visual instructional materials. It can further be concluded that realism in a visual display is a factor which should be considered in addition to t total number of visual cues presented. In terms of the design of instructi al materials, this would mean that teachers and designers should avoid the use of non-realistic colors or shadings in visuals unless they serve a specific purpose, such as to make parts or objects more distinct from one another or from a background.

 Evidence further suggests that while visual materials used to complement in struction facilitate immediate retention of information, these effects disappear after six weeks.

## SELECTED BIBLIOGRAPHY

Attneave, F. "Some Informational Aspects of Visual Perception", <u>Psychological</u> Review, 1954, <u>61</u>, pp. 183-193.

- Bourne, L. F., Jr., and Restle, F. "Mathematical Theory of Concept Identification", Psychological Review, 1959, 66, pp. 278-295.
- Broadbent, D. E. Perception and Communication. New York: Pergamon Press, 1958.
- Broadbent, D. E. "Information Processing in the Nervous System", Science, 1965, 3695, pp. 457-462.
- Cherry, C. E. "Some Experiments on the Recognition of Speech With One and Two Ears", Journal of the Acoustical Society of America, 1953, 25, pp. 975-979.
- Dale, E. Audiovisual Methods in Teaching. New York: Dryden Press, 1946.
- Dwyer, F. M. "Adaption Visual Illustrations for Effective Learning", Harvard Educational Review, 1967, 37, pp. 250-263.
- Dwyer, F. M. A Guide for Improving Visualized Instruction. State College, PA: Learning Services, 1972.
- Gibson, J. J. "A Theory of Pictorial Perception", <u>Audiovisual Communication</u> Review, 1954, <u>2</u>, pp. 2-23.
- Jacobson, H. "The Informational Capacity of the Human Ear", Science, 1950, 112, pp. 143-144.
- Jacobson, H. "The Informational Capacity of the Human Ear", <u>Science</u>, 1951, <u>113</u>, pp. 292-293.
- Kanner, J. H., and Rosenstein, A. J. "Television in Army Training: Color Versus Black and White", Audiovisual Communication Review, 1960, 8, pp. 243-257.
- Katzman, N., and Nyenhuis, J. "Color Versus Black and White Effects on Learning, Opinion and Attention", <u>Audiovisual Communication Review</u>, 1972, <u>20</u>, pp. 16-20.
- Morris, C. W. Signs, Language and Behavior. New York: Prentice-Hall, 1946.
- Saltz, E. "Compound Stimuli in Verbal Learning: Cognitive and Sensory Differentiation Versus Stimulus Selection", Journal of Experimental Psychology, 1963, <u>66</u>, pp. 1-5.
- Travers, R. M. W. "Transmission of Information to Human Receivers", Educational <u>Psychologist</u>, 1964, 2, pp. 1-5.
- Underwood, B. J. "Stimulus Selection in Verbal Learning". In C. Cofer (ed.) <u>Verbal Behavior and Learning: Problems and Processes</u>. New York: McGraw-Hill, 1963.
- VanderMeer, A. W. <u>Relative Effectiveness of Color and Black and White in In-</u> <u>structional Films</u>. Technical Report No. SDC 269-7-28, Port Washington, <u>New York: Special Devices Center, Office of Naval Research, 1952</u>.

# TITLE: A Psychological Rationale for the Experimental Application of the Dwyer Stimulus and Criterial <u>Materials in</u> Instructional Theory Research

27

# AUTHOR: James Canelos

A Psychological Rationale for The Experimental Application of The Dwyer Stimulus and Criterial <u>Materials in Instructional Theory Research</u>

> Invited Panel Discussion Presentation, AECT National Convention, Dallas, Texas, 1982

> > James Canelos, Ph.D. The Pennsylvania State University College of Engineering

#### Introduction

A series of experimental studies have been conceptualized and conducted by Drs. William Taylor, Ohio State University, and James Canelos, The Pennsylvania State University, using the Dwyer stimulus and criterial materials. These studies have investigated the general and specific effects of external learning conditions on the internal psychological state of the cognitive structure. We found that the Dwyer stimulus and criterial materials could be operationally defined in specific psychological learning terms, and this led to a variety of experimental possibilities dealing with external (environmental) and internal (cognitive) instructional and learning hypothesis. The following experimental studies have been conducted or are currently in progress using the Dwyer materials:

#### Completed

- The Effects of Three Levels of Visual Complexity on the Information Processing of Field-Dependents and Field-Independents When Acquiring Instructional Information for Performance on Three Types of Educational Objectives, <u>Journal of Instructional Psychology</u>, Vol. 7, No. 2, pp. 65-70, 1980 (Canelos, J.; Taylor, W; Gates, R.).
- The Effects of a Networking Information Processing Strategy on the Learning of Field-Dependents When Receiving Visual Instructional Information, <u>Journal of Experimental Education</u>, Vol. 50, No. 1, pp. 42-46, 1981 (Canelos, J.; Taylor, W.).
- 3) The Instructional Effectiveness of Three Content-Independent Imagery Learning Strategies on Different Learning Outcomes When Learners Received Visualized Instruction of Varying Complexity, Journal of Experimental Education, in press, Heldref Publications, Washington, D.C., 1982 (Canelos, J.).
- 4) Content Independent Learning Strategies and Their Relative Effectiveness on Acquiring Concept Information and Spatial Information When Learning from Visualized Instruction, Presentation at the 1982 AECT National Convention, Dallas, Texas, published in <u>Research and</u> <u>Theory Division Proceedings</u>, 1982 (Canelos, J.; Taylor, W.; Altschuld, J.).
- 5) The Instructional Effectiveness of Three Content-Independent Imagery Learning Strategies on Different Learning Outcomes When Learners Received Visualized Instruction of Varying Stimulus Complexity, Winning research effort of the Association for Educational Communications and Technology, Research and Theory Division, 1982 Young Researcher Award, National Competition, 1982 (Canelos, J.).

#### In Progress

 The Effects of Cued Recall and Free Recall on the Long-Term Retention of Learning from Visual Instructional Materials, The Pennsylvania State University, 1982-83 (Canelos, J.; Taylor, W.).  The Relative Effectiveness of a Visual Advance Organizer and a Verbal Advance Organizer When Learning from Visualized Instruction, The Pennsylvania State University, 1982-83 (Canelos, J.; Taylor, W.).

### Problem and Rationale

The research problem confronting many experimental researchers is not so much designing unique studies but finding criterial and stimulus materials that are valid and that operationally fit their hypothesis. Such materials can usually be developed and in many cases this is the only solution. However, this will involve time and considerable expense. In addition, many experimental studies use simplistic and totally unrealistic learning and testing materials, making generalization to the classroom difficult at best. The Dwyer stimulus materials represent a typical academic instructional program on the human heart. Most school learners have experienced similar mediated instruction and therefore the Dwyer stimulus materials are not significantly different from school learning conditions. The same is true of the Dwyer testing materials. These dependent measures are representative of typical classroom testing conditions students are familiar with.

The Dwyer stimulus and criterial materials are very typical of academic learning and testing conditions, making experimental results using these materials quite generalizable to <u>real</u> classroom learningtesting conditions. The fact that the instructional materials deal with a heart instructional program is irrelevant unless the subject pool has significant prior knowledge of heart physiology. What is relevant is that the various slide-sets which make up the visual variable of the heart instructional programs can be defined in specific operational terms. Additionally, the tests on the heart learning program can be defined in terms of specific psychological learning factors.

#### Solution

To address the specific experimental problem of using valid instructional materials (stimulus materials) and testing materials (criterial materials), in the Canelos, et. al., studies, the Dwyer stimulus and criterial materials were used. The series of studies previously cited dealt with internal cognitive factors as well as external stimulus conditions. The problem we faced was finding, or developing, stimulus and testing materials that were typical to classroom learning experiences, and could be operationally defined in specific psychological terms.

The Dwyer materials fit these two requirements in the following way:

#### 1) Dwyer Instructional Program on the Human Heart.

The Dwyer instructional program used in the Canelos, et. al., studies was the slide-tape program. Three visual program types were

used: (a) line drawings with a colored background, (b) illustrations, in color, (c) realistic photograph, in color. Each of these program types can be operationally defined in terms of the psychological abstraction process by the amount of relevant or irrelevant material contained in the visual sets. The first operation in information processing is selective attending or selective perception. During attending the individual selects relevant information from irrelevant information, this defines the abstraction process (e.g., abstracting relevant data from background data). Therefore, the addition of, or deletion of, irrelevant information should significantly effect learning.

3

The three Dwyer instructional program slide sets used were operationally defined as having an effect on abstratcion because of differences between relevant and irrelevant information contained in each set

a) The line drawing slide set contained the lowest amount of irrelevant data.



(R = relevant; I = irrelevant)

b) The illustration drawing slide set contained an equal amount of relevant and irrelevant data.



c) The realistic photograph slide set contained more irrelevant than relevant data

IIIIIIIIIIIIIII RRRRRRR

Additionally, the instructional programs contained exactly the same amount of to-be-learned information since each used the same audio script.

2) Dwyer Testing Materials on the Heart Programs.

The Dwyer testing materials can be operationally defined in specific psychological information processing terms. The tests used in the Canelos, et. al., studies were derivations of (a) the Drawing Test, (b) the Terminology Test, (c) the Comprehension Test.

The Drawing Test can be operationally defined as a spatial learning task and a list learning task. A spatial learning task will involve the use of imagery information learned from the heart programs and knowledge of spatial relationships among and between the parts of the heart. This spatial learning is different than verbal learning and usually interacts with other experimental variables such as cognitive style or learning strategy. The list learning part of the Drawing Test involves the identification of, or listing of, the heart part names. List learning can be defined as a very simple learning task involving the recall or recognition of a list of names. Interestingly, this list learning task is usually what is found with typical experimental learning studies!

The Terminology Test can be operationally defined as a simple concept learning task or conjunctive concept learning task. In this case, the learner is given a short description and he must classify, from a number of choices, what this description defines. This type of learning task is different from list learning, spatial learning, and complex concept learning. Additionally, this learning task fits the true definition of concept learning (e.g., a concept is a classification rule, allowing the person to classify what is or what is not in that conceptual category).

The Comprehension Test can be operationally defined as a complex concept learning task or a relational concept learning task. The Comprehension Test requires that the learner understand relationships between simple concepts or facts. A relational concept is typically quite difficult since several bits of information must be combined to solve the conceptual problem.

#### Conclusion

The Canelos, et. al., studies used only a portion of the Dwyer stimulus and criterial materials. There are additional slide sets and programmed learning materials on the heart as well as additional testing conditions. We have found that the Dwyer stimulus and criterial materials are effective since they can be operationally defined in terms of specific psychological variables. Additionally, they are valid and represent materials allowing for a reasonable generalization to the classroom situation.

# TITLE: The Effects of Review and Practice Techniqu on Learning from Prose Material

# AUTHOR: Mary Ann Chezik Francis Dwyer

### The Effects of Review and Practice Techniques

### on Learning from Prose Material

#### Mary Ann Chezik Francis Dwyer The Pennsylvania State University

#### The Problem

The problem under investigation in this study had several aspects:

- What effect do intervening synthesis/review sheets have on learning from prose text?
  - What effect do periodic practice worksheets have on learning from prose text?
    - 3. What effect do combination of review and practice have on learning from prose text?

A fourth grea of concern was the effect of an advance organizer containing general orienting information, educational objectives, and a preview of posttest question types. An initial pilot study text showed no observable differences when the organizer was used, so the text in all five treatments was preceded by the advance organizer introduction.

#### Related Literature

The basis for developing the treatments for this study was provided by the ideas of Rothkopf (1965) and Gagne (1978) that activities engaged in by the learner at the time of presentation of material influence the outcome of learning.

Rothkopf called these activities the "mathemagenic behaviors" of the learner: the behaviors that produce learning. These "behaviors" included special instruction, questions, cues, and suggestions. This definition of a set of behaviors led to research centering on how the activities can be incorporated into instructional units for the best effect on learning.

Faw and Waller (1976) suggested that rather than call these activities "behaviors," they were more precisely "techniques" employed by the instructor that could have an influence on student learning. They related that research had centered on four techniques in particular:

- advance organizers (Ausubel, 1960)
- instructions that put the student in a response mode (taking notes, underlining, etc.)
- providing objectives
- 4. presenting inserted questions.

Much of the research in the area of these mathemagenic techniques has centered on the effects of advance organizers (Barnes and Clawson, 1975; Mayer, 1979), and on the effects of questions (Frase, 1967, 1968; Rickards, 1979; Rickards and DiVesta, 1974; Rothkopf and Bisbicos, 1967). Results have been inconsistent. They have varied according to how the experimenter has defined "advance organizer," and how the concept of practice questions was approached: where they were placed, how many were asked, at what frequency they were placed in the text, whether review was allowed while answering questions, the type of response required, and the length and nature of the prose material they accompanied.

Ellen Gagne re-emphasized the need to look at events at all stages of the learning process with prose material:

- prior knowledge of content (learner history)
- 2. before reading (advance organizers, instructions, suggested strategies)
- 3. during reading (inserted questions, pictures, cues)
- after reading (review, practice)

This study attempted to add, in a step-like fashion, an increasing amount of these techniques or leraner activities to an instructional unit, to determine what effect they would have on post-test performance. Of particular interest were review activities and practice post-questions.

#### Procedure

#### Materials

The learning unit used in this study was Lamberski's revised edition (1980) of the Dwyer heart material (1967)--a 2,000 word prose text with accompanying black and white line drawings on the structure and function of the human heart. Lamberski's text divided the passage into three sections with the sub-headings:

- The Parts of the Heart
- The Circulation of Blood Through the Heart
- The Cycle of Blood Pressure in the Heart.

These logical divisions were used to determine the placement of review and practice activities.

The review pages synthesized material presented in the previous section on one sheet; the review following the nine pages on the parts of the heart was a drawing that showed the twenty parts labeled appropriately with the instructions to view it before continuing. The page following the section describing the flow of the blood through the heart had two diagrams showing the flow plus information that divided the action into "phases"--a term used on the post-test; the final review page also contained two labeled diagrams plus information that detailed the action of the heart in relation to the blood pressure values.

The practice worksheets were single pages inserted after the synthesis/ review sheets that gave the learner instructions to answer the questions using either the review sheets or the text before continuing with the unit. This allowed both review and feedback opportunities for the learner. The first worksheet was a matching exercise between the names of the parts of the heart and their descriptions. The second and third pages related to the action of pumping the blood through the heart and were considered to contain questions that aided the students in understanding the "process" of the heart's functioning.

Lamberski's short introductory statement to the unit was replaced by the more detailed advance organizer introduction in all groups.

The criterion measure was performance on a four-part post-test (drawing, identification, terminology, and comprehension) both immediately following the reading of the material and at a two-week delay interval.

Design

The additions to the original prose materials led to the following design, using five treatment groups:

 $T_1$  - Text only  $T_2$  - Text + three review pages

T3 - Text + three review pages + "parts" worksheet

T<sub>4</sub> - Text + three review pages + 2 "process" worksheets

T<sub>5</sub> - Text + three review pages + 3 worksheets

The length of time each subject spent interacting with the instructional materials was noted by the experimenter by recording when the text package was distributed and when it was returned for the test materials.

A one-way analysis of variance was performed to determine any significant effects between the treatment groups.

#### Subjects

The subjects for this study were 161 college students, recruited from several classes at both Penn State University, University Park, Pa. and Marywood College, Scranton, Pa.: Instructional Systems 411, Speech Communications 352, Health Education 303, and Man/Environment Relations. Students participating received some class or laboratory credit for their efforts. All of the classes sampled were general upper-level course offerings with a variety of college majors represented among the students in each class. The testing was done outside of class and required about 11 - 2 hours participation time from each subject.

#### Analysis

The initial analysis (ANOVES) showed no significant differences among treatment groups as measured by mean scores on the four criterion tests, either immediately or two weeks after the initial reading.

The one significant effect was found in the amount of time spent on task (p 0.000), with subjects in TI speinding an average of about 21 minutes interacting with the materials, and subjects in T5 interacting for almost 40 minutes with the materials. This suggests that there is a point beyond which it is no longer efficient or effective to continue adding learning activities. Further analysis was undertaken to explore the effects of the treatments and account for the relatively high mean scores, which, while not significantly different over treatments in this study, represent higher scores than usually achieved while interacting with the Dwyer heart unit.

Two previous heart studies provided some basis for further study: Lamberski (1980) and Jennings (1979). The Lamberski study provided scores on the same prose/test arrangement used in this study, but without the extended advance organizer introduction. The Jennings' study identified problem areas in the original Dwyer text that resulted in low achievement (defined as a correctresponse rate of less than .600) on each of the four criterion tests. An item analysis was done and compared to the findings of the Jennings' study.

#### Results

Preliminary findings show that the mean scores across each of the four tests taken <u>immediately after</u> interacting with the unit in this study are (significantly) higher than those in the Lamberskicontrol group.

Direct comparison of results on the delayed retention aspect of the studies was not possible since the interval was two weeks in this study and six weeks in the Lamberski study. However, the mean <u>scores on the two-week delayed reten-</u> tion test in the current study are <u>higher</u> than the <u>immediate post-test scores</u> of the Lamberski study:

	DR	ID	Term	Comp	DR	ID	Term	Comp
Control	13.05	15.23	12.45	11.91		-	-	-
т,	16.12	17.15	14.67	13.61	14.75	16.57	13.18	14.11
T,	16.33	16.97	15.03	14.73	14.42	15.65	14.04	13.65
Ta	17.22	18.63	15.91	15.47	15.07	16.72	14.24	14.10
TA	17.00	18.66	15.63	15.47	15.07	16.86	13.62	14.00
T	17.55	18.13	15.58	15.71	15.77	16.77	14.85	15.08

It appears that the orienting information and the preview of the test quest types provided in the introduction to the instructional unit in this study did has a significant impact on the way the students approached the task of learning the material.

The item analysis of the test questions that had correct-response rates of less than .600 on the original Dwyer study, according to Jennings, has shown that improvement has occurred across all treatments in this study. The most dramatic increase is seen in the Identification test, which had seven questions with correct-response rates ranging from .197 to .598. In the current study, the correct-response rates ranged from .606 to 1.00 on the same questions. In comparing the improvement across treatments, T3, T4, and T5, those treatments with practice activities as well as review pages, appear to produce higher correct response rates. Additional analyses of these response rates and trends in the data are currently being undertaken.

#### Discussion

Results of the study suggest that:

 The pre-set that the subjects received with the additional information in the advance organizer introduction made a difference in the way the material was learned and stored for testing. Additional research needs to be conducted to find the strength of the effects of each part of that introduction--the general orientation to the subject, the statement of learning outcomes, and the preview of post-test guestion types.

- The learning of particulary difficult or detailed concepts (similar to the process of blood circulations through the heart) may need more planned instructional activity than reading a text and viewing a visual. Review plus practice questions can provide this activity and prepare students for more difficult questions.
- 3. The high mean scores that were similar across all treatments may be indicative of a need to re-examine the test questions used with this unit. There may not be enough items in the current post-test that challenge a sufficient range of knowledge; i.e., the treatments with more activity required may have prepared the students to answer questions of a more detailed and difficult nature than were provided in the twenty item tests.
  - 4. The significantly greater amounts of time spent on the treatments with more activities without a corresponding increase in achievement suggests that the amount of activity planned into an instructional unit should be appropriate to the amount of emphasis the unit has within the curriuclum, and to the nature of the expected learning outcome.

#### Literature Cited

- Andre, T. Does answering higher-level questions while reading facilitate learning? Review of Educational Research, 1979, 49, 280-318.
- Ausubel, D. P. The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educatonal Psychology, 1960, 51, 267-272.
- Barnes, B. R., & Clawson, E. U. Do advance organizers facilitate learning? Recomimmendations for further research based on an analysis of 32 studies. <u>Review of</u> Educational Research, 1975, <u>45</u>, 637-659.
- Faw, H. W. & Waller, T. G. Mathemagenic behaviors and efficiency in learning from prose materials: review, critique and recommendations. <u>Review of Educa-</u> tional Research, 1976, <u>46</u>, 691-720.
- Frase, L. T. Learning from prose material: length of passage, knowledge of results, and position of questions. <u>Journal of Educational Psychology</u>, 1967, 58, 266-272.
- Frase, L. T. Questions as aids to reading: research and theory. <u>The American</u> Educational Research Journal, 1968, 5, 319-332.
- Frase, L. T. Some unpredicted effects of different questions upon learning from connected discourse. Journal of Educational Psychology, 1968, 59, 197-201
- Gagne, E. D. Long-term retention of information following learning from prose. Review of Educational Research, 1978, 48, 629-665.
- Jennings, T. J. The effectiveness of elaborate visual cueing and reduced step size in facilitating student achievement on different instructional tasks. Unpublished doctoral dissertation, The Pennsylvania State University, 1979.
- Lamberski, R. J. The effect of a verbal and visual color code on self-paced instruction and testing for retention on different tasks. Unpublished doctoral dissertation, The Pennsylvania State University, 1980.
- Mayer, R. E. Can advance organizers influence meaningful learning? <u>Review of</u> <u>Educational Research</u>, 1979, <u>49</u>, 371-383.

- Rickards, J. P. Adjunct postquestions in test: a critical review of methods and processes. Review of Educational Research, 1979, 49, 181-196.
- Rickards, J. P. & DiVesta, F. J. Type and frequency of questions in processing textual material. Journal of Educational Psychology, 1974, 66, 354-362.
- Rothkopf, E. Z. Some theoretical and experimental approaches to problems in written instruction. In J. D. Krumboltz (Ed.), Learning and the Educational Process. Chicago: Rand McNally, 1965.

Rothkopf, E. Z. & Bisbicos, E. E. Selective facilitative effects of intersperse questions on learning from written materials. <u>Journal of Educational Psycho-</u> logy, 1967, <u>58</u>, 56-61.

TITLE: A Multifactor Analysis of the Instructional Effect of Type of Instruction, Testing, Recall and Order of Testing

AUTHOR: Hermes Teixeria De Melo Francis M. Dwyer

### A Multifactor Analysis of the Instructional Effect of Type of Instruction, Testing, Recall and Order of Testing

Hermes Teixeria De Melo Associate Professor of Education Universidade Federal da Bahia, Brazil Francis M. Dwyer Professor of Education The Pennsylvania State University

#### Background

A considerable amount of research has been conducted in an attempt to determine whether there is a difference in achievement among students who receive visualized instruction and are evaluated verbally and those who recei visualized instruction and are evaluated visually (Torrence, 1976; Dwyer, 197 Szabo, Dwyer & DeMelo, 1981). In this respect a number of different types of strategies have been utilized to investigate the parameters of visual testing e.g., film (Carpenter, 1954), slides (Stallings, 1972; Dwyer & Tanner, 1978), etc. However, a more comprehensive understanding of the visual testing pheno non might well be achieved with a more systematic examination of the relation among (a) different types of visual-testing formats, (b) the level of stutent achievement of different types of educational objectives, and (c) their effec (visual) on short-term (STM) and long-term memory (LTM).

#### Problem

The purpose of this study was to empirically investigate (a) the effect of verbal instruction alone vs. verbal instruction complemented by simple line drawings, (b) the effect of visual testing vs. nonvisual testing, (c) the effect of verbal cued vs. free recall on students' achievement, (d) the effec of order of testing on subsequent achievement, and (e) the interactions among type of instruction, type of testing and order of testing.

#### Procedure & Experimental Design

One hundred fifty-one undergraduate students enrolled at The Pennsylvania State University volunteered to participate in this study. The design of the experiment was a posttest only, 2x2x2x2 factorial design (Figure 1). Students were randomly assigned to one of the sixteen treatment cells. The four independent variables were (1) type of instruction: visual and nonvisual, (2) types of achievement test: visual and nonvisual, (3) types of drawing test: free recall and verbal cued recall, (4) order of drawing test: before and after completion of the three criterion measures. The dependent variables Identification Test. This test consisted of 20 multiple-choice items with five alternatives which required the subject to identify the numbered parts on a detailed drawing of a heart. Each part of the heart presented on the instructional units received a number which was associated to the multiplechoice segment of the test; KR-20=.86 on the immediate test, and KR-20=.83 on the two weeks delayed retest.

Terminology Test. This test consisted of 20 multiple-choice items with five alternatives each, designed to measure the subjects' knowledge of specific facts, terms and definitions related to the human heart; KR-20=.82 on the immediate test, and KR-20=.81 on the two weeks delayed retest.

<u>Comprehension Test</u>. The comprehension test consisted of 20 multiplechoice items with four alternatives each. Given the location of certain parts of the heart at a particular moment of its functioning, the subjects were asked to locate the position of other specified parts of the heart at the same point in time. This test was designed to measure a type of understanding that occurs when an individual fully grasps what is being communicated and can use the information being received to explain some other phenomenon occurring simultaneously; KR-20=.72 on the immediate test, and KR-20=.74 on the two weeks delayed retest.

The reliabilities of the total criterion test score of the paper-pencil version of the achievement test were KR-20=.92 on the immediate test and KR-20=.91 on the two weeks delayed retest.

#### The Visual Version of the Achievement Test

The visual version of the achievement test developed by DeMelo (1980) was an attempt of having a literal version of a test from a verbal language, into a visual language. Its main characteristic was the use of visual items and the reduction of printed words to a minimum in such a way that printed words were used only for stem of the question. The response options of each visual item were fully visual, and the illustrations were identical to those used in the visualized instructional unit. The obtained KR-20 for the immediate and delays retention on each of the visualized versions of the criterion measures follow: identification (.82, .82), terminology (.74, .74), comprehension (.76, .60), total criterion test (.91, .90).

#### The Drawing Test: Cued Recall-Free Recall

The drawing test in this experiment was also composed in two versions; Dwyer's original version (1972, 1978) herein named <u>Verbal Cued Version of the</u> Drawing Test, and the <u>Free Recall Version of the Drawing Test</u> first used in this study.

The <u>Verbal Cued Version of the Drawing Test</u> had as its objective the evaluation of the subjects ability to construct and/or reproduce items in their appropriate context. For example, the test (N=18) items provided the students with a numbered list of terms, e.g., (1) superior vena cava; (2) aorta; (3) tricuspid valve; (4) pulmonary vein; etc. corresponding to the parts of the heart presented in the instructional unit. The subjects were required to draw a representative diagram of the heart (a symbol like a valentine sufficed; the quality of the drawing did not enter into the scoring) and place the numbers of the listed parts in their respective positions. In this test, the emphasis wa

the correct positioning of the verbal symbols with respect to one another and to their concrete references. The <u>Free Recall Version of the Drawing Test</u> had the same characteristics of its verbal cued version except for the absence of the verbal cues.

#### Results

A 2x2x2x2 analysis of variance was conducted on the dependent variables for both immediate and delayed retention testing. Reported findings were significant at the .05 level. The results of this study suggest that:

- The use of visuals (simple line drawings) as mediation of written instruction improve students' achievement at different cognitive levels (identification and comprehension) and its effects were retained two weeks later.
  - Students participating in this study performed better on the immediate nonvisual test on subscales terminology, comprehension, and composite scores than did equivalent subjects on the visual version of the same test; this effect, however, disappeared two weeks later.
- 3. The order of drawing test (before or after the achievement test) had no significant effect on subjects' performance on the achievement test; the performance on the drawing test, however, was significantly better for the students who received the visual achievement test before the drawing test.
  - An interaction among visual instruction, nonvisual test, and drawing test before the achievement test was revealed for the identification test on the immediate achievement test.
  - Interactions among visual instruction, visual test and drawing test after achievement test were found to exist for both the 2 weeks delayed total criterion test, and on the drawing test for immediate retention.

#### References

- Carpenter, C. R. Evaluation of the film: Military police support in emergencies (riot control) TF 19-1701 (Technical Report SDC-269-7-52). Port Washington, New York: Special Devices Center, Office of Naval Research, 1954.
- DeMelo, H. T. Visual self-paced instruction and visual testing in biological science at the secondary level. Unpublished doctoral dissertation, The Pennsylvania State University, 1980.
- Dwyer, F. M. <u>Strategies for improving visual learning</u>. State College, PA: Learning Services, 1978.
- Dwyer, F. M. & Tanner, G. Visual testing: A viable instructional variable. British Journal of Educational Technology, 1978, 1, 34-37.
- Stallings, W. M. A comparison of television and audio presentations of the MLA French listening examination. <u>Journal of Educational Research</u>, 1972, <u>65</u>, 472-474.
- Torrence, D. R. The television test of science processes. Unpublished doctoral dissertation, The Pennsylvania State University, 1976.

TITLE: Considerations for Sustaining Instructiona Design Research Using an Integrated Learning System

AUTHOR: Barbara Grabowski

A Symposium: Relevant Cue Research A Program of Systematic Evaluation:

AND DE STORE

A LAND AN AN ADD AN ANY A

Considerations for Sustaining Instructional Design Research Using an Integrated Learning System

#### by

Barbara Grabowski, Ph.D. University of Maryland University College College Park, Maryland 20742

,

Presented at the 1982 Association for Educational Communication and Technology National Convention Dallas, Texas

The purpose of this presentation is to describe an integrated learning system on which comprehensive instructiona development research can be conducted. This learning system i my opinion, will help to circumvent the more "dead" media research question which Richard Clark has called it, that compares <u>delivery options</u> and student achievement. The integrated learning system by its nature, focuses the researcher's attention on the more pertinent design questions that investigate which stimulus dimensions are effective in eliciting student achievement.

-2-

The integrated learning system is comprised of several equipment components: the videodisc, microcomputer, printer, single monitor, hard disc storage with CPU for random access digitized audio, and headphones.

The first statement may seem contradictory now since it appears I am presenting another media study, however, media selection is not the issue with this system. The learning sys combines <u>all</u> other existing media' (except real objects, of course, but which could be easily added), and therefore, represents an integrated audio and visual learning system. Deciding what is displayed on that one monitor, printed from t printer, or listened to through the headphones becomes attribu selection rather than media selection.

This system which will be operational at the Center for Instructional Development and Evaluation of the University of Maryland University College in the near future has also been called an intellegent videodisc learning system. A discussion

the system features is warranted to understand why this learning system has the potential for becoming a powerful instructional development research tool.

From the <u>videodisc</u>, with its 54,000 slide or 30 minute motion capacity per side, stills or motion with any variation of realism (contained in any other medium) can be selected. Also, the videodisc itself has 2 audio tracks which can be used to present different verbal messages (if any) to complement the same visuals. The audio track, however, is limited to 30 minutes and takes up visual space, so we have added the <u>hard disk</u> that stores digitized audio in words or sound effects that can be randomly or systematically generated.

From the microcomputer, any feature provided by computer based instruction can be selected, that is, text, graphics, interaction through question and answers, branching, etc.

From the printer, hard copy versions of text, maps, assignments, etc. are available.

The monitor is the key component in this system because it has a high resolution color display, that enables intricate detailed color graphics. Most importantly, however for the research project, is that this one monitor can display the computer generated graphics, the visuals from the videodisc, or a combination of the two which overlays the computer graphics onto visuals. Another feature of the monitor is the touch sensitive screen, which simply means the system can be operated or questions answered by touching various portions of the screen

48

-3-

with your finger rather than searching and typing from the keyboard.

The hard disc computer stores all of the instructions for integrating the various system features.

-4-

Since this system is "integrated and intelligent," future research can combine various design attributes which were not possible or as easily done before. Of particular interest will be the potential for investigating the combination of levels of realism on one visual. What happens when a variety of realistic pictures are integrated in one lesson or one visual? The studen views the realist photograph, then the line drawing is overlaid onto the realistic picture from computer graphics, the realistic picture disappears, leaving the line drawing and the instruction continues.

Next, the effects of more complex cueing strategies on learning could be investigated, such as the use of flashing arrows, or flashing areas of the picture themselves. Most interesting will be the integration of any of the capabilities of computer-based graphics with the realism and motion of other media.

Another variable which can be tested combines realism with the touch sensitive screen. Does the learner become more intimately involved with the instruction when he/she touches or traces the various parts of the visual, and is this the instructional variable needed for increasing learning and retention from realistic pictures, or even enhancing transfer? There is also great potential for assessing individual

differences by having on-line tests which branch students to different treatments.

As you can see with this very brief introduction, designing research or designing instruction using the intelligent videodisc learning system is a very complex process, and it also demonstrates the extent of the feature decisions instructional developers must make when preparing effective instruction.

After reading much of the literature describing design investigations which used variations of Dwyer's heart materials as their treatments, I realized that these materials would be most appropriate for research using the intelligent videodisc learning system. This is especially so primarily because the heart presentations were carefully developed to include different levels of objectives and different levels of abstraction in the visuals which would enhance the instruction. The presentations could be varied using most of the learning system features.

The next important reason for using his instructional materials is that the literature is full of calls for a systematic research approach to the identification of effective instructional design techniques. Many research investigations of the various effects of individual differences, cueing strategies, and presentational strategies on each level of objective and degree of realism in the visuals have already been conducted. Since these studies have already been conducted and the materials already been validated, a systematic investigation varying the design features available singly and in combination on the intelligent videodisc learning system is possible. (Such as

. ...

50

-5-

combining levels of realism in one visual--the computer generate line drawing overlaid onto the realistic picture, animated cueing, use of touch to touch or trace various parts of the visual, etc.)

Considering the tremendous potential for varying stimulus variables on this system to use it as a research tool, a systematic approach to conducting this comprehensive research would be needed. A logical approach has already been conceived in Dwyer's divisions into the four types of complexities associated with the various levels of abstraction in visuals. These are:

- (1) different levels of objectives
- (2) individual differences
- (3) cueing differences
- (4) differing presentational strategies

This structure would be useful by expanding item three, cueing differences, to include the visual learning/cognitive processes which Winn is proposing. He states "Cognitive theorie of learning offer more comprehensive (though still imcomplete) accounts of learning that have profound implications for . . . building theories that direct practice" (Winn, 1982, p. 3). He presents three types of visual learning processes: perceptual, assimilative, and analogical processing. One of the instructional strategies matched to the assimilative process is cueing, so it seems these processes would fit well within the Dwyer model. Revising the model to account for visual learning processes increases the design questions which could be posed t<sup>o</sup>

-6-

include a more comprehensive investigation of visual organization and design of instruction for integration into one's own schema. Because of the branching capabilities of the system many investigations in this area can be undertaken which may otherwise have been too complex to manage.

with these four areas as a structure, a careful breakdown of each into its components could then be built into theories which are tested with a selected combination of intelligent videodisc learning system features. From this analysis and theory building could come a comprehensive systematic plan for conducting ID research with the ultimate goal of directing instructional design with sound theory rather than intuition.

The intelligent videodisc learning system in the form presented is very expensive, so the likelihood that the combination of all of the components would be available in every school system is remote. However, I do believe that this system combined with Dwyer's heart materials and his breakdown of important areas for design investigation offers to researchers an ideal combination for attacking a very complex problem and responding to directives in the literature which call for "research to provide guidance for designers."

-/-

#### References

- Clark, R.E. "Book Review: Media in Instruction: 60 Years of Research." Educational Communication and Technology Journal, 1982, 30, 60.
- Dwyer, F.M. Strategies for Improving Visualized Instruction. State College, PA: Learning Services, 1978.

Winn, W.D. "Visualization in Learning and Instruction: A Cognitive Approach." <u>Educational Communication and</u> <u>Technology Journal</u>, 1982, 30, 3-25. TITLE: The Effect of Varied Visual Cueing Strategies in Facilitating Student Achievement on Different Educational Objectives

54

AUTHOR: Thomas Jennings Frances Dwyer The Effect of Varied Visual Cueing Strategies in Facilitating Student Achievement on Different Educational Objectives

Thomas Jennings USREP IJECOR APO, New York 09038 Francis Dwyer 140 Chambers Building The Pennsylvania State University University Park, PA 16802

#### Background

Early research in visualized instruction subscribed to a conceptual framework which emphasized comparisons between different media types. While this approach has generated some useful information for the selection and utilization of media types, it has done little to develop a scientific base for improving the learning effectiveness of visual materials produced by instructional designers and teachers (Lumsdaine, 1960). A serious flaw in this approach is its failure to deal with visual instructional materials as combinations of distinct cues.

A more productive approach is one which would employ a conceptual framework which would investigate the stimulus characteristics of visuals. Levie and Dickie (1973, p. 860), in a state-of-the-art report, advocated research that "...specifies the relevant variables in terms of the attributes of media rather than in terms of the media themselves." They qualified this by adding, "Media attributes are properties of stimulus materials which are manifest in the physical parameters of media." Recent research efforts have moved in this direction by dealing with the stimulus characteristics of visuals in relation to specific educational tasks (Dwyer, 1967, 1972; Trabasso and Bower, 1968; Berry, 1974; and Parkhurst, 1974).

The present study attempted to contribute to the conceptual base for visualized instruction by exploring two cueing strategies used in visuals. Specifically, its purpose was to investigate the effectiveness of elaborate visual cueing and reduced step size (increasing the number of visual cues) in facilitating student achievement on different instructional tasks.

#### Hypotheses

The following hypotheses were proposed in an effort to generate information to assist designers of instructional visuals in selecting cueing techniques which are most effective for facilitating learning on specific educational tasks.

- H1: The instructional treatments utilizing reduced step size will be superior to the larger step size treatments in terms of facilitating student achievement on the immediate and delayed criterion tasks.
- H2: The instructional treatments utilizing elaborate visual cueing will be superior to the simple visual cueing treatments in terms of facilitating student achievement on the immediate and delayed criterion tasks.

H3: The instructional treatment combining reduced step size with elaborate visual cueing will be superior to all other treatments in facilitating student achievement on the immediate and delayed criterion tasks.

# Experimental Treatments

Dwyer's original instructional package was used, in part, as the basis for this study. The 2,000-word script, terminology labels, and criteria measures were all retained intact. Modified versions of the black and white, simple-line-drawing sequence served as the primary presentation in this study. Modifications were made to further this study's investigation and they occurred as the result of a task analysis performed on previous research results obtained from a study conducted by Dwyer (1971). Utilizing the task analysis, four instructional treatments were designed and produced to test the hypotheses of this study.

Students in Group I received the larger step size (37 visuals), with simple visual cues (static position indicators). Students in Group II also received the 37 visuals; however, in addition they received what was considered to be elaborate cueing (dynamic-process arrows, motion indicators, and shading). Group III received reduced step size (47 visuals), with simple visual cueing (static position indicators). Group IV received the same reduced step size as did Group three; however, they also received elaborate visual cueing (dynamic-process arrows, motion indicators, and shading).

Each treatment consisted of an instructional booklet describing the human heart, its parts, and the internal processes occurring during the systolic and diastolic phases. Contained within each booklet was the 2,000-word instructional heart script accompanied by appropriate visuals of the heart. The booklets were divided into individual pages (or frames). Each page of the booklet consisted of an 8 1/2 x 11 inch sheet of white paper; occupying the top portion of the page was a 4 x 5 inch simple black-line drawing of the heart. Corresponding paragraphs of the instructional script were positioned on the lower portion of the page beneath the heart picture. Each illustration of the heart was labeled with appropriate terminology.

#### Experimental Procedures

The sample population for this study consisted of 92 university students enrolled in The Pennsylvania State University. For participation in this study, and as a motivational device, all subjects received extra credit in their respective courses. Each subject was required to attend two experimental sessions. During Session 1, subjects were randomly assigned to one of the four treatment groups--resulting in an n = 23 for each treatment group.

In Session 1, subjects interacted with their assigned instructional presentations and completed four criterion tests. Before treatments were begun, subjects were arranged in separate treatment groups and told to read the directions on the cover of the instructional booklet. All subjects received the same directions. The printed information consisted of three points: (1) subjects were told that the purpose of the study was to investigate the effectiveness of visual illustrations and cueing strategies; (2) subjects were told that there was no time limit and that they, therefore, should progress at their own pace through the booklet (self-pacing); and (3) subjects would be tested on a battery of criterial tests immediately after completing the booklet. Subjects were also told verbally that they would be retested six weeks later in Session II. The subjects than interacted with their respective instructional booklets on an individual and self-paced basis. Although no time limit was imposed, subjects were timed so that efficiency scores could be computed later. Upon completion of the treatment, each subject was asked to take the drawing, identification, terminology, and comprehension tests. Subjects were permitted to take as much time as needed for each criterion test before proceeding to the next. All data were analyzed by analysis of variance techniques to determine if statistically significant differences existed among instructional treatments.

3

#### Statistical Analysis

The first part of the statistical analysis examined both criterion test reliabilities (K-R 20) and homogeneity of variance among treatment groups (Bartlett's Test). Following this, interpretation of the study's findings was accomplished by a randomized factorial design. Specifically, a three-factor, repeated-measure design was used with two between-subjects factors (A and B) and one within-subjects factor (C). In notation form, the design can be characterized as  $(A_2 \oplus B_2)$  in C<sub>2</sub>, indicating two levels of factor A crossed with two levels of factor B, and both A and B nested in factor C. The independent variable in the study was the method of visual cueing used, while the dependent variables were test scores on the drawing, identification, terminology, comprehension, and total criterion tests.

Between-Subjects Factors								
Factor A:	Step Size	Factor C:	Time/Test Administration					
	Level A <sub>1</sub> (Larger Step Size)		Level C <sub>1</sub> (Immediate Testi					
	Level $A_2$ (Reduced Step Size)		Level C2 (Delayed Testing					
Factor B:	Cueing Technique							
	Level B <sub>1</sub> (Simple Visual Cueing)							
	Level B <sub>2</sub> (Elaborate Visual Cueing)							

Factors in Experimental Design

A three-way analysis of variance (ANOVR) was conducted on the number of correct responses achieved by subjects on each criterion test, as well as on their combined total criterion score. An F-ratio with a p value .05 significance level or less was considered sufficient to reject null hypotheses and to verify alternative hypotheses. An additional two-way analysis of variance (ANOVES) was performed separately on the immediate and delayed retention measures to reveal any significant findings observed by collapsing data on the within-subjects factor of the three-way analysis of variance. Efficiency scores were calculated for each treatment group and analyzed by analysis of variance (ANOVES) techniques to determine if significant statistical difference.

#### Results

Criterion test reliabilities were obtained by calculating Kuder-Richardson Formula 20 reliability coefficients; the values obtained for the criterion tests were all of a satisfactory level (Drawing test, .84; Identification Test, .85; Terminology Test, .86; and Comprehension Test .789). Results from Bartlett's Test for homogeneity of variance conducted on the dependent variables (the criterion tests) were all non-significant at the .05 level, indicating that the subjects who received the instructional treatments could be viewed as having been drawn randomly from populations with common variance.

Based upon the data obtained in the statistical analyses of this study, the following findings were made in regard to the design of visualized learning materials. Relative to the step size of visuals within a self-paced visualized instructional sequence, it was found that:

- Instructional treatments containing identical printed scripts and word labels, but employing different visual step sizes, were not equally effective in facilitating student achievement on certain criterion tasks.
- 2. In the immediate retention condition, those instructional treatments employing selective reduction of visual step size had an overall facilitative effect on learning as evidenced by the significant F-ratio of 4.1 (.05 level) for reduced size treatments on the total criterion test measure. On individual criterion tasks, selectively reduced visual step size treatments had a facilitative learning effect on drawing (significant F-ratio of 5.1 at a .05 level) but not on comprehension, identification, or terminology.
- 3. In the delayed retention condition, those instructional treatments employing selective reduction of visual step size had little facilitative effect on the criterion tasks. The overall learning effect present in the immediate retention condition did not occur in the delayed retention condition. Of the individual criterion tasks, only drawing appeared to be positively affected by selectively reducing visual step size.

Relative to elaborate visual cueing within a self-paced, visualized instructional sequence, it was found that:

- Instructional treatments containing identical printed scripts and word labels, but differing in degree of visual cueing elaborateness present, were equally effective in facilitating student achievement on the criterion tasks (drawing, identification, terminology, comprehension).
- No advantage was gained in a visualized instructional sequence by utilizing elaborate visual cueing.

#### References

- Berry, L. H. An Exploratory Study of the Relative Effectiveness of Realistic and Non-Realistic Color in Visual Instructional Material. Unpublished Doctoral Dissertation: The Pennsylvania State University, 1974.
- Dwyer, F. M. An Experimental Evaluation of the Relative Effectiveness of Selected Visual Illustrations in Teaching Science Concepts to College Freshmen. Unpublished Doctoral Dissertation: The Pennsylvania State University, 1965.
- ------. "Adapting Visual Illustrations for Effective Learning." <u>Harvard</u> Educational Review, 1967, 37, pp. 250-263.
- ------. "Effect of Knowledge of Objectives on Visualized Instruction." The Journal of Psychology, 1971, 77, pp. 219-221.
- ------. A Guide for Improving Visualized Instruction. State College, PA: Learning Services, Box 784, 1972.
- ------. Strategies for Improving Visual Learning. State College, PA: Learning Services, Box 784, 1978.
- Levie, W. H. and K. E. Dickie. "The Analysis and Application of Media. In R. M. W. Travers (Ed.), <u>The Second Handbook of Research on Teaching</u>. Chic Rand McNally, 1973.
- Lumsdain, A. A. "Graphic Aids, Models, and Mockups as Tools for Individual and Classroom Instruction." In G. Finch (Ed.), <u>Educational and Training</u> <u>Media: A Symposium</u>, Washington, D.C.: National Academy of Science -National Research Council, Publ. No. 789, 1960, pp. 69-113.
- Parkhurst, P. E. Assessing the Effectiveness of Self-Paced Visualized Instrution: A Multifactor Analysis on Five Different Educational Tasks. Unpubl Doctoral Dissertation: The Pennsylvania State University, 1974.
- Trabasso, T. and G. H. Bower. Attention in Learning: Theory and Research. New York: John Wiley, 1968.

## TITLE: The Instructional Effectiveness of Integrating Abstract and Realistic Visualization

60

AUTHOR: John H. Joseph Francis M. Dwyer

Matal Hon Kra

A CAR NUCLAS

CERS MARTE V
The Instructional Effectiveness of Integrating Abstract and Realistic Visualization

John H. JosephFrancis M. DwyerAssistant Provost140 Chambers BuildingThe Pennsylvania State UniversityThe Pennsylvania State UniversityThe Capitol CampusUniversity Park, PA 16802

#### A. Problem

The relative effectiveness of abstract and realistic visualization is debated in the literature and by practitioners. Various theories support both the general preference for realistic visuals and the notion that there is a limit to the useful detail in visuals. Related research suggests the possibility that integration of abstract and realistic visualization might prove effective under more general conditions with respect to the learner, content, and presentation.

The purpose of this study was to assess the instructional effectiveness of integrating abstract and realistic visualization. Independent variables were: 1) five types of visualization, including two methods of integrating abstract and realistic visualization; 2) three levels of general ability; and 3) two modes of instruction. The dependent variable was performance on a four-part criterion test, representing five different types of instructional objectives. The criterion test was administered twice, first as an immediate and again as a delayed posttest.

#### B. Rationale

The general preference for realism in educational practice is reinforced by several theorists including Dale (1946), Morris (1946) Carpenter (1953). Other research supports the notion that realistic visuals arouse interest, gain and sustain attention, or provide a rewarding condition (French, 1952; Spaulding, 1955; Dember, 1960; Yarbus, 1967; Haber, 1973; Hanes, 1973; Kahneman, 1973).

Other theorists argue that an increase in realism may not lead to increased learning and that irrelevant cues may interfere with communication (Gibson, 1954; Broadbent, 1958, 1965; Hochberg, 1962; Travers, 1964, 1970; Dwyer, 1972). Dwyer found that the type of visual illustration which was most effective for instruction was dependent upon the type of information to be communicated, whether the instruction was self-paced or externally-paced, the grade level, the level of entering behavior, and the level of general ability.

#### C. Procedure

Subjects were 490 tenth grade public school students enrolled in coeducational health classes. The subjects were stratified into high, medium and low general ability groups on the basis of their scores from the Analysis of Learning Potential test. All subjects received a general physiology pretest prior to instruction. The instructional unit and criterion tests were those developed and used by Dwyer (1972). The criteria were a drawing test with 18 items and identification, terminology and comprehension tests with 20 items each. Together these four tests constituted a total criterial test.

Half of the subjects received self-paced written instruction and half received externally-paced instruction by an audio tape recording (with visuals in booklet form). Within each of these two modes the students received one of the five treatments: instruction with simple line drawings. instruction with realistic color photographs (3X5 inches), instruction with both line drawings and color photographs, instruction with hybrid illustrations of realistic photograph and line drawing segments, and a control group with no visuals. Treatments were randomly assigned to subjects. All students received the four-part criterion test on the day immediately following the instruction and again after two weeks.

#### o. Analysis

The two methods of integrating abstract and realistic visualization were each separately compared with the control group, the realistic visualization treatment group and the abstract visualization treatment group. These separate comparisons constituted a set of contrasts in a two-by-two matrix formed by the absence or presence of realistic visualization versus the absence or presence of abstract visualizations. This analysis model was chosen in order to facilitate identification of the anticipated additive effect of integration as an interaction of two factors.

The primary analysis involved a five-factor mixed design denoted as in (A<sub>2</sub> @ B<sub>2</sub> @ C<sub>2</sub> @ D<sub>3</sub>) @ J<sub>4</sub>. Random subjects were nested in cells formed by the four factors: the realism variable, the abstraction variable, the presentation mode variable, and the general ability variable. All subjects are crossed with four levels of the dependent criterion variable. A total criterion test score which combined the other four scores were analyzed separately.

Because two methods of integrating realistic and abstract visualization were being contrasted, the entire design was analyzed twice with one oblong formed by the A and B factors being changed.

A separate analysis was used to compare the two methods of integrating abstract and realistic visualization across the pacing and general ability factors. This secondary design was denoted RS<sub>n</sub> (A<sub>2</sub>' @ B<sub>2</sub>' @ C<sub>3</sub>') @ J<sub>4</sub>'.

The library program ANOVR was used for the principal analysis of variance computations. The library program FOLUP was used for the follow-up comparisons of means after significant F tests. The Tukey Wholly Significant Difference test was specified.

#### E. Results

In the analysis of variance procedures for both the immediate and delayed posttests, the two-way interaction effects which compared the four types of visualization were non-significant. In the analyse comparing the two methods of integrating abstract and realistic visua tion the main effects of interests were similarly non-significant. Accordingly, the analyses of both the immediate and delayed posttest scores failed to reject the null hypotheses. Follow-up tests were conducted in a post-hoc investigation of other significant effects.

The specific findings of the various analyses are too numerous for inclusion here; however, several results of interest are:

- Abstract visualization tended to enhance externallypaced instruction more than self-paced instruction.
- Students who received instruction accompanied by realistic visualization achieved significantly higher scores than stude who received instruction which was not accompanied by realist visualization.
- Simultaneous use of both real and abstract visualization appears to be more effective than integration through use of the hybrid visual.
- Use of both real and abstract visuals tended to reduce the difference in performance of different ability groups on certain tests.

#### G. Discussion

The results of both posttests suggest that designers of visualized instruction may expect to enhance its effectiveness under general conditions by inclusion of realistic visualization. Inclusion of abstivisualization cannot be expected to improve effectiveness under general conditions and should be based on consideration of pacing, general ability and type of instructional objective.

Although the integration of abstract and realistic visualization does not appear to improve effectiveness generally, it may serve to enhance externally paced instruction and may reduce the difference in achievement between students of different general ability, particula when both types of visualization are presented together.

# TITLE: The Instructional Effect of Color in Immediate and Delayed Retention

AUTHOR: Richard J. Lamberski

#### THE INSTRUCTIONAL EFFECT OF COLOR IN IMMEDIATE AND DELAYED RETENTION

Richard J. Lamberski, Ph.D. Associate Professor Department of Communications Media 127 Stouffer Hall Indiana University of Pennsylvania Indiana, Pennsylvania

May 1982

Paper presented as part of a symposium at the Annual Convention of the Association for Educational Communications and Technology, Dallas, Texas.

Research and Theory Division Symposium: Relevant Cue Research - A Program of Systematic Evaluation

#### THE INSTRUCTIONAL EFFECT OF COLOR IN IMMEDIATE AND DELAYED RETENTION

Richard J. Lamberski, Ph.D. Associate Professor Indiana University of Pennsylvania

#### Problem

The purpose of the study was to assess the relative achievement effect of verhal and visual color or black/white coding strategy, when incorporated into welf-paced instruction and test materials for facilitating student retention on different cognitive tasks.

#### Perspective

Research during the instructional media era of the 1950's and 1960's was comparative in nature and sought to identify <u>device</u> usefulness rather than to identify the parameters impacting on elements of the <u>message</u>. In surveying the color literature, researchers have concluded that the significance of color as a message design variable has typically eluded researchers who have attempted to define its <u>unique</u> role rather than its possible <u>interrelated</u> role in the arguisition and retrieval process. While there is support for the affective preference for color and for the physiological and developmental influence of color, it is evident that the cognitive value of color to the learning process must be clarified further.

#### Design

Independent variables were type of presentation coding employed (color or black/white), type of evaluation coding employed (color or black/white), students' retention performance (immediate and six-week delayed), and type of criterion task represented by the testing material (drawing, identification, terminology, and comprehension test). The dependent variable was the number of correct responses on each twenty-item criterion test.

#### Hethods

One hundred seventy-six college students were randomly assigned to one of four treatment conditions: (1) color presentation with color evaluation materials; (2) color presentation with black/white evaluation materials; (3) black/white presentation with color evaluation materials; and (4) black/white presentation with black/white evaluation materials.

Materials consisted of self-paced learning booklet containing complementary simple line drawings, word labels, and prose text on the human heart. The self-paced test materials consisted of items measuring four different tasks of cognitive knowledge. Learning and test material content were identical except that in some treatment conditions a six-color code having discriminating physical form and meaningful associative value was applied to the relevant (central) verbal and visual concepts. The color code was applied orly to relevant (central) concepts and was present only for the intended learning or test task at hand. Subjects, assigned to their respective treatment conditions, received of set of instructional materials to work through, then received the evaluation materials consisting of the criterion tests. Six weeks later subjects were asked to complete the same evaluation materials.

A four-factor analysis of variance was used to test the four hypotheses. Alpha was set at .05 for all study comparisons.

#### Results

Major findings indicated that color coded self-paced presentation mater, were superior to the black/white presentation materials at both retention pol-(immediate and six-week delayed) and on all task tests (drawing, terminology, identification, and comprehension). The presence or absence of color in evaluation materials had no significant effect on student achievement.

#### Discussion

The effectiveness of the color coded instructional materials may reside their ability to demand sustained student attention and interaction with the content along with their ability to be able to provide an enhanced association memory structure. It was also found that the color coding had a more position impact on tests representing visual tasks (drawing, identification) rather the the more verbal tasks (terminology, comprehension). Also noted was the drop recall from immediate to delayed retention testing, which though statistically different, evidenced a similar percentage decline for both color coding and black/white instructional groups.

#### LITERATURE FOR FURTHER INVESTIGATION

- Lamberski, R. J. An exploratory investigation on the instructional effect of color and black and white cueing on immediate and delayed retention. Empublished master's thesis, The Pennsylvania State University, 1972.
  - Lamberski, R. J. <u>An exploratory study in maximizing retention by utilizing</u> <u>black/white and color coding in visualized instruction</u>. A paper presented at the Annual Convention of the Association for Educational Communications and Technology. Dallas, TX, 1975.
  - Lamberski, R. J., & Dwyer, F. M. The Instructional Effect of Color in Intermediate and Delayed Reaction. Journal of Instructional Psychology, 1981, 8(4), 122-131.
- Lamberski, R. J. The effect of a verbal and visual color code on self-paced instruction and testing for retention on different tasks. Unpublished doctoral dissertation, The Pennsylvania State University, 1980.
  - Lamberski, R. J. The achievement effect of a color or black/white code in learning and test materials. A paper presented at the Annual Convention of the American Educational Research Association, Boston, MA, 1980.
  - Lamberski, R. J., & Myers, B. E. <u>The efficiency of a color or black/white</u> <u>code in learning and test materials</u>. A paper presented at the Annual <u>Convention of the American Educational Research Association</u>, Boston, MA, 1980.
  - Lamberski, R. J., & Roberts, D. M. Efficiency of student's achievement using black/white and color coded learning and test materials. A paper presented at the Annual Convention of the Association for Educational Communications and Technology, New Orleans, LA, 1979.
- Limberski, R. J. <u>A comprehensive and critical review of the methodology and findings in color investigations</u>. A paper presented at the Annual Convention of the Association for Educational Communications and Technology, Denver, CO, 1980.

# TITLE: The Effect of Organizational Chunking and Retrieval Strategies in Facilitating Learning and Recall of Cognitive Learning Tasks

# AUTHOR: Susan D. McBride Francis M. Dwyer

The Effect of Organizational Chunking and Retrieval Strategies in Facilitating Learning and Recall of Cognitive Learning Tasks

Susah D. McBride Sperry Univac Blue Bell, Pa. Francis M. Dwyer The Pennsylvania State University

The purpose of this study was to investigate the effectiveness of efficiency of organizational encoding and retrieval strategies within an information-processing framework. The independent variables included organizational chunking and batched postquestions as strategies which facilitate learning and recall performance. The dependent variables consisted of a comprehension test which was chosen as an effectiveness measure because it represented a higher level instructional task and recorded time which was chosen as a efficiency measure. The problem addressed in this study directly related to the information-processing framework that looks at encoding and retrieval.

#### Statement of the Problem

Designer-produced materials offer great practical significance if an instructional designer can incorporate events that influence retention in an optimal manner. Gagne (1978, p. 637) groups the events of prose learning and retention into four phases: a) prelearning history; b) the events occurring just prior to reading, i.e., advance organizers, prequestions, objectives; c) the reading interval, i.e., imagery, inserted questions, organization; and d) a retention period that includes all events between initial learning and the retention test, i.e., postquestions, notetaking. This study, within the information-processing context, focused on manipulations within the last two phases since they parallel research in encoding and retrieval processes that affect learning from prose. Tulving (Thompson & Tulving, 1970; Tulving & Thompson, 1973) provides evidence for considering content organization as a process that encompasses both encoding and retrieval and provided a logical starting point for designing effective instruction.

The conception of verbal learning as a direct consequence of the process of organization is seen in the early work of G. A. Miller (1956). The organizational strategy of chunking that he described has been used extensively in explanations of verbal learning (McLean & Gregg, 1967). It has been suggested that better memory performance may result from the chunking of words into associative, syntactical, or other units because of the reduced memory capacity resulting from this formation of larger units (Eagle, 1967). Thus, the particular conception of organization that was utilized within this study was that of the chunking process. By manipulating this variable within a passage closely analogous to materials used in instructional settings, its effect on performance of a given outcome was observed. This encoding aid was thus the variable that occurred during the reading interval phase.

Retrieval aids appeared during what Gagne (1978) terms the fourth phase, a retention period that includes all events between initial learning and the retention test. Although much fruitful experimentation has been done with inserted questions (Frase, 1968; Rothkopf, 1970), this study viewed postquestions as a variable within the final phase rather than the reading interval phase. By placing all questions at the end of the instructional unit, the backward effect of these questions was able to be observed. As McConkie (1977, p. 25) points out, these questions "provide a review of the specific information being interrogated and greatly enhance the likelihood it will be retained on a later test". Further, by having these questions measure performance of learninoutcomes different than the higher level performance task, their effect, as well as the chunking effect, was able to be ascertained.

2

#### Summary

This study was concerned with content organization and how it affects prose learning. The encoding process entailed by organization encompass both encoding and retrieval aids as they affect the memory or storage of the information to be learned. What processes produce different patterns of posttest performance on a measure requiring integrative ability? Is it the organization that occurred du encoding, the organization facilitated by a testlike review, or is it a combination of the two effects? To answer this question organizational chunking during the encoding or reading interval and batched postquestions during the retrieval period that includes all events between initial learning and the retention test were used to determine the effectiveness and efficiency of experimenter-imposed organization utilizing these encoding and retrieval strategies.

#### Statistical Design

A two factor (between subjects) design denoted as RS in  $(A_2 \ embed{B}_2)$  was utilized in this study. Factor A: Two levels of organizational encoding, 1) organizationally chunked instructional materials and 2) conventionally ordered materials. Factor B: Two levels of organizational retrieval activities, 1) non-intervening postquestion, testlike conditions and 2) intervening postquestic testlike conditions. All subjects were given the dependent criterion variable which was the comprehension test performance measure to determine instructional effectiveness. Time with the instructional booklet, time with postquestions, and time with performance measure were recorded to aid in determining instructional efficiency.

Consistent with the ideas of instructional psychology that suggest the value of particular types of acquisition activities being defined relative to the testing context (Bransford, 1979), this study focused on one particular criterion test of interest: the comprehension test. Dwyer (1978) indicated that the type of learning that this evaluation instrument was meant to measure was a higher level cognitive task, requiring a thorough understanding of the heart, its parts, its internal functionings, and the simultaneous processes occurring during the systolic and diastolic phases. Consisting of 20 multipler choice items, the test gave the location of certain parts at a particular moment of its functioning and required the subject to locate the position of other specified parts of the heart (Dwyer, 1972). Thus, this task clearly requires the subject to integrate information. Therefore, this measure served as the dependent variable since it represents the kind of complex task of interest for this particular study.

The first independent variable consisted of two treatments; the modified, experimental treatment and the original, control treatment. The second independent factor in this design was interveing versus non-intervening postquestions test trials. Two of the original criterion tests were used, identification and terminology. Requiring learners to identify the numbered parts on a detailed drawing of the heart, the 20-item multiple-choice identification test measured the learner's ability to use visual cues to discriminate one structure of the heart from another and to associate specific parts of the heart with their proper name.

One of four treatments was randomly assigned as the 112 university volunteers appeared individually for their experimental session, resulting in a n=28 for each group. Each experimental treatment required that the subjects interact with an instructional booklet describing the parts and the functioning of the heart. Two of the groups received a booklet wherein the content had been chunked in terms of the functioning of the heart. Two other groups received a more conventional step-by-step linear booklet. One chunked group and one conventional group then received intervening batched postquestions during a retrieval interval before taking the comprehension test performance measure. The other groups had a non-intervening treatment and took the comprehension test performance measure immediately upon completion of the booklet. Separate times were recorded for 1) time with booklet, 2) time with postquestions, and 3) time with performance measures.

Eleven hypotheses were tested using a computerized two-way analysis of variance (ANOVES) program. Null hypotheses were rejected if an F-ratio with a p value of .05 or less was obtained. In addition to the analysis of the dependent measures, calculated efficiency scores were also analyzed to further determine the relative efficiency of the four experimental treatments. Comparisons were likewise made on differing learning outcomes as measured by the two types of postquestions.

#### Summary of Major Findings of Interest

The major findings of this study support the conclusion of Faw and Waller (1976) and McConkie (1977) that time is a significant variable to consider in instructional research. First, it was shown that the chunked treatment was more efficient in terms of instructional time spent with the booklet than the conventional treatment. Further, when efficiency scores were computed, it was demonstrated that the chunked treatment resulted in better performance on the comprehension test per unit of time spent with the instructional booklet than the conventional treatment. It was inferred from these differences that the chunked treatment resulted in a more efficient strategy for processing information and hence a different structural representation in memory of the information (Mayer, 1976; Mayer, 1978; Mayer & Greeno, 1972). The implication of this result for instructional designers is an important one, for it gives evidence to Glaser's (1976) contention that the designers may be in a position to optimize instruction by designing it in such a way that it approximates the most efficient method. Thus, organizational strategies improving information processing clearly occur at encoding, appear to affect memory storage, and can be built into the instruction.

In addition, this study also provided some insight into the significance of the organizational processes for retrieval (Postman, 1972). The intervening postquestions strategy did result in subjects taking less time on the performance measure than those not taking the postquestions (non-intervening group).

3

This increasing rate of retrieval is seen as support for the contention of Wortman and Greenberg (1971) and Buschke (1976) that storage becomes more efficient over time as a result of the mental review provided by the postquestions. This shows, once again, that time is a variable that must be seriously considered for optimizing learning within the information-processing framework.

Major findings indicated that the chunked treatment resulted in a more efficient learning strategy than the conventional treatment. The chunked and conventional treatments did not, however, appear to produce different learning outcomes as measured by the postquestion identification and terminology testlike trials. Nor, at least for the comprehension test performance measure, did noe encoding strategy result in more effectiveness than the other. The intervening versus the non-intervening postquestion retrieval strategy did not result in a performance difference on the comprehension test. There was, though, an interesting efficiency effect. By receiving the intervening postquestion strategy, subjects took significantly less time completing the performance measure than those subjects who received the non-intervening postquestion treatment.

#### References

- Bransford, J. D. Human cognition learning understanding and remembering. Belmont, California: Wadsworth Publishing Company, 1979.
- Buschke, H. Learning is organized by chunking. Journal of Verbal Learning and Verbal Behavior, 1976, 15, 313-324.
- Dwyer, F. M. <u>A guide for improving visualized instruction</u>. State College, Pennsylvania: Learning Services, 1972.
- Dwyer, F. M. <u>Strategies for improving visual learning</u>. State College, Pennsylvania: Learning Services, 1978.
- Eagle, M. N. The effect of learning strategies upon free recall. American Journal of Psychology, 1967, 80, 421-425.
- Faw, H. W., & Waller, T. G. Mathemagenic behaviors and efficiency in learning from prose materials: review, critique and recommendations. <u>Review of</u> Educational Research, 1976, 46, 691-720.
- Frase, L. T. Some data concerning the mathemagenic hypothesis. American Educational Research Journal, 1968, 5, 181-189.
- Gagne, E. D. Long-term retention of information following learning from prose. Review of Educational Research, 1978, 48, 692-665.
- Glaser, R. Cognition psychology and instructional design. In D. Klahr (Ed.), <u>Cognition and instruction</u>. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1976.
- Mayer, R. E. Comprehension as affected by structure of problem representation. Memory and Cognition, 1976, 4, 249-255.

- Mayer, R. E. Effects of prior testlike events and meaningfulness of information on numeric and comparative reasoning. Journal of Educational Psychology, 1978, 70, 29-38,
- Mayer, R. E., & Greeno, J. G. Structural differences between outcomes produced by different instructional methods. Journal of Educational Psychology, 1972, 63, 165-173.
- McConkie, G. W. Learning from text. <u>Review of Research in Education</u>, 1977, 5, 3-48.
- HcLean, R. S., & Gregg, L. W. Effects of induced chunking on temporal aspects of serial recitation. <u>Journal of Experimental Psychology</u>, 1967, <u>74</u>, 455-459.
- Hiller, G. A. The magical number seven, plus or minus two: some limitations on our capacity for processing information. <u>Psychological Review</u>, 1956, 63, 81-97.
- Postman, L. A pragmatic view of organization theory. In E. Tulving & W. Donaldson (Eds.), <u>Organization of memory</u>. New York: Academic Press, 1972.
- Rothkopf, E. Z. The concept of mathemagenic activities. <u>Review of Educational</u> Research, 1970, 40, 325-335.
- Thomson, D. M., & Tulving, E. Associative encoding and retrieval: weak and strong cues. Journal of Experimental Psychology, 1970, 86, 255-262.
- Tulving, E., & Thomson, D. M. Encoding specificity and retrieval processes in episodic memory. Psychological Review, 1973, 80, 352-373.

BARIS A

Wortman, P. M., & Greenberg, L. D. Coding, recording, and decoding of hierarchical information in long-term memory. <u>Journal of Verbal Learning</u> and Verbal Behavior, 1971, 10, 234-243. TITLE: Eye Movement as an Index of Learning AUTHOR: Larry L. Nesbit Eye Movement As An Index of Learning

Larry L. Nesbit Retan Center Library Mansfield State College Mansfield, PA 16933

Within the past few years eye movement indicies, i.e., the number of fixations and their average duration, have been used as a measure of cognitive processing. Loftus (1972) found that the number of fixations made by a subject while initially viewing a picture was the best indicator of subsequent picture recognition. Gould's (1973) research indicates that the fixation duration is reflective of cognitive processes while viewing stimuli of varying complexity. Perhaps Wolf (1970) most succinctly states the case of using eye movements as an index of learning:

Eye movements present an unusual opportunity for finding out the reactions of viewers to a visual stimulus. They give information on where the subject is looking, how long he looks at particular objects and the type of movements he makes...This reaction is different from giving the subject a printed test or asking him in an interview what he has learned from the stimulus. (p. 13)

According to earlier research, there are two factors that may influence the looking behavior of subjects: the stimulus materials themselves and the intelligence level of the viewer. The areas that have received the most attention from researchers are those of complexity and novelty. Fav and Nunnally (1967, 1968), Mackworth and Morandi (1967), Hochberg and Brooks (1978), and Zusne and Michels (1964) found that the more complex stimulus drew more eye fixations than the simpler stimulus materials. However, Wolf (1970) qualified the complexity issue because he found that the more sophisticated stimulus materials attract more eye fixations, but only up to a point. When the stimulus becomes extremely complex, the subject may tend to avoid the stimuli or to fixate centrally.

Just as the complexity issue is clouded with contradictory findings, so are the results of picture recall tests. It was mentioned earlier that Loftus (1972) found that recall is positively related to the number of times a subject fixated a picture. Tversky (1974), however, found different results. In her study, subjects who fixated the stimulus material fewer times had the highest recall on later memory tasks. The two studies did differ in the type of stimulus materials employed: Loftus used photographs and Tversky used simple line drawings.

According to some previous research, it is the viewers' intelligence levels -- not the stimulus materials -- which influence how viewers look at the stimulus material. Anderson (1937), Guba, Wolf, deGroot, Knemeyer, Van Atta, and Light (1964), and Wolf (1970) have all completed research in which a correlation between eye fixations and intelligence was evidenced. It should be emphasized, however, that some of these studies had confounding problems.

The following hypotheses were explored in this study:

Subjects who have a greater number of eye fixations will have higher scores on the posttest than students who have fewer fixations.

- Subjects who view the stimulus materials composed of shaded line drawings will have more eye fixations than subjects who view either the simple line drawings or the realistic photographic representations.
- Subjects who are in varying categories of intelligence will have different numbers of eye fixations.

The experimental design of the study was the posttest only controltreatment groups but the subjects were not randomly assigned to either of the groups because of geographical limitations. The treatment subjects (N = 46) were students enrolled at Harford Community College, Harford MD which is in close proximity to the Human Engineering Laboratory, Aberdeen Proving Ground, MD where the advanced, unobtrusive oculometer is located which was utilized in the study. The control subjects were all enrolled at Mansfield State College, Mansfield, PA and this is where the investigator is employed.

The treatment subjects were administered the physiology pretest and the mental ability test before they were individually shown one of the treatment conditions, i.e., simple line drawings, shaded drawings, or realistic photographs. Immediately after viewing the treatment slides, the subject was taken to another room and administered the posttest. All tests were administered to the control subjects in the same sequence as the treatment subjects.

As alluded to earlier, the study was conducted at the Human Engineering Laboratory, Aberdeen Proving Ground, Maryland because they maintain an advanced oculometer which has the capability of tracking the eye movements of a subject unobtrusively. For a more complete description of the oculometer, the reader is referred to an article published by Monty (1975).

Four statistical tests were utilized in the study to analyze the data. A t test was used to compare the pretest and posttest scores of the treatment and control subjects and there was no difference on the pretest, i.e., t (89) = 1.64, p = .104, but there was on the posttest, i.e., t (68) = -12.7, p = .001. To test for any relationship between eye fixations and posttest scores, the Product Moment Coefficient was used. The overall relationship between eye fixations and the posttest score was r = .2467, p = .049. Three additional Pearson r's were computed for each sequence of 13 slides of the total of 39 slides to determine if the relationship varied during the treatment and they are .1834, p = .111; .1948, p = .097; and .3040, p = .020 respectively.

To determine if eye fixations are influenced by either the type of visuals viewed or the intelligence of the viewer, two-way analysis of variance was employed. The effect of the type of treatment was not significant, F (2,57) = 1.73, p = .192, but the intelligence level of the subject did influence the average number of fixations and was significant, F (2,37) = 3.89, p = .029.

Finally, two-way analysis of variance with repeated measures was used to determine if fluctuations in the eye fixation data could skew the data.

-2-

Again, it was found that the treatment was not significant F (2,37) = 1.73, p = .191, but intelligence level was significant F (2,37) = 3.88, p = .030. In addition, the mean number of fixations did vary throughout the treatment, F (2,74) = 58.74, p = .001, but neither the interaction of treatment type and slide group, F (4,74) = .68, p = .610, or intelligence level and slide group, F (4,74) = .41, p = .799, were significant using the repeated measures test.

#### Conclusion

The present study supports previous findings that: (1) there is a relationship between the number of eye fixations and internal cognitive activity, (2) novelty is an important factor in viewing visuals, and (3) the intelligence level of the subject influences the number of eye fixations. The study did not give evidence that the level of picture complexity will influence the number of eye fixations.

#### Discussion

The present study was designed to determine if a relationship exists between cognitive activity, i.e., posttest scores and the number of fixations. Past research has indicated that there is a positive correlation between learning and the number of eye fixations. The present study confirmed this relationship using an unobtrusive eye movement measuring system.

The second objective of the study was to determine if eye movement is a stimulus or a personalogical variable. The present study did provide evidence that it is personalogical: Subjects in the highest category of intelligence had a significantly higher number of fixations than did subjects in the lowest category of intelligence. This finding supports previous research.

The investigator did not find a relationship between the type of visuals viewed and eye movements. This result is similar to Barron's (1980) work because neither study found any evidence that the stimulus materials influenced eye movements. It should be noted, however, that the findings of the present study were both internally consistent and supportive of the research of Loftus (1972, 1976), i.e., no difference in eye movements should be expected because there was no significant difference in learning. Thus, additional research needs to be completed in order to learn whether, and how, different types of visuals influence eye movement. For instance, Fleming (1978) has listed many perception principles which are based on previous research, but not on eye movement studies. It would be interesting to construct visuals which incorporate the principles outlined by Fleming to determine if eye movement research will support the previously reported findings. Since eye movement indices are more item specific than other summary measures such as posttests, the results of the proposed research may enable researchers to refine the principles presented by Fleming through the use of current technology such as the HEL Oculometer. This latter type of information, if available, would be instrumental in providing guidance in the design, development,

and use of visual materials in the learning process because researchers (Baron, 1980; Rayner, 1978; Wolf, 1970; Yarbus, 1967) have concluded eye movements are an objective measure of cognitive activity.

#### References

- Anderson, I. Studies in the eye movements of good and poor readers. Psychological Monographs, 1937, 48, 1-35.
- Baron, L. Interaction between television and child-related characteristics as demonstrated by eye movement research. <u>Educational Communication</u> and Technology Journal, 1980, 28, 267-281.
- Faw T., & Nunnally, J. The effects on eye movements of complexity, novelty, and affective tone. Perception and Psychophysics, 1967, 2, 263-267.
- Faw. T., & Nunnally, J. The influence of stimulus complexity, novelty, and affective value on children's visual fixation. <u>Journal of Experimental</u> Child Psychology, 1968, 6, 141-153.
- Fleming, M., & Levie, W. Instructional messages design: principles from the behavioral sciences. Englewood Cliffs, N.J.: Educational Technology Publications, 1978.
- Gould, J. Eye movement during visual search and memory search. Journal of Experimental Psychology, 1973, 98, 184-195.
- Guba, E., Wolf, W., deGroot, S., Knemeyer, M., Van Atta, R., & Light, L. Eye movements and TV viewing in children. <u>Audiovisual Communication</u> Peview, 1964, 12, 386-401.
- Hochberg, J., & Brooks, V. Film cutting and visual momentum. In J. Senders, D. Fisher, & R. Monty (Eds.), Eye movements and the higher psychological functions. New York: Erlbaum, 1978.
- Loftus, G. Eye fixations and recognition memory for pictures. <u>Cognitive</u> <u>Psychology</u>, 1972,3, 525-555.
- Loftus, G. A framework for a theory of picture recognition. In R. Monty & J. Senders (Eds.), Eye movements and psychological processes. New York: Erlbaum, 1976.
- Mackworth, N., & Morandi, A. The gaze selects information details within pictures. <u>Perception and Psychophysics</u>, 1967, 2, 547-551.
- Monty, R. Advanced eye movement measuring and recording systems. <u>American</u> Psychologist, 1975, <u>30</u>, 331-335.
- Rayner, K. Eye movements in reading and information processing. <u>Psychological</u> <u>Bulletin</u>, 1978, <u>85</u>, 618-660.
- Tversky B. Eye fixations in prediction of recognition and recall. Memory & Cognition, 1974, 2, 275-278.

Wolf, W. <u>A study of eye movement in television viewing</u>, <u>Final report</u>. Columbus: Ohio State University, 1970. (ERIC Reproduction Service No. ED 046 254)

Yarbus, A. Eye movements and vision. New York: Plenum Press, 1967.

Zusne, L., & Michels, K. Nonrepresentational shapes and eye movements. Perceptual and Motor Skills, 1964, 18, 11-20.

# TITLE: Level Of Reading Comprehension And Achievement With Visualized Instruction AUTHOR: Perrin E. Parkhurst

#### LEVEL OF READING COMPREHENSION AND ACHIEVEMENT WITH VISUALIZED INSTRUCTION

Perrin E. Parkhurst, Ph.D. Coordinator, Research and Advanced Study College of Osteopathic Medicine Michigan State University East Lansing, MI 48824

#### PROBLEM

The increased demand for self-paced courseware, applicable to diverse audiences, has presented many problems for instructional designers. The problem investigated in this study centered around defining guidelines for instructional materials designers, to use when developing courseware that uses visuals in a self-paced format. More specifically, the following four research questions were addressed:

- Is the same degree of realism in visuals, accompanying self paced text materials equally effective in facilitating achievement, when students differ in level of reading comprehension?
- Are different media presentation strategies equally effective in facilitating achievement for students who differ in level of reading comprehension?
- 3. Is achievement on a particular educational task facilitated either by degree of realism in visuals or a media presentation format, for students who differ in level of reading comprehension?

#### RELATED LITERATURE

#### Overview:

Little is known about the processes used by individual learners as instructional information is being internalized and "learned." Three theoretical frameworks provide the basis for this study of individual differences: the "realism researchers," the "sense modalities" studies, and the "text organizational format" studies.

#### Realism Continuum:

This study has as one theoretical framework, the works of the "realism researchers," Dale (1946), Morris (1946), Carpenter (1953), and Gibson (1954). In brief, their thesis was that as instructional materials became more realistic, they tend to be more effective. Travers (1967) (1970) and Dwyer (1967) (1972) found evidence suggesting that this generalization does not hold for all levels of educational tasks. Expanding on that research, Goldberg (1974), Levin <u>et al</u>. (1974), and Peeck (1974), have studied such phenomena as: the effect of imagery on learning incidental material; individual differences in learning from pictures and words; and retention of pictorial and verbal content.

#### Single and Multiple Channel Presentation

Research into sense modalities and the human's ability to process information received via several channels provided another theoretical framework. Evidence by Broadbent (1958) (1965), Miller (1956), and Hartman (1961) indicate that humans are basically limited channel process beings. That is they are unable to filter, process, and store information presented via multiple sense modalities.

"Simultaneous audiovisual presentation of words (with visuals) is not superior to learning from print alone, but when pictures are presented in the visual channel more learning <u>may</u> (emphasis added) result from audiovisual presentations under certain conditions which are not fully defined or understood" (Travers, 1973, p. 87

#### Text Material Presentation Strategies

Self-paced mediated strategies can take many forms; for example, filmstrips with and without adjunct questions, programmed booklets, variable speed audio tape playback units, computer assisted instruction with infinite branching capabilities, and many others. The work done in the area of presenting questions with text material by Rothkopf (1965) (1970), Frase (1968a) (1968b), Anderson (1970), Boker (1974), Shavelson <u>et al</u>. (1974), and Koran and Koran (1975) weighed heavily in the decision to use the "method of presentation" format described as Factor "A" in the next section.

Generally their work may be summarized by saying that,

- Retention increases with an increase in the frequency of postquestions; that is, questions inserted shortly after the instructional information.
- An increased frequency of postquestions facilitates both relevant and incidental learning.
- 3. Very specific questions are more effective than general questions.

This study then was an attempt to (1) assist in resolving the dilemma of the realism researchers and (2) provide specific presentational guidelines for instructional designers contemplating a self-paced format.

#### PROCEDURE

#### Design:

A three factor multivariate analysis of variance was used, with five levels of a repeated measure.

#### Independent Variables

Factor A was the "media presentation" variable. There were three levels: (1) programmed booklets with periodic review questions and answers after approximately every 10 frames; (2) same as #1 with additional questions and answers after each frame; and (3) same as #2 with printed instructional material simultaneously presented on audiotape. Factor B was the "visual realism" variable. There were four levels: (1) no visuals; (2) line drawings; (3) detailed shaded drawings; and (4) realistic pictures of the object.

-3-

Factor C was the "individual difference" variable (level of reading comprehension). There were three levels: (1) high; (2) medium; and (3) low.

### Dependent Variables:

The five levels of the dependent variable (achievement) were: (1) a drawing test; (2) an identification test; (3) a terminology test; (4) a comprehension test; and (5) a total score (above four tests combined). All scores were standardized to a "T" score prior to data analysis.

#### SUBJECTS

Students (n = 332; 250 females and 82 males) were given the 1973 Iowa Silent Reading Test and then randomly assigned to treatment groups of Factor A and B. After the Iowa Silent Reading Test was scored, a <u>post hoc</u> randomization procedure was used on the individual difference variable (reading comprehension portion of the test). Reading comprehension was selected as the individual difference variable of interest, because it was believed to be the element of I.Q. most closely related to other factors under study. Cells were adjusted to attain proportionality and a multivariate analysis of variance was conducted, both on an immediate posttest and a four week delayed posttest.

#### ANALYSIS

According to Lindquist (1953), Kirk (1963), and Games (1971), the generally accepted procedure to follow for four factor multivariate analysis is to first test the four-way interaction, using an F test. If significant, do follow-up tests on the four factor interaction, report the results and stop. If nonsignificant, test the three-way interactions, using an F test. If significant, do follow-up T tests on the three factor interaction (averaged over the non interacting factor), report the results and stop. The procedure continues with the same rationale for the two factor interaction and main effects.

#### RESULTS

On the immediate posttest analysis of variance, there was a significant three-way (reading comprehension, visual realism, achievement) interaction (p <.05). On the delayed posttest analysis of variance, there was a significant three-way (reading comprehension, method of presentation, achievement) interaction (p <.01). Follow up tests were conducted on those significant interactions only.

#### Immediate Posttest

Any assumption by instructional materials designers that there are no differences in achievement on different educational tasks among students who differ in levels of reading comprehension and instructional treatments using visuals varying in degree of realism is not supported by the results of this study. Furthermore, the use of visualization did not automatically result in improved achievement on different educational tasks for students who differed in level of reading comprehension.

#### Delayed Posttest

The results of this study do not support any assumption by instructional materials designers that there are no differences in achievement on different educational tasks among students who differ in level of reading comprehension and method of self-paced instruction received. That is, for students who differed in level of reading comprehension, the cumulative effect of adding information channels (redundancy of presentation stimulus and feedback) either facilitated or inhibited achievement depending on the educational tasks involved.

#### CONCLUSIONS

#### Immediate Posttest

- Not all visuals were equally effective in facilitating student achievement on different educational tasks.
- Not all students who differed on level of reading comprehension achieved at an equal level of performance on identical criterion measures when different visuals were available.
- On most of the educational tasks, the simple or less realistic visuals reduced the overall significant differences in achievement between the high, medium, and low level of reading comprehension.
- The high level reading comprehension group achieved their lowest performance on all educational tasks when they received line drawings.
- The high level reading comprehension group's achievement improved as the degree of realism in visuals increased from line drawings to details shaded drawings to realistic model.
- The low level comprehension group's achievement decreased as the degree of realism in visuals increased from no visuals to realistic model.
- The pattern of student achievement for the medium level reading comprehension group was inconsistent and irregular on each of the education tasks as the amount of visual realism increased from no visuals to realise model.

## Delayed Posttest

- Not all methods of presenting instructional information were equally effective in facilitating student achievement on different educational tasks.
- The use of questions and answers as a method of presentation factor, to focus student attention on relevant information, is an effective way to facilitate retention of that information for the low level reading comprehension group.
- The added dimension of audiotape as a supplement to printed instruction does not automatically improve the effectiveness of that instruction for students who differ on level of reading comprehension.
- 4. Not all students who differed on level of reading comprehension achieved at an equal level of performance on identical criterion measures when different methods of presenting instructional information were used.
- 5. On all educational tasks except that measured by the comprehension test, the method of presentation consisting of review questions and answers periodically, plus questions and answers after each frame (A<sub>2</sub>) reduced the existing significant differences between the three levels of reading comprehension.
- 6. Students at the low level of reading comprehension improved moderately, although not significantly, on all of the educational tasks when the method of presentation contained the added stimulus of questions and answers after each frame (as compared to review questions and answers periodically.
- Students in the high level reading comprehension group improved their performance as each method of presentation cue was added to the previous one.
- 8. The pattern of student achievement for the medium level of reading comprehension group differed significantly from the high group only when the added stimulus of audiotape was presented. This significance occurred only on the drawing and identification tests and is attributed to the high level group's increase in student achievement, contrasted with the medium level group's decrease in student achievement.

#### FURTHER RESEARCH TOPICS

The findings of this study raise several questions and possible research topics which must be answered before any theory of instruction may be advanced.

- Is it possible to measure the degree or extent to which students actually interact with a visual when it is present in visualized instruction?
- 2. Would postquestions which require a visual response rather than a printed response facilitate achievement on different kinds of educational tasks?
- 3. Is it possible to measure the amount of information which is actually extracted from a visual stimulus accompanying printed instruction?
- Do further extremes on the selected individual difference variable;
  e.g., higher highs and lower lows, produce any different results?

- 5. Is it possible to devise an instructional unit which <u>requires</u> students to interact with visuals?
- 6. When instructional content is presented via audiotape, is there any difference between the presence or absence of a) identical printed narrative and/or b) visuals which differ in degree of realism?
- Are there other individual difference variables which would produce stronger interactions or more easily interpretable results?
- 8. It is strongly recommended that research be conducted which attempts to increase the construct validity of identifying such individual difference variables as high visual imagers, low visual imagers, high auditory attenders, and low auditory attenders, etc. That is, place added emphasis on identifying, validating, and implementing the variables which will facilitate an understanding of the information gathering <u>processes</u> which human beings use when they interact with visualized material.

This exploratory study of the effectiveness of self-paced visualized instruction has demonstrated that individuals achieve at a different level of performance depending on (1) the method of presenting instructional content, (2) the type of visuals accompanying printed instruction, and (3) the level of reading comprehension. Further studies of the kind suggested are necessary before detailed guidelines for developing self-paced visualized instruction may be set forth.

#### REFERENCES

- Boker, J.R. Immediate and Delayed Retention Effects of Interspersing Questions in Written Instructional Passages. <u>Journal of Educational Psyhcology</u>, 1974, 66:1, 96-98.
- Broadbent, D.E. Perception and Communication. New York: Pergamon Press, 1958.
- Broadbent, D.E. Information Processing in the Nervous System. <u>Science</u>, 1965, 3695, 457-462.
- Carpenter, C.R. A Theoretical Orientation for Instructional Film Research. AV Communication Review, 1953, 1, 38-52.
- Dale, E. Audio-Visual Methods in Teaching. New York: Dryden Press, 1946.
- Dwyer, F.M. Adapting Visual Illustrations for Effective Learning. <u>Harvard</u> Educational Review, 1967, 37, 250-263.
- Dwyer, F.M. <u>A Guide for Improving Visualized Instruction</u>. State College: Learning Services, 1972.
- Frase, L.T. Effect of Question Location, Pacing, and Mode Upon Retention of Prose Material. Journal of Educational Psychology, 1968a, 59, 244-249.
- Frase, L.T. Some Data Concerning the Mathemagenic Hypothesis. American Educational Research Journal, 1968b, 5, 181-189.
- Games, P.A. Multiple Comparisons on Means. <u>American Educational Research</u> Journal, 1971, 8, 531-565.
- Gibson, J.J. A Theory of Pictorial Perception. <u>AV Communication Review</u>, 1954, 2, 2-23.
- Goldberg, F. Effects of Imagery on Learning Incidental Material in the Classroom. Journal of Educational Psychology, 1974, 66:2, 233-237.
- Hartman, F.R. Single and Multiple Channel Communication: A Review of Research and a Proposed Model. AV Communication Review, 1961, 9, 24-43.
- Kirk, R.E. <u>Experimental Design for Behavioral Sciences</u>. Belmont, Calif.: Brooks Cole, 1968.
- Koran, M.L. and Koran, J.J. Interaction of Learner Aptitudes with Question Pacing in Learning from Prose. <u>Journal of Educational Psychology</u>, 1975, <u>67:1</u>, 76-82.
- Levin, J.R., Divine-Hawkins, P., Kerst, S.M., and Guttman, J. Individual Differences in Learning from Pictures and Words: The Development and Application of an Instrument. Journal of Educational Psychology, 1974, 66:3, 296-303.

- Lindquist, E.G. Design and Analysis of Experiments in Psychology and Education Boston: Houghton Mifflin, 1953.
- Miller, G.A. The Magical Number Seven, Plus or Minus Two; Some Limitations on our Capacity for Processing Information. <u>Psychological Review</u>, 1956, 63, 81-97.

Morris, C.W. Signs, Language and Behavior. New York: Prentice-Hall, 1946.

- Peeck, J. Retention of Pictorial and Verbal Content of a Text with Illustration Journal of Educational Psychology, 1974, 66:6, 880-888.
- Rothkopf, E.Z. Some Theoretical and Experimental Approaches to Problems in Written Instruction. In J.D. Krumboltz (Ed.) <u>Learning and the Educational</u> Process. Chicago: Rand McNally, 1965, pp. 193-221.
- Rothkopf, E.Z. The Concept of Mathemagenic Activities. <u>Review of Educational</u> Research, 1970, 40, 325-336.
- Shavelson, R.J., Berliner, D.C., Ravitch, M.M., and Loading, D. Effects of Position and Type of Question on Learning from Prose Material; Interaction of Treatments with Individual Differences. <u>Journal of Educational Psycholc</u> 1974, 66:1, 40-48.
- Travers, R.M.W. <u>Research and Theory Related to Audio-Visual Information</u> <u>Transmission</u>. (Rev. ed.) USOE, Contract No. 3-20-003. Washington, D.C.: U.S. Department of Health, Education, and Welfare, Office of Education, 1967.
- Travers, R.M.W. <u>Man's Information System</u>. Scranton: Chandler Publishing Company, 1970.
- Travers, R.M.W. Second Handbook of Research on Teaching. The American Educational Research Association. Chicago: Rand McNally, 1973.

TITLE: The General Impact of the Dwyer Materials on the Acquisition and Retention of Information About the Heart

AUTHOR: Dennis M. Roberts

The General Impact of the Dwyer Materials on the Acquisition and Retention of Information About the Heart

Dennis M. Roberts

Division of Counseling and Educational Psychology

The Pennsylvania State University

May 1982

Paper presented as part of a symposium at the annual meeting of the Association for Educational and Communications Technology in Dallas, TX.

#### Introduction

Of all the investigations that have been completed using Dwyer's (1967) materials on the heart, no one has asked the simple question "How effective are the materials for facilitating the acquisition and retention of information and concepts related to the heart?" Certainly, the focus in most of these investigations has been on the manipulation of stimulus dimensions (step size, type of coding, degree of stimulus reality, etc.) and I have no quarrel with that emphasis. However, the extent to which readers can interact with the materials and gain useful information about the heart will - to a certain extent - determine whether stimulus manipulation studies will provide any meaningful results. For example, if students gain nothing or gain everything by working through the materials, then it would be difficult to expect external stimulus gyrations to have any impact. However, if the materials provide some middle ground for gaining information, the manipulation of stimulus dimensions may provide insights into how to improve instruction and hence, strategies for learning. Thus, the basic and simple question addressed in this paper is: "How well do the heart materials work under normal research conditions?"

#### Data Base

Only one investigator (Lamberski, 1980) has presented pretest data on the criterion tests used with the heart material although that data were used for different purposes. Data came from a pilot study done a term before the main study was completed. Data were considered to be comparable to what would have been found in the main investigation because scores on a physiology pretest (given in both pilot and main studies) were not significantly different. In fact, the means were nearly identical, 22.00 versus 22.03. Data on test performance after having interacted with the material came also from Lamberski (1980) who examined effects of color coding, Jennings (1979) who studied the elaborateness of cues and step size, and Parkhurst (1974) who examined the self pacing nature of the materials. All studies were conducted with college level students, gave the criterion tests immediately after the materials were completed, and finally gave a delayed retention test with the criterion measures after a reasonable length of time (4 to 6 weeks). These similarities in the studies were considered desirable for meaningful comparisons to be made.

. 92

#### Results and Discussion

-2-

Table 1 presents descriptive data for the pretests, immediate tests, and delayed retention tests from the three studies. Four points are worth mentioning. First, there is a large difference between the pretest values and the immediate test values. Since criterion tests had approximately 20 items, it also means that the instructional materials were not maximally effective. Second, groups showed substantial loss from the immediate testing to the delayed retention testing. Third, even at the delayed testing though, performance was substantially better than at the pretest. And fourth, data across the three studies are quite similar.

Table 2 presents similar data with values averaged (weighted) across the three studies. In addition, the immediate gain, the delayed gain and the loss are also indicated. On the average, students almost doubled performance from the pretest value and lost about 40 percent of that after four to six weeks. Table 3 presents the results of some significance tests performed on some of the data from Table 2. The first and third columns present t values comparing the difference between pretest and delayed test scores (delayed gain) and between immediate test and delayed test scores (loss). All differences were highly significant. However, due to the fact that some comparisons had very large sample sizes, the denominators in the t tests tended to be very small. To test the same differences under more reasonable sample size conditions, all sample sizes were assumed to be equal to 27, the same as was for the pretest data. These recomputed t values appear in second and fourth (adjusted) columns. Although the t values drop tremendously due to increased error terms, all but one comparison are still significant. The conclusion therefore is that while there was a significant amount of loss over the four to six weeks until the delayed test, delayed test performance was still better than pretest performance which represents scores on the tests without benefit of the heart materials. Considering the fact that the average time spent on interacting with the heart materials was approximately 15 minutes (from Jennings, 14.18; from Lamberski, 16.43), the initial gain and delayed retention seems reasonable evidence that the heart instructional booklets are effective learning materials, especially under experimental conditions in which they have been used.

#### References

- Dwyer, F. M. An experimental evaluation of the relative effectiveness of selected visual illustrations in teaching science concepts to college freshmen. Unpublished doctoral dissertation. The Pennsylvania State University, 1965.
- Jennings, T. J. The effectiveness of elaborate visual cueing and reduced step size in facilitating student achievement on different instructional tasks. Unpublished doctoral dissertation. The Pennsylvania State University, 1979.
- Lamberski. R. J. The effect of a verbal and visual color code on self-paced instruction and testing for retention in different tasks. Unpublished doctoral dissertation. The Pennsylvania State University, 1980.
- Parkhurst, P. G. Assessing the effectiveness of self-paced visualized instruction: A multifactor analysis on five different educational tasks. Unpublished doctoral dissertation. The Pennsylvania State University, 1974.

## Table 1

# Descriptive Data for Criterion Tests Across Three Separate Studies

Criterion Test	Statistic	Pretest Lamberski (N=27)	Immediate Retention			Delayed Retention		
			Jennings (N=92)	Lamberski (N=176)	Parkhurst (N=332)	Jennings (N=92)	Lamberski (N=176)	Parkhurst (N=301)
awing	x	3.74	13.96	14.09	10.36	9.51	9.09	8.60
	σ	3.44	3.82	4.66	4.48	4.51	4.56	4.32
antification	x	7.48	15.18	15.91	13.21	10.95	12.39	11.24
	σ	3.37	3.96	3.64	4.78	4.07	4.18	4.38
rminology	x	7.52	13.47	13.29	13.19	9.92	9.96	10.82
	σ	3.36	4.02	4.18	4.21	4.25	4.07	4.02
prehension	x	6.56	12.01	12.75	11.53	9.61	10.28	9.86
	σ	1.99	3.77	4.28	3.84	3.16	3.93	3.64

## Table 2

# Comparison Between Pretest Data and Combined Studies for Immediate and Delayed Retention

riterion Test	Statistic	Pretest (N=27)	Immediate Retention (N=600)	Delayed Retention (N=569)	Immediate Gain (IG-P)	Delayed Gain (DR-P)	Loss (IG-DG)	
rawing	x	3.74	12.01	8.90	8.27	5.16	3.11	
	σ	3.44	4.81	4.44				
dentification	x	7.48	14.30	11.55	6.82	4.07	2.75	-
	σ	3.37	4.53	4.31				
erminology	x	7.52	13.26	10.41	5.74	2.89	2.85	
	σ	3.36	4.18	4.12				
Comprehension	x	6.56	11.96	9.95	5.40	3.39	2.01	1
	σ	1.99	4.00	3.67				
ummary	x	6.33	12.88	10.20	6.56	3.88	2.68	

.
## Table 3

Statistical Comparisons (t tests)

Due to Learning Materials

Criterion Test	DR-PRE (actual)	DR-PRE (adjusted)	Loss (actual)	Loss (adjusted		
 Drawing	7.500	4.773	11.519	2.4681		
Identification	6.048	3.865	10.618	2.2861		
Terminology	4.320	2.825	11.728	2.5221		
Comprehension	8.208	4.222	13.052	1.923 <sup>2</sup>		

<sup>1</sup> p < .05 <sup>2</sup> ns

all other t values p < .01</p>

TITLE: The Differential Employment of Cognitive Skills as a Function of Increasing Iconic Stimulus Complexity

AUTHOR: Richard E. Wise

Marza and

## The Differential Employment of Cognitive Skills As

A Function of Increasing Iconic Stimulus Complexity

Richard E. Wise, Ph.D. Assistant Vice President Hartford National Bank and Trust Company 777 Main Street Hartford, Connecticut 06115

## The Problem

The problem under investigation in this study had two aspects:

- As iconic stimulus complexity ("realism") increases, are the cognitive processes involved in picture interpretation differentially employed (i.e., see there significant aptitude-treatment interactions between selected cognitive skills and "realism")?
- 2. If so, are the interactions dependent upon, or independent of, the type of learning the student is expected to demonstrate (i.e., are there significant aptitude-treatment-task interactions)?

## Related Literature

## A Model Of Picture Interpretation Behavior

The theoretical framework for the study was provided in part by Higgins' (1975) "Model of Picture Interpretation Behavior." The model integrates previous work by Piaget (e.g., 1950) on the nature and development of intelligence, and by Gagne (e.g., 1966) on problem solving.

The model suggests that picture interpretation comprises two interrelated even observation and inference-drawing. Observation includes processes such as deployment of attention, perception, and initial categorization of stimuli on the basis of "formal" attributes. Inference drawing involves further categorization not necessarily on the basis of observable attributes, and generalization to other non-visual states and events. Inference drawing is "going beyond the in" formation given" (Higgins, 1975).

The picture interpretation model comprises a large number of cognitive activities. The efficiency and effectiveness with which these activities are execute appears to be mediated by a number of individual difference variables. Two of these -- field independence and ideational fluency -- were selected for further study.

# Individual Differences in Picture Interpretation

Field Independence, which is described in detail by Witkin, et al., (1977), considers the extent to which a surrounding framework dominates the perception of an item within it. It is the "ability to overcome embedding contexts of perceptual functioning" (Goodenough, 1976, p. 675). Thus field independence should play an important role in the observation stage of the model.

-Z-

In addition to its role as a variable mediating perceptual disembedding, field independence (as the Convergent Production of Figural Transformations) has been associated with the redefinition, recombination, and modification of arrangement of perceived elements (Guilford, 1959, cited in Nunnally, 1967). These are acts of categorization associated with the inference drawing stage of the model of picture interpretation.

Field Independence was indicated by performance on the Group Embedded Figures Test (Witkin, et al., 1971). The test involves disembedding and tracing a simple figure hidden within a complex geometric display. Split-half reliability with Spearman-Brown correction was .837 in this study.

Ideational Fluency also appears to be involved in the interpretation of pictures, in "the conceptual dissection of more cue-laden stimuli of which pictures, especially realistic pictures, are representative" (Higgins, 1978). Ideational fluency involves the Divergent Production of Semantic Units (Nunnally, 1967, pp. 454-455); i.e., the searching of episodic memory(Ekstrom, et al., 1967, p. 67), and the recalling and selecting of conceptual material.

In terms of the picture interpretation model, ideational fluency (the Divergent Production of Semantic Units) would seem to be a determinant of the way in which an observer uses available cues from the iconic stimulus to direct his categorizing. Agility in category generalization would allow the subject to take fullest advantages of the available cues.

Ideational Fluency was measured by performance on the Topics Test. The test comprises two parts of four minutes each. Given a topic, the subject's task is to write as many ideas about the topic as possible. Split-half reliability with Spearman-Brown correction was .936.

In this study, the correlation between the aptitude measures was .087.

## "Realism" In Instructional Materials

Dwyer's Systematic Program of Evaluation (e.g., 1978) has amassed a large body of evidence that offers convincing support for the theoretical position that "for the promotion of specific educational objectives, visuals possessing realistic detail beyond a certain point add very little or actually decrease student learning" (Dwyer, 1978, p. 8). More cues may simply complicate the disembedding, encoding, and categorization tasks -- often to the point that unless the student possesses a highly developed set of the cognitive skills requisite to performance of those tasks, achievement declines.

#### Procedure

## Design

The study was designed as an aptitude-treatment-task-interaction experiment which investigated the interactions of several individual difference variables on two types of cognitive tasks, as complexity of iconic stimuli increased over two treatment levels. The design also allowed investigation of the extent to which aptitudes interact with each other, as well as with treatments.

For the analysis, a three factor multivariate analysis of variance was employed. The three factors were (1) Iconic Complexity (i.e., "realism"); (2) Field Independence; and (3) Ideational Fluency. Each had two levels: "High" and "Low," in the cases of the aptitude variables; "Simple Line Drawing" and "Realistic Photograph" for the treatment variable. Dependent variables were scores on tests of drawing and comprehension. Significant main effects and interactions were followed up by constructing simultaneous confidence interval: and by conducting univariate analyses of covariance.

The stimulus materials used were based on those used by Dwyer (e.g., 1976), and included an audiotaped script accompanied by thirty-seven 2 X 2 photographic slides. The subject was "Structure and Function of the Heart." The script was edited to delete some verbal information and to include prompts to attend to the visuals.

## Subjects

Forty subjects, all prospective trainees at the Naval Hospital Corps School at Great Lakes, Illinois, completed the entire study. None had begun the school's curriculum at the time the study was conducted. The sample included 22 males and 18 females representing eighteen states and every major geographic area of the country. The mean age of subjects was 20.25 years; the mean number of year education was 12.3. Subjects were randomly assigned to two groups prior to administration of the treatments.

## Analysis

The multivariate analysis showed that there was a significant main effect of Stimulus Complexity and a significant second-order interaction effect involving complexity, field independence, and ideational fluency. Other main effects and interactions were not significant.

Simultaneous confidence intervals were constructed as a follow-up to the significant MANOVA. Because of the relatively small N, power was a special concern. After MANOVA, univariate analyses of covariance were conducted on each dependent variable and (1-beta) power coefficients were obtained. For the drawing test, power of the 3-way ANCOVA was about 0.65; for the comprehension test, about 0.90 Patterns of significance were identical to those observed in MANOVA. The power of MANOVA to detect actual differences among group centroids was in the vicinity of 0.75 - 0.80 -- sufficiently high to continue the analysis.

#### Results\*

#### Results Involving the Drawing Test

Significant differences in achievement on the Drawing Test were found between the

*For	brevity, the following abbreviations are used:													
	FI	=	Field	Inde	pendence	("Hi"	and	"Lo"	levels)					
	IF	=	Ideati	ional	Fluency	("Hi"	and	"Lo"	levels)					
	SLD	-	Simple	Lin	e Drawing	g treat	tment	t.						
	RP	-	Realis	tic !	Photogray	ph trea	atmen	1 t						

igh field independence/low ideational fluency group that received the SLD restment, and the same group receiving the RP treatment. The source of the main effect for complexity, in favor of the SLD group, seems to be iso-

# sults Involving the Comprehension Test

ne significant second-order interaction appears attributable to the eight roups' performances on the Comprehension Test. Group differences are reapped below:

High Performance Group	Lower Performance Group	Comment
Hi FI - Hi IF - SLD	> Lo FI - Lo IF - RP	Extreme Groups difference
Hi FI - Lo IF - SLD	> Lo FI - Lo IF - RP	Weak treatment X FI interaction noted
Hi FI - Lo IF - SLD	> Hi FI - Hi IF - RP	Weak treatment X IF interaction noted
Hi FI - Lo IF - SLD	> Lo FI - Hi IF - SLD	In SLD, FI explains 29% of comp. test variance.

### Discussion

esults of the study suggest that:

0.252.0

- 1. Field Independence and ideational fluency are important cognitive skills in the interpretation of pictorial stimuli;
- In the processing of pictorial information, the primary role of field independence is as an evaluative, analytic, problem-solving skill, rather than as a perceptual disembedding skill;
- As the complexity of iconic stimuli increases, the psychological processes involved in their interpretation are differentially employed;
- The differential employment of cognitive skills is dependent, to some degree, on the type of learning the student is expected to demonstrate;
- Aptitudes may interact with each other, as well as with treatments and tasks; and
- Overall, the superiority of the Simple Line Drawing treatment over the Realistic Photograph treatment, is confirmed. This is consistent with a large body of previous research.

- Dwyer, F.M. The effect of IQ level on the instructional effectiveness of black-and-white and color illustrations. <u>AV Communication Review</u>, 1976, <u>24</u>, 49-62.
- Dwyer, F.M. <u>Strategies for improving visual learning</u>. State College, PA: Learning Services, 1978.
- Ekstrom, R.B., French, J.W., Harman, H.H., & Dermen, D. <u>Manual for kit</u> of factor-referenced cognitive tests, (August, 1976 ed.). Princeton, NJ: Educational Testing Service, 1976.
- Gagne, R.M. Human problem solving: Internal and external events. In B. Kleinmuntz (Ed.), <u>Problem solving: Research, method, and theory</u>. New York: John Wiley, 1966.
- Goodenough, D.R. The role of individual differences in field dependence as a factor in learning and memory. <u>Psychological Bulletin</u>, 1976, 83, 675-694.
- Guilford, J.P. Three faces of intellect. <u>American Psychologist</u>, 1959, 14, 469-479.
- Higgins, L.C. Children's inference drawing behavior: Its psychological nature and responsiveness to educational intervention. Unpublished doctoral thesis, University of Sydney, 1975.
- Higgins, L.C. A factor analytic study of children's picture interpretation behavior. <u>Educational Communication and Technology</u>, 1978, <u>26</u>, 215-232.
- Nunnally, J.C. <u>Psychometric theory</u>. New York: McGraw-Hill Book Company, 1967.
- Piaget, J. <u>The psychology of intelligence</u>. London: Routledge and Kegan Paul, 1950.
- Witkin, H.A., Moore, C.A., Goodenough, D.R. & Cox, P.W. Fielddependent and field-independent cognitive styles and their educational implications. <u>Review of Educational Research</u>, 1977, 47, 1-64.
- Witkin, H.A., Oltman, P.K., Raskin, E., & Karp, S.A. <u>A manual for the</u> <u>embedded figures tests</u>. Palo Alto, CA: Consulting Psychologists, Inc., 1971.



# TITLE: Evaluation Parameters for Special Education Instructional Systems: The Six-S Paradigm

AUTHORS: Mark Alter Marjorie Goldstein Francis Solano Patricia M. Yacobacci

## EVALUATION PARAMETERS FOR SPECIAL EDUCATION INSTRUCTIONAL SYSTEMS: THE SIX-S PARADIGM

## SYMPOSIUM PRESENTED

Mark 1

at the annual meeting of

10

## THE ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY Dallas, Texas 1982

## FRESENTERS :

Mark Alter, Ph.D.; New York University Marjorie Goldstein, Ph.D.; Educational Improvement Center Francis Solano, Ph.D.; St. Francis de Sales School for the Deaf Patricia M. Yacobacci, Ph.D.; New York University

## CHAIRPERSON:

Carol Carrier, Ph.D.; University of Minnesota

## EVALUATION:

## BOUNDARY IDENTIFICATION IN THE NON-LINEAR SPECIAL EDUCATION SYSTEM

Patricia M. Yacobacci, Ph.D. Assistant Professor Department of Communication Arts and Sciences New York University

## EVALUATION + BOUNDARY IDENTIFICATION IN THE NON-LINEAR SPECIAL EDUCATION SYSTEM

# INTRODUCTION

PLANG T

The complexity of social systems with human and non-human, living and on-living elements presents a myriad of interrelationships and interactions. which are complex, causal, and non-direct in their effects on environmental status. One aspect of our modern social system is the formal education process with its particular theoretical stances, settings, trained personnel, and young ones to be nurtured into the society. How well does formal aducation perform and achieve its role? For that matter, what is the role of formal education? Who makes the decisions within the "system" and society? What and how much information for the decision makers? What is the validity and reliability of this data? Who makes the judgements and for what purposes? These are questions very pertinent to the educational evaluator; the person who must search through the myriad of interrelationships, variables, and their interactions for useable information. The structure and purpose of this symposium is the exploration into a particular paradigm ofor organizing, obtaining, and managing information relative to formal educational systems; distinctly, the educational systems which provide services to students with special needs.

In most special educational settings, the classroom teacher is the principle decision maker for the individuals within his or her charge. It is the classroom teacher who decides the methods and materials of instruction, who decides referral needs for special services or testing; who manages and records student progress; and who provides major input to the decision of future placement and needs of these students. Since training for most special educators reflects a clinical approach to evaluation, these educators

tend to focus on diagnostics and performance indicators relative to individu students. The purpose and primary focus of this symposium is directed to these primary decision makers - the classroom teachers whose distinctive role propel them to function as educational evaluators. The authors wish to proa model for organizing and managing educational data which will go beyond the clinical prospective (that of data pertinent only to each individual student into an overview and boundary identification of the myriads of variables and their interactions withing the educational environment.

#### CONSIDERATIONS WITHIN THE SPECIAL EDUCATIONAL ENVIRONMENT

Special education is a term used to categorize the provision and deliver, of instruction and programming which differs from the "regular" educational setting (Hallahan and Kauffman, 1978). The students who are serviced through special educational programming are often described as exceptional children. Within this rubric of "exceptionality" exists a number of categories which generally depicts the nature of the exceptionality. Kirk (1972) lists the following six categories used for classification of these children with special needs:

- 1. mental characteristics,
- 2. sensory abilities,
- neuromuscular or physical charateristics.
- 4. social or emotional behaviors,
- 5. communication abilities,
- multiple conditions of the above categories.

The incidence of exceptionality has been estimated to be twenty percent of the current school population ( Gearheart and Weishahn, 1976). This most likely being a very conservative estimate, in that the sited authors also indicated that approximately sixty percent of all school aged children would benefit educationally from some form of special services. No matter what the incidence or classification of exceptionalities; it still remains that the design of instruction, the components of programming, and the education of instructors to meet these special needs are an integral part of the general educational system.

within the current framework of special education, several factors should be considered. As listed above, the educational setting appropriate for an individual must be determined. This procedure is usually initiated through a battery of testing situations and in some cases diagnostic observations. All resulting in a particular educational placement for this Until the mid seventies of this century, most exceptional Individual. children were grouped for educational purposes with others who had the mane characteristics (Hallahan and Kauffman, 1978). In cases of severe disability, these children were often placed in residential settings away from the general society, some appropriately and some not. The Federal mandate, Public Law 94-142, issued in 1976 has been termed the All Handicapped Children's Act and calls forth from each State an accountability of educational programming for all exceptional children through the Individual Educational Plan ( IEP) which is a written document depicting the goals and Instructional services for each child. In additional to the IEP, the Legislature also mandated that the "least restrictive educational environment" be provided for each individual. This provision has lead to the current mainstreaming issues in special education. Whereby, the term mainstreaming meaning placement within a general educational setting, has given rise to a continuum of alternative educational programs available to this population. This continuum ranges from complete residential placement to placement within a regular classroom with no special services provided. This mainstreaming

110

issue is a viable factor in the evaluation of educational services provided exceptional children.

Other factors relevant to the special educational setting are knowledgeable instructors, specifically designed instructional materials, curricula concerns, and communication needs. Although differing educational philosophies and managerial approaches for the instruction of exceptional children exist, special considerations abound within each theoretical framework no matter which special category is being addressed. An instructor must know the needs of a partially sighted child as opposed to the needs of a totally blind child; the needs of a hard of hearing child verses a profoundly deaf child; or the needs of a child in a wheelchair verses a child on crutches. In most situations adaptation in communication and in instructional materials is necessary for the special child to process the information given.

The evaluation process within special education, or general education for that matter, most often becomes one of data collection consisting of formal and informal tests given by the school psychologist and the classroom instructor. Flacement decisions and predictions of educational attainment are generated from this data. Often ignored are the influences of the complex environment on the educational process. A widely used definition of evaluation is the gathering of information for decision making (Tenbrink, 1974). Other evaluators put emphasis on the process rather than a product (Cooley and Lohnes, 1976). Within this framework decisions must be made as to what variables and relationships among these variables are necessary for a purposeful evaluation process to occur. For the special educator, evaluation of pupil performance cannot just be "scores" listed on a profile. Evaluation of pupil performance should take into consideration the interactive variables within the exceptional child's living environment. One theoretical

prospectus for variable identification is protrayed in systems theory, or what is sometimes referred to as "General Systems Theory" (Laszlo, 1972). In systems theory, variables interact with each other to a greater or lesser degree for the maintanence of the system. It is the determination of the critical variables that define a system (such as an ecological system, an economic system, and now a social system) that is difficult. What variables produce a cause and effect relationship? What variables must be included in the definition of a particular system? Answering these questions is the process of determining the boundaries that define the system of consideration. Since the social system is among the most difficult to define, and since education can be viewed as a mini-system with the larger context of the social system, the remainder of this paper will focus on the "boundary" identification of a special education setting with the mainstreaming factor a determining feature of the system.

5

## BOUNDARY IDENTIFICATION ----AND THEN WHAT?

Refinement of the supra-system (society) into the sub-system of education and then into the sub-sub-system (special education) is similar to teaching the concepts of relationships in beginning set theory in modern mathematics. It is a process of deciding what elements share common properties and what elements do not exhibit those common properties. Some elements can be grouped in more than one set; thereby, the grouping Froduces a sub-set of the two orginal sets, and so on. As a small child's mind becomes confused and entangled in the sub-sub set operations, so does the adult mind become entangled with the delineation of the myriad of variables operating within the subset of a larger set which becomes a "system". At this point, one constructs a mental model of elements

and intuits the nature of their relationships (Root, 1977). Since the human mind cannot hold every variable or element interacting in even a sub-sub-system and cannot determine every influential factor of each variable, the mental models are of necessity abstractions of the real environment. In the process of abstracting critical elements, it is possible for one to lose significant information. Therefore, mental models must be shared in written-form; discussed and validated as to the representation of reality.

A system, as defined by Banathy (1968) is an assemblage of parts that are designed and built into organized wholes for the attainment of specific purposes. When constructing a mental model of special education into system components, one must realize that the purpose of special education is the provision of opprotunities for individuals to obtain their full human potential. With this then being the goal, the individual variables and elements can be modelled into organized units representing the system and its boundaries.

A more formal approach to system boundary identification in special education, particularly the education of hearing impaired children, was studied by Clark and Yacobacci (1978). This approach reached beyond the representation of a mental model and portrayed the special educational program as a system with dynamic interrelating variables. This model construction was based on Forrester's previous work in modelling urban settings using a specialized computor program termed DYNAMO (1969).

This DYNAMO technique portrays the interaction of designated system variables and their effects over estimated time intervals. Thereby, illustrating cause and effect relationships in a non-linear form. If the underlying model is perceptually correct in relationship to reality, then the prediction characteristics of the interactive components should hold true over time.

7

The focus of the Clark and Yacobacci model was the determination of critical elements which provided academic success and social integration for hearing impaired students who would be mainstreamed along some point of the continuum mentioned previously. In order to produce the boundaries of this particular educational and construct a realistic model for computor analysis, the following procedures were conducted. First, thirty professionals in the field of education for hearing impaired children were identified. Each person was asked to participate in this study. Fifteen replied positively. The second step involved the use of a modified Delphi Technique, a series of mailings, to identify the elements which would enhance academic achievement and faciliate social integration for mainstreamed hearing impaired students. The first mailing was open-ended in that the researchers asked each subject to identify ten critical elements for each category. When this information was received, the researchers then grouped the items according to similarity. The second mailing called for consensus to item similarity and for rank ordering the elements from most crucial to least effective. (refer to page 8 for listing).

## ELEMENTS THAT CONTRIBUTE TO ACADEMIC ACHIEVEMENT

- 1. QUALITY OF SUPPORT SERVICES
- 2. QUALITY OF SPECIALIZED FACILITIES
- REGULAR CLASSROOM TEACHER COMPETENCE
- 4. DEGREE OF INDIVIDUALIZATION
- 5. QUALITY OF STUDENT ASSESSMENT
- QUALITY OF ADMINISTRATIVE SUPPORT AND SUPERVISION
- AMOUNT OF INSERVICE TRAINING
- FAMILY INVOLVEMENT
- 9. QUALITY OF LANGUAGE DEVELOPMENT CURRICULUM
- 10. COHESIVENESS OF CURRICULUM
- 11. FACILITATION OF PEER RELATIONSHIPS
- 12. SUITABILITY OF ADAFTED MATERIALS FOR THE HEARING IMPAIRED
- 13. QUALITY OF EARLY CHILDHOOD PROGRAM
- 14. QUALITY OF ACADEMIC CURRICULUM
- 15. CONSISTENCY OF COMMUNICATION MODE
- 16. PROVISION FOR EXTRACURRICULAR ACTIVITIES
- 17. QUALITY OF ON-GOING PROGRAM EVALUATION
- RATIO OF IN-REGULAR-CLASS SCHOOL TIME TO OUT-OF-REGULAR CLASS TIME
- 19. FACILITATION OF SELF-RELIANCE
- 20. LEVEL OF TEACHER/CHILD COMPATIBILITY

## ELEMENTS THAT CONTRIBUTE TO SOCIAL INTEGRATION

- 1. FACILITATION OF SELF- RELIANCE
- 2. FACILITATION OF POSITIVE SELF-CONCEPT
- 3. ORGANIZATION OF CURRICULAR OPPORTUNITIES12. QUALITY OF SUPPORT SERVICES FOR SOCIAL INTEGRATION
- 4. FACILITATION OF PEER RELATIONSHIPS
- 5. DEGREE OF INDIVIDUALIZATION
- DEVIATION FORM CHRONOLOGICAL AGE FOR PLACEMENT
- QUALITY OF COMMUNICATION ENVIRONMENT
- 8. IN CLASS/OUT OF CLASS RATIO
- 9. LEVEL OF TEACHER CHILD COMPATIBILITY

- 10. QUALITY OF EARLY CHILDHOOD PROGRAM
- 11. FAMILY INVOLVEMENT
- - 13. QUALITY OF PRACTICAL LIVING PROGRAM
  - 14. LEVEL OF ATTENTION TO AFFECTIVE DOMAIN

Subjects were also asked to list "indicators" of both academic achievement and social integration. Once these lists were refined, they were then asked to weight each of the indicators according to effect on these two categories. when the researchers asked the subjects to construct a cross-impact matrix, the number of active participants dwendled from fifteen to six. The matrix elements were as follows: 9

- 1. Family Involvement
- 2. Language Development
- 3. Academic Curriculum
- 4. Communication Mode
- 5. Support Services
- 6. Teacher Competence
- 7. Self-concept
- 8. Self-reliance
- 9. Environment
- 10. Peer relationships
- 11. Achievement
- 12. Integration

The subjects were to indicate the cause and effect relationship that each had on the other.

From these six respondants, the information listed by three individuals was selected for model constuction. The researchers first constructed a representation verbally. Then from this verbal model, a model depicting DYNAMO terms

and format was drawn (See Figure I). At this point the computor equations were written to depict this model. Numerous sensitivity computor runs were conducted. During these runs, particular variables were manipulated by adjusting them in multiplicatives of 2, 3, and .5. An example of the computor runs is shown on page 11. This example illustrates the most impressive run obtained during this modelling process. That is, when selfconcept was doubled, most of the other variables were positively influenced and the levels for academic achievement and social integration stablized for the stated time period.



Figure 1. Enriched model including both Academic Achievement and Social Integration.

# VERSION 1: Facilitation of Self-Reliance doubled.

. . .

AA=A+SI=S+AH=1+CM=2+EC=3+EN=4+IZ=5+PR=6+SC=7+SR=8

1.4

50.000		50.	000			70	.00	00			80	00	00			90		000	AS	45479
0,000	1000		000	_	-		_	· -		_	_			-	_	2	-		AC. 17	745670
0.00	1											2						•	AC.11	345070
ALC: A	13.70		*										•					•	HOTIA AC	2430/0
-0-	1		*					•				- 1	•					•	HSF14	3436/8
A	1.000						- 3	5					•					•	A5714	3436/8
A	1		•				- 3						•					٠	AS,12	2345678
A .	151.00		٠					•				- 23	•					•	AS,12	2345678
A	1						- 8						•					٠	AS,12	2345678
A	Laner							•					•						AS,12	2345678
A	1							•					•					٠	AS,12	2345678
A	1												•						AS,12	2345678
10.0A	1 -8-						- ,			-		+ ;			-	-	-		ASe12	234567
A	1 8							•					•						AS,12	234567
A	1 8						- 3	£				- 3							AS,12	234567
A 1	1 8	1.1					2					3							AS,12	234567
A	12 8																		AS,23	\$4567
A	12 8											- 5							AS,13	\$4567
A	12.8																		AS+13	45+267
20	1 2 1	3	÷.				- 3	÷										0	1345.	247
AG	13.2	8	- C				- 3											÷.	74.15	- 27
AC	147	170	<u> </u>				1.3	·										•	45.90	11.67
CH A	140 0	12		0-3-3-3	100	-	201	·	1.12	100	20110	63	•	2016	1005	103	6.07	•	40720	2
2010111	5 146		14		_		- 1		-				• -		-	-		•	431/0	2
·A	8145.	5 0	•8	1 2			- 1						•					٠		
• •	9 514:	3 6	. •	8	/	2	_						•					•		120
	A 15	53	6+	10	8	1	2.			1.1		- 0	•						54	
10000	A1	\$53	6.			8	1.1	72		2			*						14	
	11	5	68	-			8		7	2		- 1	•					٠	\$3,14	1
BEESS	41	L A	53	S		100	\$	5		2	1		•					٠	56,27	2
	41		53A			S	- 3	.8		27		- 2	•					٠	56	
	41		53	A	1.02	80	5	38		27		- 1	•						56	
	41	L I	53		f	÷		.8		527			•					•	56	
30.0	41		53 .			- 6	A .	-8-	-	27	-S-	83			-	-	-		56	
	41		53					· A		27			• S						56,A8	3
1.	41	L 1	53					.8	A	27		۰.,	•	S					56	
	41	E 3	53		25		- 34	.8	13	A27					S				56	
	41	L 3	53					.8		A7						S			A2,56	5
	41	6	53					.8		2A						5	3	0	56.47	7
	41		53					.8		20							8		54.47	7
	41		53				- 8	8		24			<u> </u>				č	÷.	54.47	7
	41		53				- 1	8		27	^						0	•	507HI	
	4		57					0		27	~		•				۰,	<u>.</u>	50	
10.0	A1		57 .		-	200	1	0_		27	A	- 1	•				-	•	36	
	4		53		-			8	-	57	н ·	5.3	• -			_	-2	**	26	
	41		57					0		27	A .						1		54	
	41	8	57					0	÷.	27	A		•				1.1	•	JO	
		1	67					0		21	A		•				100	*	50	
		2 1	2.2				1	0		21	1		•				1		26	
			33					. 8		21	A .	- 3					- 2	5 +	26	

## NOW --- AND THEN WHAT????

It is very evident that the classroom instructor does not have the time or the facilities to pursue systems thinking and boundary identification in this rigious fashion. However, the members of this symposium support the concept of system thinking and design for use in the evaluation procedures and processes reletive to student performance in any educational setting, particulary the special educational setting. A focus away from the strict clinical model of evaluation must be accomplished. It is to this point that Dr. Mark Alter addresses his concerns by developing the 6-S paradigm to illustrate evaluation parameters in the special educational setting. Then Dr. Marjorie Goldstein will elaborate on one particular system element, the curriculum; as will Sr. Francis Solano elaborate on the component of formal testing.

### BIBLIOGRAPHY

- Banathy, B. Instructional Systems. Palo Alto: Fearon Publishers, 1968.
- Clark, B. and Yacobacci, P. Phase I in the construction of a dynamic computer codel relating program elements in education programs to mainstream hearing impaired children. <u>Proceedings of the International Congress on the Education</u> of the Deaf; Hamburg, Germany, 1980.
- Cooley, W. and Lohnes, P. Evaluation Research in Education. New York: John Wiley& Sons, 1975.
- Hallahan, D. and Kauffman, J. <u>Exceptional Children</u>. Englewood, N.J.: Prentice-Hall, Inc. 1978.
- Gearheart, B. and Weishahn, M. The Handicapped Child in the Regular Classroom. St. Louis: C.V. Mosby Company, 1976.
- Lazlo, Ervin, The Systems View of the World. New York: George Braziller, 1972.
- Root, A. "Modeling and Simulation". Unpublished manuscript.
- Tenbrink, T. Evaluation: A Practical Guide for Teachers. New York: McGraw-Hill, 1974.

Evaluation Parameters for a Special Education Instructional System: The Six-S Paradigm

> Mark Alter, Ph.D. Assistant Professor

Department of Educat Psychology New York University valuation Parameters for a Special Education Instructional System; The Six-S Paradigm

There is little doubt that two of the major elements of contemmary special education involves mainstreaming handicapped learners implementing the mandates of Public Law 94-142. Ever since Dunn (968) questioned the justifiability of self-contained classes for ucable mentally retarded pupils, there has been an accelerating wement to avoid placing handicapped learners in self-contained asses. Although the term mainstreaming does not appear in P.L. 94-2; the term that is used is "least restrictive environment," the tent of the law is that the educational provisions offered to handapped children should be appropriate and that they should be proded in the least restrictive environment insofar as they maximize portunities for contact with nonhandicapped children. A major obacle preventing schools from providing handicapped children with the sast restrictive environment has been in establishing criteria by ich the appropriateness of the environment may be determined. hat do we mean when we speak of an appropriate placement? Do we an appropriate insofar as if offers the mentally retarded child portunities to interact with nonhandicapped peers? Do we mean it appropriate insofar as it maximizes opportunities for academic mievement? For improved social behavior? Do we mean that it iximizes opportunities for the child to function normally only uring his school career, or are we also concerned with enabling the hild to lead an independent life as an adult? Ideally, we would ike to achieve all of these objectives.

While many of the answer(s) to these questions are grounded in

political, social and economic ambiguity the task of actualizing the mandate of the federal legislation, to provide handicapped children with an appropriate education in the least restrictive environment, is primarily the "sole" responsibility of the classroom teacher. The complexity of their mission is evident when examining representative tasks that a teacher must respond to:

- Determining the current status of the child's skills, attitudes and knowledge
- Determining appropriate goals and objectives based on assement
- 3. Deciding what is the point of departure in stating goals
- Determining how objectives should be sequenced for instruction
- Determining appropriate instructional procedures for reaching objectives
- 6. Implementing individualized programs in group situations
- Orchestrating all information from 1-6 into daily lesson plans
- 8. Setting criteria and evaluating instructional program

Each of the above tasks represents decisions which must be may by the teacher. Decisions that answer the questions, what am I doing? Why am I doing it? And how do I know that what I am doing is appropriate and working? While the answers to these questions and the mastery of teacher tasks are facilitated by support personnel (e.g., speech therapist, physical therapist, psychologist, etc. it is the teacher who must collect, analyze, synthesize, develop and implement a program that meets the unique educational needs of individual students.

To guide the teacher's decision-making the Six-S paradigm (Alter & Bepko, 1976; Alter & Goldstein, in press) was developed at model for representing an instructional system. For the purpose of the Six-S paradigm Banathy's (1968, p. 12) definition of systems was used. She defines systems as assemblages of parts that are designed and built into organized wholes for the attainment of specific purposes. The purpose of a system is realized through processes in which interacting components of the system engage in order to produce a predetermined output. Purpose determines the process required, and the process will imply the kinds of components that will make up the system. A system receives its purpose, its input, its resources, and its constraints from the suprasystem (society). In order to maintain itself, a system has to produce an output which satisfies the suprasystem.

3

The Six-S paradigm is an attempt to simplify and reduce the complexities of instructional systems into manageable proportions. The intent of the paradigm is to crystalize instructional systems thereby permitting teachers to examine, analyze and plan programmatic solutions. The paradigm is derived from Henderson's (1961) conceptualization of a triadic relationship between teacher, content of instruction, and the learner. The paradigm is an extension of Henderson's formulation and represents a more comprehensive and Systematic conceptualization of the instructional process. The com-Ponents of the paradigm include <u>SOMEONE</u>, the individual who manages the teaching-learning process in the classroom, and is most often the program implementor. Within this group are teachers, aides, parents, ward attendants, residence managers and anyone else who has direct contact with, and responsibility for, educating the student. <u>SOMETHING</u>, the content of instruction, represents an amalgam of the

knowledge, skills, and attitudes consistent with the goals of education. SOMEBODY is the student, as characterized by particular learning characteristics, learning style, rate of learning, motivation to learn, and the background of knowledge and experience the s/he brings to the learning situation. SOMEHOW reflects the strate egies and tactics that are used to guide the learning process in ways that are consistent with the content of instruction and the student's learning characteristics. SOMEWHERE, the learning environment, encompasses any area in which instruction occurs and is de fined in relation to physical, social and psychological aspects of the environment. Finally, SOMETIME incorporates all of the timerelevant dimensions of the instructional process and includes sched uling and pacing of activities as well as readiness for learning. The "Six-S Paradigm" thus organizes the instructional process into logical elements with the objective of making the resulting management of the learning process more coherent and effective. Utilizi the Six-S paradigm as a frame of reference the teacher can generate the questions that will effect their decisions regarding program d velopment and implementation. Table 1 shows representative question for each of the six factors.

A major obstacle in answering questions generated by the Six-3 paradigm is an extreme across the board variability in students and delivery systems. This includes differences in the nature and rols of teachers, ancillary personnel, parents and facilities. The exist literature, which is equivocal at best, cannot be relied upon to supply the empirical basis for decision making regarding both the development and implementation of site specific instructional programs. For a teacher to effect a "best fit" among the six factors

## TABLE 1

5

MEONE

22

MEWHERE

MEHOW

- Who are the people who come into direct content with the child?
- 2. What are the responsibilities of these people for the implementation of the instructional program and do they have the competencies required for implementation?
- 3. What additional support personnel will be needed to implement the instructional program?
- METHING 1. What areas of human development are most important for this child and what programs exist in these areas?
  - Are the available programs "modifiable" to meet the unique needs of the child and the conditions under which program implementation is to occur?
  - 3. How is the content of instruction to be organized?
  - 4. What are the evaluation and assessment procedures for each content area or program?
- MEBODY 1. Dimensions of educability.
  - 2. What are the characteristics and needs of this child and how are they to be determined?
  - 3. Which of these needs takes priority and on what basis is priority assigned?
  - What environmental conditions effect the results of educational programming for this child?
    - What are the optimal environment(s) for program implementation and content of instruction?
    - What is the optimal strategy for communicating the content of instruction to this child?
      - What modifications in instructional methodology need to be made as a function of the characteristics of the child, implementor competencies, and environmental conditions?
      - 3. How are the instructional strategies and methodology to be evaluated with regard to their appropriateness and effectiveness with this child?

## TABLE 1 (con't)

## SOMETIME

- 1. When should specific activities be scheduled?
- 2. How long should an activity take?
- 3. How should the activity be paced?

research model needs to take the implementator of the program as the int of departure . Applying Smith's (1980) model of curriculum-dicted vs. curriculum-related research the following describes the disnction between an implementor-directed approach to answering Six-S estions as opposed to an implementor-related perspective. First, the rm implementor-directed deals with research questions that are inhert in or generated by the implementors of programs while the implementorlated implies research questions that seek clarification of broad sues involving the behavior of a specific target population. cond, implementor-directed research would examine theories and ndings as a function of the question, while implementor-related search would explore the question(s) as a function of a theory. ird, implementor-directed questions as opposed to implementorlated questions would be raised prior to the need for the research swer so that the problem solution can be developed, implemented, I made available as input to facilitate decision-making concerning ogram development, whereas implementor-related questions, may be ised quite independent of development needs. Finally, the two proaches also differ concerning the methodological procedures eded to answer the research questions. This includes questions but the subjects to be employed, the design of the study, statiscal analysis, and the use to be made of the findings. For example, issue involves the degree of similarity between the characterisis of subjects employed in a study or experiment and the target pulation for which the programs are intended. For example, the get population for a gross motor program could include persons signated as mentally retarded with other concomitant difficulties;

12%

delayed motor development; their teachers, parents, physical ther apist, and characteristics of the educational environment in whic the programs are to be implemented. Implementor-directed research is more likely to employ samples of <u>this</u> target population in its work than would implementor-related efforts which are likely to go outside the network either for representatives of the target population or for comparison and contrast groups, namely "non-handicapped" and other children not identified as retarded. In terms o experimental design, it would appear that implementor-directed research would focus on the naturalistic situations in which behavic occur, while implementor-related efforts typically resort to more contrived, experimental conditions, though some overlap is reasona

To answer questions generated by an implementor-directed research model requires at least three primary classes of informatic First, is information from the implementors of the program. This class of information provides important data regarding the effects of the program on their users. User perceptions of a program will of course, influence the ultimate effect of the program itself on the target population of children. The second primary class of in formation concerns actual implementation of the programs; that is, the degree to which programs are implemented in accord with the intent and purposes of the teacher. To that end, data needs to be collected from systematic observations of teacher-student interactions during actual use of the programs and teacher self evaluations may need to be augmented by the utilization of observers who collect information on the impact of programs in their various delivery settings. The third primary class of information concerns

....

the effects of the programs on the target population. This includes, but is not limited to estimates of change in student behavior as a function of exposure to a program. This data is related to information concerning the biobehavioral characteristics of the children in order to provide a broad picture of the effects of a program. The three classes of information represent a balanced effort to obtain data concerning implementor evaluations, assessments of student progress, and observed crucial delirery system variables. A variety of procedures and techniques can be utilized in gathering these data. For example, descriptive data can be obtained on the child, implementor, and delivery system and The various information sources provide feedback on prosetting. gram manageability, clarity, format, media, and the modifications and adaptations which were required in order to meet the unique characteristics of individual children. Estimates of child progress are proveded through the use of pre and post assessments, and through the continual monitoring of criteria attainment.

9

In summary, the Six-S paradigm was developed to not only provide the teacher with an instructional matrix for planning an educational program but to provide the teacher with a framework for generating areas of investigation that can maximize the teachers' implementation of the program. The notion of a teacher-directed research model as opposed to a teacher-related model was applied to the Six-S paradigm as a means for generating questions that are inherent and/or generated by the developer of the educational program.

#### REFERENCES

- Alter, M. & Bepko, R. <u>A proposal for curriculum based individualized</u> <u>educational planning</u>. Curriculum Research & Development Center in Mental Retardation, New York University, 1978.
- Alter, M. & Goldstein, M.T. Substantive IEP planning using a "six-s" paradigm, (in press).
- Banathy, B.M. Instructional Systems. Palo Alto: Fearon Publishers, 1968.
- Henderson, K.B. Uses of subject matter. In B.U. Smith & R.M. Ennis (Eds.), <u>Language and concepts in education</u>. Chicago: Rand McNally, 1961, pp. 43-58.
- Smith, I.L. Research in large-scale curriculum development for mildly retarded children. In J. Gottlieb (Ed.), <u>Educating Mentally</u> <u>Retarded Persons in the Mainstream.</u> Baltimore: University Park Press, 1980.

Curriculum:

The Keystone to Instructional Planning in Special Education

by

Marjorie T. Goldstein, Ph.D. Special Education Coordinator Educational Improvement Center/NE 2 Babcock Place West Orange, NJ 07052

Presented at the Annual Meeting of the Association for Educational Communications and Technology at Dallas, Texas, May 1982.
Curriculum: The Keystone to Instructional Planning in Special Education

# Introduction

Curriculum - the content of instruction - is interpolated from goals of education that are set forth by state and local education agencies. While the goals of education - literacy, and social and economic survival - are the same for all student the degree to which each individual achieves these goals differs It is perhaps for this reason that Kaufman and English (1976) observed that the imprecise nature of statements of the goals of education has contributed to the diffuseness seen in today's regular education curriculum. This diffuseness extends to concern with special education curriculum as well, since much of what is taught in special education classes is drawn from the regular education curriculum.

The purpose of this paper is to highlight the role of curriculum in special education within the contexts of the individualized education program (IEP) and the "6-S" paradigm of instruction.

## Early IEP Development

Early implementation of PL 94-142, The Education of All Handicapped Children Act of 1975, saw emphasis placed on procedural compliance with mandates. Concern centered on meeting timelines specified in the law, protecting the due process rights of consumers of special education services, and generating reports attesting to compliance. As with other parts of PL 94-142, the IEP posed a dilemma for many special educators: whether to attend to procedural compliance - the timelines and logistics of creating the document - OR to attend to the substance of the IEP, the content of instruction and its relevance for the student. More often than not, special education administrators were forced to choose procedural compliance as an alternative to costly and time consuming due process challenges from parents (Gross, 1979).

2

The tasks of IEP development and implementation were often delegated to special education teachers. With little direction, the teachers turned to objectives banks (generated either indistrict or by commercial publishers), curriculum guides and scope and sequence charts, or "their own intuitive sense of what comes next" as a basis for developing IEPs (Tymitz-Wolf, 1982). Not surprisingly, special education teachers have become increasingly frustrated and discouraged since they have been delegated tasks that they are ill-prepared to assume. Most special education teachers lack the training and experience that would equip them to generate valid long- and short-range objectives for students. Equally important, the teachers have not been trained in consultation skills typically required in IEP meetings, and are not prepared to rationalize their professional decisions to colleagues and parents.

The absence of districtwide curriculum foundations that provide direction for educational programming in special education creates a void that leads to haphazard instructional

decision making. Where teachers have no curriculum roadmap on which to plot "where the student has been, where he's at, and where he's going" they have no objective basis for making curriculum decisions. Consequently, teachers have relied on their own content biases and speculations about what the student's priority areas for instruction are. Since biases and speculations can vary greatly from teacher to teacher, this leads to a randomness in the selection of the content of instruction provided to handicapped students. Related to this is the problem that, in the absence of curriculum foundations, special education teachers are forced to rely on standardized tests to determine students' current levels of educational functioning and their rate of progress as well. The use of these tests for instructional purposes is of questionable value since they do not typically test what has been taught in the classroom, nor do they provide much useful information to guide teachers' subsequent curriculum decisions.

The lack of instructional consistency within special education classrooms is exacerbated when one looks at the differences in curriculum and approach used from one level of the program to the next. Thus, the absence of a consistent curriculum base from which the special education teachers in the district draw their content creates a lack of continuity in the special education program. A consequence of this discontinuity is that as students move from level to level, e.g., primary to intermedia<sup>11</sup> they are exposed to a random assortment of instructional expe-

3

riences, a crazy quilt of learnings. Implicitly, the students are expected to integrate the instructional experiences into a coherent whole for themselves, and to transfer what they have learned into socially adaptive ways to cope in the adult world. Such an expectation is contrary to research on the learning characteristics of handicapped learners (Ellis, 1963). From an extensive review of studies of the mentally retarded, we find that these individuals have great difficulty generalizing information learned in one situation to other similar situations unless they are taught to do so. This information is too important for special education decision makers and curriculum implementors to ignore.

## The IEP and Curriculum Planning

In recent years, a shift in the emphasis of implementation of PL 94-142 has been noted that suggests movement from procedural to substantive compliance with the law (Deno & Mirkin, 1980; H. Goldstein, 1980; Weiner, 1978). While it is likely that this shift is due, in part, to special educators' recognition that attention to substantive program issues represents good professional practice, parent advocates have also played a role in focusing attention on what happens after students are classified. Too frequently, the questions being asked by parent advocates are "now that you have classified out children, what sort of an education will you provide? What will the childrens' curriculum consist of? And, too often, the questions are met with silence or ambiguous references to the regular education curriculum.

Through the IEP it is possible that the intent of the law appropriate education for handicapped students -- will be realized Such a possibility exists since the IEP represents the most direct link to classroom instruction, and has the greatest potential to affect the instructional process. If the IEP is to become a powerful instructional tool, however, it is important that curriculum foundations are available to guide IEP development.

5

To accommodate the range of handicapped students entitled to a free, appropriate public education, it is likely that an array of curriculum options is needed. For some learners, parall strands of curriculum keyed to the regular education curriculum need to be devised; strands that represent the systematic expansion or contraction of the regular education curriculum. For other learners, alternative curriculum strands need to be developed that incorporate relevant instruction for students whose needs are not served through adaptation of the regular education curriculum, and that allow these students to achieve the goals of education by way of a different route.

Such an array of curriculum options would allow IEP developers to select annual goals and short-term objectives within the context of a curriculum base. And, through the use of a consistent curriculum base, the probability is increased that a more focused, coordinated and relevant instructional program would be provided for handicapped students.

To focus on the importance of curriculum for special education does not suggest that appropriate curriculum materials

do not exist. Major curriculum innovations in special education supported by the federal government during the 1960s and 1970s include: The Social Learning Curriculum (H. Goldstein, 1974; 1975), Project MATH (Cawley and others, 1975), I CAN (Field Services Unit, 1974), Project MORE (Bieberly, Lent and Keilitz, 1974), and Me Now (BSCS, 1974), Me and My Environment (BSCS, 1977), and Me in the Future (BSCS, 1979). Add to these the multitude of curriculum projects devised at state and local levels and the results suggest that what is needed in special education is not further curriculum development as such. Instead, the time has come to select from among the materials that are available those that are responsive to and compatible with a district's needs, and to weave them into an integrated set of goals, objectives and activities. What follows after is the implementation of this curriculum in the district's program.

6

From a common curriculum base, curriculum mapping for individual students can be managed in a systematic way, and a substantive IEP can be developed and implemented. By planning experiences that are developmental, activities at each level in the student's schooling serve as a foundation for learning increasingly complex knowledge, skills, and behaviors. In this way, greater use would be made of handicapped students' school years since they would be learning information that is both immediately useful and that, at the same time, serves as a foundation for meeting long-range instructional goals.

Were this curriculum-based approach to IEP development used,

it would respond to a caveat recently expressed by Herbert Goldstein (1981) concerning the use of the IEP as an alternatin to having handicapped students take state-mandated competency tests. He cautioned that LEAs may need to lay a handicapped student's IEPs end-to-end to demonstrate a coherent progression of content that the student has mastered and that allows the student to meet the goals of education. Looking to a future that promises ever-increasing emphasis on accountability, the time may not be far off that Goldstein's speculation becomes reality.

# The "6-S Paradigm and Curriculum Planning

Unlike some views which requate cubribulum with the entire instructional process (Ornstein, 1982), the "6-S" paradigm see to differentiate the elements that comprise the instructional process. This is done in order that each of the constituent elements can be examined independently of the others, as a prin step to studying their interaction. For this reason, the content and process of instruction are separated, and both are differentiated from the environmental factors that influence the instructional process and from the actors in that process.

According to the "6-S" paradigm, "SOMEONE (the manager of learning) teaches SOMETHING (the content of instruction: curriculum) to SOMEBODY (the learner) SOMEHOW (the process of instrtion: strategies and tactics) SOMEWHERE (the learning environme SOMETIME (according to a set schedule, at a particular pace)" (Alter & M. Goldstein, in press). Implicit in the paradigm <sup>15</sup>

view that teaching incorporates all of the significant instructional behaviors in which the manager of learning engages. Most importantly, these include this individual's evaluation of ongoing instructional progress of students, and his/her selection, evaluation and adaptation of instructional content to meet students' needs. Adaptation, an essential skill, requires that the manager of learning be able to systematically reteach and/or reinforce learning.

From this perspective, we find yet another rationale for providing developmentally organized, sequential curriculum for use in special education. If teachers are to evaluate student progress and adapt instruction to more effectively guide learning, they must have available the tools by which to accomplish these tasks: the curriculum roadmap that allows the teacher to know what has been taught (content) and how it was taught (process)---as the bases for making subsequent instructional decisions.

This "test - teach - test" approach is not new. However, by adding an "adapt" action to the approach, it is possible to accommodate the learning characteristics of ALL students within the paradigm, rather than as an afterthought. Equally important, the availability of curriculum roadmaps allows adaptation of instruction to be managed as systematically as the other aspects of the instructional process (M. Goldstein, in preparation).

## Summary

The relationships between the "6-S" paradigm and IEP

140

development were discussed in an earlier paper by Alter and M. Goldstein (in press). The purpose of this paper has been focus on the importance of curriculum as an essential element in IEP development, using the "6-S" paradigm and current IEP development practices as the bases for discussion.

Three related issues were identified that point up the need for curriculum roadmaps for special education: the teach need to use curriculum as an objective means to evaluate and adapt instruction, based on ongoing assessment of student progress; (2) the teacher's need to provide instruction that is integrated across subject matter areas, and that allows the student to build a knowledge base as a foundation for future learning; and (3) the special education program's need to provide continuity in instructional programming among the speceducation settings in the district so that the program provid for students represents a developmental and relevant progress of content that assists them to meet the goals of education is the extent that their abilities permit.

#### REFERENCES

神秘に建立とつう

- Alter, M.M. & Goldstein, M.T. Substantive IEP planning using a "6-S" paradigm. In press.
- Bieberly, C.J., Lent, J.R., & Keilitz, I. How to do MORE. Bellevue, WA: Edmark, 1974.
- Biological Sciences Curriculum Study. <u>Me Now</u>. Northbrook, IL: Hubbard Scientific, 1974.
- Biological Sciences Curriculum Study. Me and My Environment. Northbrook, IL: Hubbard Scientific, 1977.
- Biological Sciences Curriculum Study. Me in the Future. Northbrook, IL: Hubbard Scientific, 1979.
- Cawley, J.F. and others. Project MATH: A Program of the Mainstream Series. Wallingford, CN: Educational Sciences, 1975.
- Deno, S.L. & Mirkin, P.K. Data-based IEP development: An approach to substantive compliance. <u>Teaching Exceptional Children</u>, 1980, <u>12</u>.
- Ellis, N.R. (Ed.). Handbook of mental deficiency: Psychological theory and research. N.Y.: McGraw-Hill, 1963.
- Field Services Unit for Physical Education and Recreation for the Handicapped. <u>I CAN: Health and Fitness</u>. Northbrook, IL: Hubbard Scientific, 1974.
- Goldstein, H. The Social Learning Curriculum Level I. Columbus, OH: Merrill, 1974.
- Goldstein, H. The Social Learning Curriculum Level II. Columbus, OH: Merrill, 1975.
- Goldstein, H. Conceptual and structural foundations of curriculum. In H. Goldstein (Ed.), <u>New Directions for Exceptional Children</u> <u>Curriculum development for exceptional children</u>. San Francisco: Jossey-Bass, 1981.
- Gross, J.C. Administrative skills-coping with the future. Forum, 1979, 5 (6).
- Kaufman, R.A. & English, F.W. <u>Needs assessment: A guide to</u> <u>improve school district management</u>. Arlington, VA: American Association of School Administrators, 1976.
- Ornstein, A.C. Curriculum contrasts: A historical overview. Kappan, 1982, 63(6).

Tymitz-Wolf, B. Guidelines for assessing IEP goals and objectives. <u>Teaching Exceptional Children</u>, 1982, 1

Weiner, B.B. (Ed.). <u>Periscope: Views of the individual</u> <u>cation program</u>. <u>Reston, VA: Council for Exception</u> <u>Children, 1978</u>. TITLE: Finding the Rose Among the Thorns: Some Thoughts on Integrating Media Research

AUTHORS: Jay F. Angert Francis E. Clark

title • FINDING THE ROSE AMONG THE THORNS: SOME THOUGHTS ON INTEGRATING MEDIA RESEARCH

Jay F. Angert, Coordinator Technical Training Corporate Patents and Technology Management Hughes Tool Company Houston, TX 77001

> Francis E. Clark, Director Educational Technology College of Education Texas A&M University College Station, TX 77843

presented at the . National Convention of the Association for Educational Communications and Technology, Dallas, Texas, May 1982.

authors o

- title FINDING THE ROSE AMONG THE THORNS: SOME THOUGHTS ON INTEGRATING MEDIA RESEARCH
- authors Jay F. Angert, Coordinator Technical Training Corporate Patents and Technology Management Hughes Tool Company Houston, TX 77001
- Francis E. Clark, Director Educational Technology College of Education Texas A&M University College Station, TX 77843

## Background to the Problem

Through the years there have been frequent calls for research syntheses or integrations (Broudy, 1970, 1972; Clark & Angert, 1980; Kuhn, 1962; Petrie, 1976; Randhawa, 1978). Narrative literature reviews have been quite prevalent in media research, as exemplified by Reid and MacLennon's (1967) review of 350 instructional media comparisons, and Schramm's (1977) review of "big" and "little" media, to name but a few.

Several researchers, most notably Dwyer (1978), also have synthesized in a qualitative fashion the results of research on the realism/relevant cue controversy. As is typical of narrative literature reviews, many of the conclusions which have been drawn on this subject are vague and lack quantitative precision (Clark & Angert, 1981). The series of studies undertaken by Dwyer (1978) and colleagues is unique for its consistency, numerous replications, and longevity in investigating pictorial stimulus complexity as it relates to static instructional visuals. Since guidelines for instructional visual design rely heavily on the conclusions drawn by Dwyer and possibly on the conflicting conclusions about pictorial effectiveness drawn by Samuels (1970) and others, and since none of the reviews of this body of research have employed sampling methodologies which would ensure the inclusion of most of the relevant studies, a quantitative review of pictorial effectiveness was deemed to be a useful adjunct in guiding future instructional design and empirical efforts.

Meta-analysis (Glass, 1977) is the most recently developed methodology for accomplishing quantitative research integration. Meta-analysis research is not new to media research integrations. As one example, Cohen, Ebeling, and Kulic (1981) published a meta-analysis of 74 sta of visual-based college instruction. Unfortunately, media variable this study were still conceptualized in terms of presentation modes technologies. A statistical integration of pictorial complexity, we variables defined in terms of iconic symbols and coding elements, wei still needed.

## The Purpose

It was felt that the use of meta-analysis procedures, as described by Glass (1977), would add quantitative precision to future hypothese and also would help reaffirm the linkage between communication theory and educational technology. Although Glass has suggested that this methodology is particularly well suited for resolving controversies arising from conflicting research results, the philosophical position which guided this investigation was that research integration is best considered a form of exploratory rather than confirmatory research. Accordingly then, the purpose of this study was to generate hypotheses based upon identified differences among the coded variables resulting from a research integration. This integration was limited to the born of research utilizing static iconic visuals in instructional material The major research question that guided this investigation concerned differential instructional effectiveness, as measured by cognitive dependent outcomes (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) attributable to illustration iconicity. The influences of subject gr level, stimulus exposure control, and time of testing were examined will respect to this effectiveness.

#### Procedure

## Locating Reports of Research

Bibliographic search procedures used to locate pertinent studies volved both automated information retrieval and manual searching of selected indices and references known to contain extensive pictorial citations. Computer searching of selected data bases within the DIALOG network was performed on two occasions. Four data bases were searched: Educational Resources Information Center (ERIC), Psychological Abstracts, Sociological Abstracts, and Dissertation Abstracts. A total of 558 potentially relevant citations was derived from automated retrieval methods. The automated search procedures were augmented by a manual search of data-based indices, annual meeting and convention programs, and selected references. Upon completion of both the automated and nanual search procedures, an initial sample pool of 720 research reports was identified.

## Sample Selection

The pool of 720 research reports was reduced to a final sample of 121 data sets (from 151 separate reports of research) by means of a three-tiered screening procedure. Each of the 720 reports was obtained and read in full. These screening procedures resulted in the elimination of non-experimental reports, of research not concerned with iconic treatments or cognitive achievement, and of research with abnormal subjects, inadequate picture descriptions, faulty research designs, or insufficient data.

#### Sample Coding

Four major variables of interest to this study (illustrations, pacing, grade level, and achievement) were coded. Treatment illustrations were coded independently with respect to five physical pictorial attributes: production, shading, context, embellishment, and chroma. Pacing referred to the locus of control over subjects' exposure to treatment illustrations, with "external" coding referring to group-paced (experimenter-controlled) instruction, and "internal" coding reserved for selfpaced (programmed) materials. Grade level was coded in three ways. Kindergarten through college and non-college adult grade levels were

coded independently and with respect to two different categorization arrangements. Achievement was coded in two ways, based upon the time of retention testing.

#### Quantifying and Equating Study Outcomes

The ultimate purpose of the meta-analysis procedures in the present study was to achieve a quantitative aggregation of findings from the various reports of research. To this end, a basic index of achievener effect, called <u>d</u> (Cohen, 1969) or effect size (Glass, 1977) was first calculated for every treatment group comparison. All told, 2,607 effect size measures were generated from the available data.

#### Data Analysis Procedures

Data analysis was performed in three distinct stages. The first stage completed the establishment of the data set through an aggregation of both effect-size and pseudo effect-size values (Glass, 1977). The second stage of the analysis sought to identify potentially significes main effects and interactions among the numerous levels of the coded variables. Since the 47 levels of the 11 independent variables contain far too many main effects and interactions to examine each individually multiple linear regression was used to pare these comparisons to a manageable level. Individual effect-size values served as the units a analysis. The third data analysis stage involved using Tukey's jacked method (Glass, 1977) to calculate a grand mean and separate means for main effects and significant interactions.

# Results

By using the jackknife technique to average the 2,607 effect-size across all studies and all variables, a grand jackknifed mean effect-.51 was derived. This figure indicated that the post-test achievenet score of the average subject receiving some form of illustrated treats was about one-half standard deviation higher than the post-test achievenet score of the average control group member receiving only the verbal treatment. This jackknifed mean was nearly identical to the grand mean effect-size of .52 reported in Clark and Angert (1981).

5

The effect-size statistic is more appropriately considered to be a measure of practical significance than statistical significance, and accordingly, all mean differences between levels of main effects and interactions were interpreted in terms of practical significance. Cohen's (1969) operational definitions of small, medium, and large effect-size differences were applied to the results. A  $\underline{d}$  = .2 represented a small difference in means, d = .5 a medium difference, and d = .8 represented a large difference.

Final results were presented in the form of tables of jackknifed mean effect-sizes for all main effects and for six potential interactions. The effect-size values were interpreted in terms of the size of the mean differences between the predictor variables and verbal control groups, and in terms of the size of the mean differences between levels of the coded variables. The size of the mean differences was equated with levels of practical significance as suggested by Cohen (1969).

Jackknifed mean differences favored colored over black and white illustrations, and illustrations within a context over those out of context, at a small significance level. Medium significance level mean differences were found to favor externally paced over internally paced illustrations, and unembellished drawings over embellished drawings. Insignificant mean differences were noted between shaded and unshaded illustrations, and between immediate and retention testing and between modes of representation (photo versus drawing). The 7-12 and 9-12 grade level groupings attained the highest mean effect-size value. In general, illustration effectiveness increased from K-12 and dropped off markedly for college level subjects. Potential interactions were noted and reported for grade level versus time of testing, grade level and pacing, grade level and chroma, pacing and embellishment, pacing and representation, and representation versus chroma.

Results of the study suggested that:

 Illustrations were most effective with secondary level subject a condition not altered significantly by differences in pacing, chrome or time of testing.

 Externally paced illustrations were more effective than internally paced illustrations, a condition not significantly affected by differences in mode of representation, embellishment, or grade lear

 Colored illustrations were more effective than black and white illustrations, a condition especially noticeable with chirographic pictures, and with college and non-college adult learners.

 Mean differences between modes of representation (in favor e chirographic) were significantly more pronounced for externally paced illustrations, and for colored illustrations.

In general, the results obtained in this study were consistent with the previously reported results of a meta-analysis dealing sole with the past research of Dwyer and colleagues (Clark & Angert, 198) Since the present investigation was not conclusion-oriented, no definitive statements regarding the realism/relevant cue controversy could be derived. These results do, however, provide a means for forming future hypotheses based upon a quantitative aggregation of past research.

## Selected References

- Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. Taxonomy of educational objectives, handbook 1: Cognitive domain. New York: David McKay Co., Inc., 1956.
- Broudy, H. S. On knowing with. In H. S. Broudy (Ed.), Proceedings of the philosophy of education society: Studies in philosophy and education. Edwardsville, Illinois: Southern Illinois Univ., 1970, pp. 89-103.
- Broudy, H. S. The real world of the public schools. New York: Harcourt, 1972.
- Clark, F. E. & Angert, J. F. Inadequacies in media research. Instructional Innovator, 1980, 25(1), 36-37.
- Clark, F. E., & Angert, J. F. Instructional effectiveness of illustration iconicity. Paper presented at the annual meeting of the Southwest Educational Research Association, Dallas, Texas, January 1981.
- Cohen, J. Statistical power analysis for the behavioral sciences. New York: Academic Press, 1969.
- Cohen, P. A., Ebeling, B. J., & Kulik, J. A. A meta-analysis of outcome studies of visual-based instruction. Educational Communications and Technology Journal, 1981, 29, 26-36.
- Dwyer, F. M. Strategies for improving visual learning. State College, Pa.: Learning Services, 1978.
- Glass, G. V. Integrating findings: The meta-analysis of research. Review of Research in Education, 1977, 5, 351-379.
- Kuhn, T. S. Structure of scientific revolutions. Chicago: Univ. of Chicago Press, 1962.
- Petrie, H. C. Do you see what I see? The epistemology of interdisciplinary inquiry. Educational Researcher, 1976, 5(2), 9-15.
- Randhawa, B. S. Visual trinity: An overview. In B. S. Randhawa & W. E. Coffman (Eds.), Visual learning, thinking, and communication. New York: Academic Press, 1978, 191-211.

Reid, J. C., & MacLennon, D. W. Research in instructional television and film. Washington, D. C.: U. S. Government Printing Office, 1967.

Samuels, S. J. Effects of pictures on learning to read, comprehensic and attitudes. Review of Educational Research, 1970, 40, 397-40

Schramm, W. Big media, little media. Beverly Hills, Ca.: Sage Publications, Inc., 1977. TITLE: Development of Aural Perception of Selected Percepts of Musical Form Utilizing Programmed Instruction

AUTHOR: Nicholas Bridges

Nicholas Bridges 917 14th Street Rockford, IL 61108

DEVELOPMENT OF AURAL PERCEPTION OF SELECTED PERCEPTS OF MUSICAL FORM UTILIZING PROGRAMED INSTRUCTION

#### Purpose of the Study

The purpose of this study was to compare the relative en tiveness of three teaching methods, two of which utilized mented programed instructional materials in developing the aural discrimination of percepts related to musical form in undergo uate elementary education majors. Programed lessons recorded audiotape and reinforced with workbook materials were utilize to teach the musical percepts of phrase, theme, introduction interlude, coda, binary form, ternary form, and rondo form. Procedures of the Study

The experimental design chosen for the study was one while incorporated the pretest, posttest, retention test format in experimental vs. control group configuration with assignment groups made via intact classroom units. Because this procedum cannot guarantee pre-experimental equivalence of groups, pretesting procedures helped to establish group equivalence. Desi gathered from pretesting indicated group equivalence in an ab

ty to aurally perceive aspects of musical form, in length of prior musical experience, and in attitudes toward listening experiences.

Internal validity of the study was protected by use of this specific research design, and external validity was protected in great measure by the use of a criterion measure constructed in parallel, equivalent forms.

A pilot study was used to field test materials and to establish reliability and validity for the criterion measure and attitude scale which were used in the main study.

The criterion measure (r=.89) was a test of aural perception skills which used clear examples of various forms chosen from standard repertoire of popular and art music. It was standardized with regard to recorded directions, questions asked and answers expected of students.

The attitude scale (r=.81) was a four-point Likert-type scale with ten positively stated and ten negatively stated statements about listening to music. The statements were arranged by random assignment.

Prior to the experiment a thirteen-lesson unit of linear, self-paced programed audiotaped materials dealing with percepts of musical form were developed by the researcher. Lessons were restricted to a 15- to 20-minute time limit except for the final two which included review materials.

Three treatment groups were used and the same objectives and percepts were utilized in the development of the instructional

156

materials which were presented to these groups. The first enmental group used the individualized programed materials in self-paced format. The second experimental group used the saprogramed materials, but they were presented by a music teat in a whole-class format using the same script as the narrate individualized audiotaped version and the same musical exampl In both experimental groups the students used a workbook which accompanied the tapes. The workbook listed the objectives for each lesson and reinforced visually information which was presented in the programed lessons. The students indicated their responses to questions in this workbook.

Subjects were assigned to experimental treatment groups a intact classes. The total population of 124 subdivided by gra as follows: individualized programed treatment, 43 subjects: whole-class programed treatment, 49 subjects; control, 32 subjects.

The experimental period spanned five weeks preceded by a pretest administration of Form A of the criterion measure and the attitude measure. At the conclusion of this period Form I of the criterion measure and the attitude measure were readistered as posttests. Form A of the criterion measure was rea ministered as a retention test four weeks following the end of the experimental period.

#### Statistical Analysis of the Data

Scoring of individual responses to the criterion measure for pretest, posttest, and retention testadministrations; and

scoring of the two administrations of the attitude scale were conducted, the scores recorded on charts, and statistical procedures conducted. While it is often the practice in studies of this nature to eliminate from statistical consideration scores of those experimental treatment subjects who have completed what is deemed an insufficient number of the lessons contained in the experimental package, this may possibly result in some skewing of results if the same consideration has not been observed with regard to a careful monitoring of the attendance of control treatment subjects upon the lessons presented in that group. Therefore, no subject was eliminated from consideration in the statistical procedures when a full set of scores was available, i.e., three scores on the criterion measure and two scores on the attitude scale.

4

Analysis of variance and covariance were used to conduct those statistical procedures needed to answer the main research questions: (1) Will non-music major university students who have had percepts of musical form presented to them through the use of individualized, self-paced, linear, programed lessons recorded on audiotape score significantly higher on a criterion test than non-music major university students who have had the identical linear, programed lessons presented to them in a large-group, whole-class format? (2) Will the individualized treatment group and/or the whole-class treatment group score significantly higher on a criterion test than non-music major university students in a control group which will not have received programed instruc-

tion in musical form? (3) Which of the two groups that rec experimental treatment will have retained the greatest amo of information presented during the experimental treatment as measured by a retention test administered approximately weeks after the end of the experimental period? (4) Will the dividualized treatment group and/or the whole-class treatment group score significantly higher on a retention test than the control group?

The data which were collected from an experiment involtwo experimental treatment groups and a control group resul from measures of subjects' abilities to perceive musical fo as measured by the criterion measure and from the scores of jects achieved on the attitude scale. All mean scores were jected to analysis of covariance to help determine the equal of means for groups of unequal size; analysis of variance to termine possible significance between pairs of mean scores; the Scheffé range test procedure which also helped establish equality of means between groups and determined significance lack of significance between groups.

The four major research questions which were proposed by the investigator were answered through statistical comparison reported here. The findings were that:

 There was a significant difference found at the .05 is between the two experimental groups, with the mean scores of whole-class group being significantly higher than those obtain by the individualized group on the criterion posttest;

 Analysis of variance between mean scores of all groups on the criterion posttest showed significantly higher scores by both experimental groups versus the control group;

6

3. Analysis of the data obtained from the performance of subjects on the retention test revealed that the whole-class experimental group scored significantly higher at the .05 level of confidence than did the individualized experimental group; and

4. The two experimental groups scored significantly higher mean scores at the .05 level of confidence on the retention test than did the control.

## Conclusions of the Study

Within the parameters of this study the following conclusions were drawn:

1. The ability to discriminate selected percepts related to form, i.e., phrase, theme, introduction, interlude, coda, binary form, ternary form, and rondo form, can be effectively developed in non-music major university undergraduates through the use of programed lessons in both individualized and teacher-presented whole-class formats.

This finding was supportive of the findings of a number of previous studies done in various places, most notably the lengthy series of investigations conducted at Boston University.

Within the limits of this study teacher-presented whole-class programed lessons in audiotape format were found to be signifi-

cantly more effective in developing discrimination of music, than the use of the same programed lessons used in an indiv setting.

Since this study involved the first direct comparison to this author of the use of programed materials for teach musical percepts in the whole-class and individualized setu it was not possible to make direct comparisons to the result of other studies.

3. The variable length of prior music experience consist alone and in combination with the effects of treatment had a statistically significant effect upon the statistical analysis

4. Since no significant change of attitudes were observing in any group, it cannot be said that the experimental treatment in this study led to any significant attitude shift. Recommendations for Future Research

The following topics for future research are suggested

1. A study which further compares the effectiveness of whole-class versus the individualized format for presentation of programed learning materials in the music classroom would pand the findings of this study. Such a study might explore use of other percepts and/or concepts, it could utilize the cepts of this study at the elementary or secondary level, or might utilize the materials of this study in a setting approx to their level of difficulty, e.g., with musically talented school students.

2. A study could be initiated which employed a comparis

of these two programed approaches with a population of gifted students.

3. A study which limited the teaching materials to one type of literature, e.g., popular music, orchestral music, etc., would give further indication of the validity of the findings of this study.

 A study could be done which made a comparison of the relative time and cost effectiveness of these two approaches.

5. Further validation of this study's results could be obtained by using all of the materials of this study in a replication of the study with true random sampling and groups of equal size.

6. Further validation of this study's results could be obtained by using the materials of this study in an appropriate setting with a new criterion and attitude measure constructed specifically for such a study. New figures for reliability and validity would, of course, be necessary.

7. A study is suggested which would employ either the same or different percepts and/or concepts in both the whole-class and individualized programed formats using a branching programed instruction method.

8. A study based on any combination of the above programed approaches could be utilized to develop, refine and standardize a more large-scale instrument for the measure of a student's ability to discriminate a variety of musical concepts.

 The expansion of these materials into some form of computer assisted instruction would provide a valuable area of study.

# TITLE: Young Researcher Award, Acceptance Pre ation

AUTHOR: James Canelos

5/6/82 Dallas, Texas

Acceptance Presentation And Research Study Summary:

1982 Association For Educational Communications And Technology Young Researcher Award, Research And Theory Division

James Canelos, Ph.D. Research Associate In Instruction & Educational Psychology College of Engineering, Office of the Dean The Pennsylvania State University University Park, PA

ANTIS CALLS .....

#### Introduction

Prior to beginning a summary of my research study, I would like to discuss a few ideas on significant current trends in educational research. Of specific importance to us are how these trends affect the research in Educational Communications and Technology.

# Trends In Educational Research

The traditional research paradigm in Educational Communications, adapted from Experimental Psychology, has in the past been a Behavioral research orientation. However, the research orientation in Experimental Psychology and Educational Psychology is now radically changing from a Behavioral orientation, to a <u>mentalistic</u> or Cognitive orientation. Because of this it is becomming much more complex but yet, much more interesting and productive. A cognitive orientation to research opens up a variety of hypothetical and theoretical research questions that Behavioral Psychology simply did not consider, and in many circumstances, did not allow:

Looking at the history of Educational Communications and Technology research, one can easily see how our profession field fits "quite nicely" into a traditional Behavioral researc paradigm. Behaviorism deals with the manipulation of the <u>external</u> learning environment, or external events, to cause some <u>observable</u> change in human behavior. Traditionally, this observable change in behavior, if relatively permanent, has <sup>167</sup> operationally defined as learning by Behavioral Psychologists. In essence, Educational Technology has had as its primary orientacien, in both research and practice, doing precisely this: "changing the external learning environment (e.g., learning conditions) through instructional technology, to cause learning to occur or to improve learning. While this Behaviorist research and practice orientation has been productive, it tends to leave an entire area of human learning untouched. This area of learning untouched by Behaviroistic research paradigms is the internal cognitive area, or the <u>Cognitive Structure</u>. Behaviorism simply does not seriously consider this internal cognitive area of the human learner, and does not attempt to explain learning and memory phenomena related to internal cognitive behavior (e.g., levels of processing - Deep vs. Surface Structures, mnemonic systems, cued/free recall, etc.).

2

Traditional Behaviorism referred to the cognitive structure as a <u>Black Box</u>, and the "father of psychology", Wilhelm Wundt, clearly stated that internal mental events were not open to empirical research. Wundt divided psychology into two divisions: <u>"simple psychical processes"</u>, such as physiological reflexes and sensation which could be studied by direct experimental designs; and <u>"higher psychical processes"</u>, which according to Wundt were, "too variable a character to be subjects of objective observation." Essentially, Wundt decreed that higher level mental processes <u>could not</u> be studied by observation, and, therefore, <u>should not be studied</u>. This type of classical Behavioristic attitude regarding research on human cognitive processes has

persisted to the present, but is no longer totally appropriation Internal cognitive events, mentalistic events, have been they about, experimentally examined and experimentally manipulated leading to improved learning and changed behavior in a number of empirical studies dealing with cognitive factors as indepenvariables. However, until quite recently, traditional Behavior has controlled experimental research in most serious research efforts about learning and instruction.

Wittrock noted in his AERA state-of-the-art address several years ago: "A cognitive approach implies that learning and instruction are scientifically more productively studied as an internally, cognitively mediated process than as a direct product of the external environment. The cognitive approach to educational research is involved with understanding the related or interactions between the learner's cognitive processes and aptitudes; such as, attribution, motivation, encoding, memory cognitive styles, and characteristics of the external environor instructional treatments. Additionally, a cognitive researc design for learning and instruction emphasizes the active and constructive role of the learner and is concerned with internacognitive events not only external instructional events."

Finally (Wittrock), "In a Cognitive research paradigm instruction involves stimulating the learners information processing strategies, aptitudes, and stores of relevant specific knowledge in relation to the information to-be-learned."

For Educational Communications and Technology to remain in the forefront of educational research, it is no longer possib

to adopt only a Behavioral research paradigm, internal cognitive variables should be considered. However, one serious caution in this regard. A cognitive orientation is not rea-ly new, it is not a panecea, and it is not an area in which "we can generate andless adjectives of new jargon". Cognitive research is actually muite old, older than Behavioral Psychology, and really preworld War II vintage. Can anyone tell me from what classical research paradigm Cognitive research stems, (Gestalt Psychology)? The majority of the research questions modern-day cognitive psychologists are considering, including cognitive learning strategies, can be found in the classic Gestalt psychologist's experiments. So before you get started in this area of research, read up on the Gestalt psychologists such as Kohler, Katona, Werthcimer, Wallas, Duncker, Luchins, and Birch. An excellent treatment on Gestalt psychology and cognition can be found in Richard Mayer's delightful text Thinking and Problem Solving, 1977.

#### Research Study Summary

The present investigation experimentally examined the internal cognitive variable of mental imagery representation in the form of a set of learning strategies, under external stimulus visual display conditions, for various learning (information processing) levels.

Internal variables are processes directly affecting the state of the cognitive structure during learning. Such processes range from: sequential and imagery mediation, assimilation and accommodation, accessibility and availability, encoding and decoding, insight, and lateral transfer, to such characteristics of the leraner as expectancy and cognitive style. Internal
processes are influenced or reflected in a number of learning strategies such as, paraphrasing, mathemagenics, hierarchical rules, concretizing, mnemonic memory techniques, and generation rules. Within the context of the present study, learning is synonomous with information processing. Additionally, learning has been operationally defined as a three step cognitive procof: abstraction, encoding, and retrieval. Abstraction is the selective perception of to-be-processed information, encoding is the mental storing of information and retrieval is the sean and decision process leading to recall.

Both internal and external variables were considered in the present investigation, the specific internal variable of concern in this study was mental imagery mediation (e.g., image representation of stimulus events). The imagery mediation precess was operationally related to a set of three information processing strategies that varied in the amount of cognitive organization they tended to impose upon information during learning. The three levels of the strategy variable were called the <u>copy strategy</u>, the <u>relational strategy</u>, and the <u>hierarchy</u> strategy.

The information processing advantage of the <u>copy</u> <u>strategy</u> is that it required the subject to form a vivid mental image of the perceived visual stimulus display. The developed of the copy strategy was based upon the general research concle that imagery mediation facilitates learning due to the information processing advantage of dual-coding. Dual-coding is the multiple encoding of processed information into a sequential of (e.g., verbal trace) and a spatial code (e.g., imagery trace).

The relational strategy provided for the processing advantage of dual-coding as well, however, the relational strategy soves one step farther to facilitate information processing with the use of a peg-mnemonic memory procedure. A peg-mnemonic memory procedure will facilitate the assimilation and accommodation of to-be-acquired information by providing a pre-existing cognitive framework for the newly learned information. The pegmemonic technique employs the same process as a rhyme mnemonic, except the pre-learned conceptual pegs in this case were a set of pre-learned images instead of a rhyme. The psychological basis of this memory technique can be found in David Ausubel's "meaningful learning theory." Ausubel notes that relevant material being available in the cognitive structure facilitates the assimilation and accommodation of new information. Relevant available information will tend to provide a cognitive organizational framework that will facilitate the encoding of new information, allowing for meaningful learning rather than rote learning.

6

The hierarchy strategy had the processing advantages of both imagery mediation and a mnemonic memory system, however, an additional processing step is implemented by using this strategy. Subjects using the hierarchy strategy learned to place each bit of imaged information into a logical network of interrelated data. With this memory strategy, the subject was able to relate each imaged bit of information to the next most logically related portion of information during information processing. Encoding new information into a logical taxonomy allows the subject to form a cluster of information that would be logically related

in terms of content meaning, and psychologically related in the of the individual's meaning interpretation. This newly forme, cluster of information tends to be more stable and clear than memory traces without a taxonomic interrelation of information. Additionally, the formation of a mental hierarchy of informat, will tend to facilitate the search and decision process during information retrieval of the available memory store. The theoretical basis for the hierarchy strategy stems from two research conclusions. First, what is stored in memory tends to be stored in a network fashion. Secondly, by imposing a hierar structure on input material during encoding, subsequent search and decision activities leading to the effective retrieval of available information tends to be facilitated.

The external variable examined in this study was the visual stimulus complexity variable. There were three levels of the visual complexity variable ranging from simple to comple in visual design. The visual display levels constituted the visual portion of three slide-tape instructional programs making up an instructional presentation about the human heart. The relevant to-be-learned academic information presented in each program was identical. In the 3 instructional programs, the three levels of visual complexity varied only in the amount of irrelevant data contained in the visual display. The first level of the visual complexity variable consisted of line drawings of the heart and its appropriate parts. This level was labeled the simple visual display, the majority of focal information <sup>17</sup> this visual display was relevant information. The second level

1.6.1

of the visual complexity variable was the intermediate visual display and consisted of a detailed color illustration of the heart and its parts. In this visual design, relevant focal information and irrelevant focal information were approximately equal in amount. The third level of the visual display was the complex visual design. The complex visuals were realistic photographs of a dissected heart. The complex visuals contained more irrelevant focal information than relevant focal information, relevant focal information tended to be embedded in the surrounding visual context of irrelevant information.

3

An additional area of interest in this study was the retnetion of information over time. It seems likely that if learners can be taught to use effective learning strategies that facilitate the acquisition and retrieval of learned information, the delayed retention of data would be improved. The delayed retention was examined in this study after a period of one week.

I would now like to provide a brief overview of the theoretical and experimental literature in the area of cognitive learning strategies.

The human learner will develop information processing strategies during development by the interaction of the genetic self and the social environment. Such natural information processing strategies are referred to as cognitive styles (Kagan, Moss, Siegel, and Hunt). Natural processing strategies of this type have also been referred to as executive systems (Gagne). Gagne implies that all aspects of the cognitive self are controlled by such

cognitive strategies. These natural information processing s seem to be quite permanent in nature. Rigney has investigated relationship between internal cognitive information processing functions, natural learning strategies and training learners general learning strategies and concluded that a learning straapproach to improving learning would be effective. Rigney not "Self-imposed cognitive strategies are always alternatives to instructional systems with built-in instructional strategies of which the student is never aware. Teaching students how t learn and how to retrieve what has been learned, as the primary objective might in fact, be done best by an instructional system, and having been taught these skills, students might profit more from an instructional system with the primary object: of teaching content."

Investigating strategies and learner ability Goldman and Hudson compared high, middle, and low quality point average subjects, and concluded that learners differed on type of strategy used to acquire information but not necessarily on all levels. This result implies that strategies are critical in determining academic success. In a discussion of learning skill Bower feels that schools should teach memory and retrieval stat as a part of the curriculum, he notes that such strategies are critical for intellectual development as learning basic subject Dansereau, Actkinson, Long, McDonald found that an exclusive concentration on instructional techniques may force learners to adopt non-transferable or inadequate learning strategies. Danset. al., defined a learning strategy as a method of cognitively This definition implies that a learning strategy is actually tool to aid the learner in effectively encoding and retrieving learned information. Dansereau designed three learning strategies based upon experimental work in mathemagenics, meaningful learning theory and imagery mediation. Of the three strategies designed and tested, the paraphrase strategy based upon advance organization, and the imagery strategy, based upon imagery representations of stimuli proved highly successful.

5.52

Of specific interest to the present investigation is that the use of imagery learning strategies has been found to be promising by a number of researchers in producing significant facilitative affects upon learning. Danner and Taylor found that their relational imagery condition proved most effective in learning paired-associates. Relational imagery subjects were instructed to form an image of the pair that would relate the stimulus and response terms in some way. This condition proved most effective over an integrated illustration presentation of the pair and an integrated illustration plus imaging the illustration condition. Their results may be interpreted in terms of a more meaningful learning of information when the subject was generating his own particular image between pairs. Similar results were reported by Persensky and Senter who instructed subjects to generate bizarre imagery. In a prose learning study, Rasco, Tennyson and Boutwell found that instructions to form an image, or the presentation of an illustration, significantly increased learning over the control. This result may be interpreted as showing that a similar cognitive process occurs, evoking of sensory imagery,

1 4/1

during imagery strategy use, or during the perception of a pice presentation. Dealing with a sentence learning task, Anderson Hidde reported an interesting and unexpected result using as the experimental design an incidental learning task. Subjects were asked to rate thirty sentences, allegedly for some future experimental study. One group was asked to rate the sentences for we meaningfulness, (verbal group), the other group was asked to rathe sentences for image evoking potential, (imagery group). The the assigned task was completed, a surprise comprehension and retention test was given about sentence content. The imagery of produced a dependent mean score three times higher than the vermeaning group.

Research with content-independent imagery learning st gies has generally concluded that strategies can be effective a significantly facilitating information processing. However, current trends in the schools are still towards more traditional uses of external instructional strategies rather than internal cognitive learning strategies. Weinstein noted, "We tell our students what to learn but we say nothing about how to go about learning. The assumption that the abilities involved in learning are either innate or naturally acquired by every child is proincorrect."

As I mentioned earlier, the experimental design implia 3 x 3 x 2 mixed analysis of variance with two between-subject factors and one within-subjects factor. The first between-subj factor was type of learning strategy (copy, relational and hid The second between-subjects variable was visual stimulus comp<sup>10</sup> (simple visual design, intermediate visual design, and comp<sup>10</sup>

1'75

visual design). The within-subjects factor was retention of information over time (immediate and delay of one week).

Two dependent measures were used for data collection. These measures represented different types of information the learner had to acquire from the instructional materials. A cued recall measure was used in the form of a forty item multiple choice examination, this measure was called the Terminology and Comprehension test. The Terminology and Comprehension test measured the amount of <u>general concept information</u>, e.g., <u>conceptual</u> information, acquired from the slide-tape instructional program.

1.2

The second dependent measure was a free recall measure. This measure was called the Drawing test. The drawing test required the subject to develop a rough sketch, from memory, of the heart. The drawing test was scored in three different ways, yielding three individual sets of data:

1) drawing test part I; Name Part/Any Placement

drawing test part II; Part Named/Error of Placement

3) drawing test part III; Adjunct Relationships of Parts. Each part of the drawing test represents a measure of a <u>different</u> <u>level of information</u> that could be acquired from the visual instructional display. Part I, Name Part/Any Placement, represented a simple list learning information processing task. In this case, the subject had to acquire the names of the parts of the heart only, and be able to list them on his or her heart sketch. Part II, Part Named/Error of Placement, represented a spatial learning task. The error of placement score was derived by tallying the number of parts of the heart correctly named but incorrectly placed

on the subject's heart drawing. This measure identifies an ada tional aspect of information processing beyond retention and reof a list of names. In this case, the subject must not only le the part name, he or she must also learn its correct location within the set of all parts. This learning task represents a higher level of, or more difficult, learning than simply learning the list of parts since now spatial information must also be acquired. A low error score indicates that the subject tended to acquire the location information and a higher error score is indicative of the inverse. Part III of the drawing test repres a measure that evaluates information acquisition at a more diff. learning level than list learning (Part I) or spatial learning (Part II). An additional level of information must now be accus "how each part of the heart functionally relates to the next nor adjacent part during heart operation". For Part III, subjects were required to indicate on their heart sketch parts of the her that functionally related during heart operation. The understanding of these "part-to-part" relationships and "among part" relationships represents a conceptual knowledge of the basic con tions of the heart during the diastolic and systolic phases of operation. This relational concept knowledge is clearly a differ level of information processing than list learning or spatial learning, and a more difficult learning level.

I won't go into a detailed discussion of the experiment procedures, subjects and apparatus. Additionally, at the present time, a comprehensive review of the resulting data sets would be far too time consuming. However, I will provide you with a grad

verview of the results, in terms of discussing the dependent easures and independent variables and their effects. Also, I cold like to mention that a complete presentation of the study an be found in an upcoming issue of <u>Journal of Experimental</u> <u>sucction</u>, Fall or Winter 1982. 1.0

Although all three strategies used imagery representations an information processing mode, they varied in the amount of emitive organization imposed on encoded data. The hierarchy trategy resulted in the most effective information processing the three strategies. The hierarchy strategy was significantly etter on the Spatial Learning task (Part II-Drawing Test), the elational Concept task (Part III-Drawing Test), and the Terminology d Comprehension test. No differences occurred on the list earning task. This implies that subjects using the hierarchy trategy had a significant information processing advantage. It I likely that this processing advantage resulted from the condition storing new information in a logical network or hierarchy of data. ring encoding, this condition permitted a more efficient assimilaon and accommodation of new information. An efficient encoding age would allow the hierarchy strategy to overcome the debilitang effects of increasing visual complexity. This may explain e hierarchy strategy's significant effects on the Terminology d Comprehension test regardless of Visual Display Complexity and me, resulting in the Second Order Interaction. Increased sual complexity increases abstraction time and effort and therere, decreases available encoding time. The only compensator for is condition would be a more efficient encoding stage during

information processing. The network cluster of data would als provide for established retrieval cues to facilitate the recal information within the cluster. The retrieval cues in this ca may have consisted of the superordinate information in the stc network. Additionally, once this single network of informatic retrieved, the available data in this network would tend to be more accessible, so retrieval was not a matter of a search and decision through the entire memory store, but a matter of reca a single network of data. After this network was retrieved, i probable that subsequent retrieval activities consisted of car out a search and decision through this single stable and clear cluster of interrelated data.

The relational strategy used as a basis imagery medi having the processing advantage of dual-coding. This strategy provided for the additional processing advantage of a peg-mnem system, making pre-learned information available in the cognit structure to facilitate future learning. This condition provide a cognitive context to relate new information to form the inst tional program. During encoding, new data could be efficiently assimilated to the cognitive structure because of this prelear available information. The relational strategy differed signifiered cantly from the copy strategy on Part III of the drawing test. This difference approached significance on the Terminology and Comprehension test. However, the two did not differ on Part I or Part II of the drawing test. The peg-mnemonic system using imaged cognitive pegs, was a slightly better information processing strategy than the copy strategy, employing only dual-co as an information processing advantage.

The copy strategy had the processing advantage of dualoding via imagery mediation. This allowed the subject to store imaged code and a complementary propositional code. Multiple modings of this type prove to be effective devices to facilitate infining. The copy strategy had the disadvantage, however, of a global" processing; in other words, the subject imaged the entire infinial display and attempted to store it globally in memory. This east that the subject had to store all information, both relevant infining, this may have placed a considerable cognitive strain on the memory system.

12

The three strategies produced differential effects during information processing. All strategies had as their representational basis, of perception, imaged mediation. The difference in tearning effectiveness appears to occur as a result of differences in the cognitive organization of processed information. As a more effective cognitive organization of information was provided for by the hierarchy and relational strategies, improved learning intromes occurred, especially for the more difficult levels of the information processing tasks (e.g., general concept learning on the Terminology and Comprehension test, and relational concept earning on Part III of the Drawing test).

The external domain of instructional design considers w materials are to be sequenced and mediated. This is a critical consideration when making decisions about solving instructional design problems. The results of this study in this regard generally complement the findings of classical research in this area. The simple visual display provided for the most effective and efficient

information processing. This display contained essentially revant information with enough background to give a logical cont. to the drawing. The simple visual display tended to minimize abstratcion process and permitted the subject to put more time and effort into encoding the information. The intermediate vis display contained an approximately equal amount of relevant an irrelevant information. This tended to make abstraction more cult, because of this the intermediate visual display was less effective than the simple. The complex visual display contained more irrelevant than relevant information, this condition would tend to cause a debilitating effect to occur on information pro cessing. The complex display required a maximum abstraction t and effort. By maximizing the abstraction effort, the encoding stage of information processing suffered. This situation may caused less relevant data to be ultimately encoded into the co tive structure. The most effective external conditions for fe materials are those requiring a minimum of abstraction (e.g., separation of relevant from irrelevant) by the learner.

This study implies that instructional system research should consider both the external and the internal conditions learning and specifically research in cognitive areas. Futurresearch in the area of learning strategies should consider the design and refinement of various types of cognitive learning strategies. The basis for developing these strategies should functionally related to the organic mediational processes occur in the cognitive structure during information processing. Additionally, external conditions should be evaluated relative to the total

effectiveness when certain types of learning strategies are used. Once learning strategies have been designed, tested, and refined, they should become a critical part of the learning of school students in the primary years of intellectual development. Learning strategies should become second nature to students in a similar way that the recursive rules of multiplication have become second nature. At present, this critical variable in learning ability, acquiring effective learning strategies, is left to haphazard development by the learner. Although researchers in instructional systems are approaching the issues related to internal cognitive facotrs and their specific affects upon learning, as Weinstein has indicated, much is left to be accomplished.

TITLE: Content Independent Learning Strategies Their Relative Effectiveness on Acquiring Concept Information and Spatial Informa When Learning From Visualized Instruct

> p. 184-196

AUTHORS: James Canelos William Taylor James Altschuld

Content Independent Learning Strategies And Their Relative Effectiveness On Acquiring Concept Information And Spatial Information When Learning From Visualized Instruction

James Canelos, Ph.D. Research Associate in Instruction College of Engineering The Pennsylvania State University

William Taylor, Ph.D. Assistant Professor of Education Educational Foundations And Research The Ohio State University

James Altschuld, Ph.D. Assistant Professor of Education Educational Foundations And Research The Ohio State University

Association for Educational Communications and Technology Research and Theory Division 1982 Dallas National Convention

### Introduction

Research on the topic of learning strategies and naturally ocur information processing strategies is currently receiving a signific amount of attention in the areas of Cognitive Psychology and Experi-Psychology. Learning strategies investigated relate to the internal cognitive representations of information in imagery and sequential Additionally, such learning strategies tend to be independent of star fic content to-be-learned or the specific instructional method. The following study further investigated the research topic of contentindependent learning strategies. Specifically, two learning strategies were evaluated for facilitating learning on two types of information processing tasks. The two strategies evaluated were the Network Stre and the Rote Strategy. The Network Strategy had the information presing advantages of imagery, a peg-mnemonic and a hierarchical retrieve system. The Rote Strategy elicited a stimulus-response type of len Stimulus-response learning, or incremental learning, can be defined rote learning and is the opposite of insightful learning or a hypol testing type of strategy. The two information processing tasks were spatial learning and concept learning. The Network Strategy was on both learning tasks and the Rote Strategy performed much like control group on both the spatial and the concept task.

### Summary of Cognitive Learning Strategies

The current emphasis with research in cognitive learning strate while still theoretical in nature, has stressed content-independent learning strategies. The content-independent learning strategy is p tively independent of a specific academic discipline, course subject instructional method, (Rigney, 1978). Therefore, the content-independent learning strategy could be used across subject areas to help learners acquire facts, concepts or procedures. The content-independent learning strategies investigated operationally relate to the mental or cognitive nanipulation of information to-be-learned, and have been aimed at improving the general information processing skills of the learner (Dansereau, Long, McDonald, Actkinson, Ellis, Collins, Williams, Evans, 1975). Dansereau et.al. (1975) have concentrated on imagery learning strategies, paraphrasing strategies and question/answer mathemagenic learning strategies, and found considerable success with the imagery and paraphrasing learning strategies, (Dansereau, Actkinson, Long; 1974);

> "The training program dramatically improved long-term retention of academic material. Consistent differences between the three training groups indicated that the paraphrase and imagery techniques should undergo further refinement and testing, the question-answer strategy should be dropped."

Content-independent learning strategies that are related operationally to a specific cognitive representational system (e.g. imagery, propositional, or dual-coding) have been particularly successful in producing significant differences between experimental and control groups. Hilgard and Bower (1975) refer to dual-coding as an explanation for the large differences in dependent means between experimental and control groups in imagery and imagery strategy studies. Hilgard and Bower (1975):

> "A large number of learning experiments have now been done indicating that imaginal or pictorial representations of information usually facilitates memory by factors ranging from 1.5 or 3.0, (p. 588)."

2

Learners can be taught to use specific information processing of learning strategies that relate operationally to the cognitive representational systems, however, a number of naturally occurring information processing strategies have been identified by Bower (1972) Bower (1972) points out that learners do develop information process strategies on their own, and he identified the:

3

Search for meaning strategy

- (2) Generative rule strategy
- (3) Mnemonic pegword system
- (4) Hierarchical retrieval strategy

All of these information processing strategies occur naturally, and a relate operationally to the cognitive representational systems. In search for meaning strategy the learner compares new information to existing information in the cognitive structure in an effort to find ing in the new information. This behavior was originally noticed by Bartlett as early as 1932, and he labeled it "effort after meaning." (Mayer 1977, p. 107). The generative rule strategy is actually a contual rule. The concept rule allows the person to efficiently deal stimuli by allowing the categorization of information into a concept catagory or out of that category.

The mnemonic pegword system is a particularly powerful memory strategy. The mnemonic pegword usually involves imagery, such as the loci method or rhyme mnemonic method. As many of you may have observe a mnemonist showman can easily recall 50-60 individual names perfect after hearing them once! Finally, the hierarchical retrieval system operates on the idea of "clusters" of information being stored, with cluster of data being logically interrelated forming a network or hierarchy. For example: if you have 100 items to recall, and can identify 5 clear categories of data, it would be more effective in terms of retrieval, to store the data as 5 clusters of 20; than to try to commit to memory 100 independent bits of information! In this case each cluster represents a stable and clear set of stored information. Additionally, once the cluster of related information is retrieved the subordinant elements in the cluster, could be easily recalled. The idea of memory sets and the storage of clusters of information is directly related to Tulving's (1968) now classic theory on subjective organization. Gagne (1977) also considers the idea of naturally occurring information processing strategies and operationally defines them as an acquired skill. Essentially, Gagne considers learning strategies the acquisition of skills involving 'learning how to learn.'

4

However, while a number of learning strategies which regulate information processing do occur, they will tend to vary in effectiveness, (e.g. consider the difference between learning for rote and learning for meaning). Goldman and Hudson (1973) compared high, middle and low, grade point average high school learners and found them to vary significantly on type of learning strategy used not on innate intellectual ability. Weinstein (1978) indicates that the assumption most schools make is that learners are equipped with effective learning strategies when they arrive at school at the primary levels. She goes on to indicate that this is a total misconception and should be remedied by training learners to use effective learning strategies.

### Design and Procedures

The present study further investigated the topic of cognitive ing strategies. The two learning strategies evaluated were the Nets learning strategy and the Rote learning strategy. Learning perform was evaluated on a concept learning task and a spatial learning task To-be-learned content information was presented to learners via a sh tape instructional program on the topic of the diastolic and systels operations of the heart. There were two media formats making up two separate slide/tape programs:

- (1) line drawing slide sets with a color background
- (2) illustration slide sets in color (adapted from Dwyer 1967).

Additionally, there was a repeated measures factor, a one week delay testing. The experimental design of this study was a 2x3x2 mixed an of variance with repeated measures.

		Line Drawing Slides	Color Illustra: Slides
Immediate Testing	Networking Strategy		
	Rote Strategy		1
	Control Group		
Delay Testing	Networking Strategy		1
	Rote Strategy		
	Control Group		

Example of experimental design.

The network learning strategy was a combination of a mnemonic pegword strategy and a hierarchical retrieval strategy (e.g. previously discussed in Bower, 1972). Subjects using the network strategy had the information processing advantage of imagery, a mnemonic memory device, and a hierarchical retrieval system. Subjects learned to use the network strategy in a training session conducted by the experimenter. Through a detailed set of explanations and practice they learned how to; form mental images, use a peg-mnemonic and use a hierarchical retrieval system. The rote learning strategy group learned to perform a stimulus-response type of learning. They learned to memorize by associating each element to the next element in the set of to-be-learned data, until the entire set could be recalled. This 'mental association' of stimulus elements resembles a typical rote learning procedure students often use in academic learning situations, (e.g. memorizing a list of dates, a listing of poet's names, etc.).

Subjects consisted of 60 graduate and undergraduate students from the Ohio State University. Subjects were pre-tested via an interview to determine prior knowledge with the content material they would learn later (e.g. diastolic and systolic heart phases). Significant prior knowledge levels were not evident. All 60 subjects were then randomly assigned to one of the three strategy groups; (1) networks, (2) rotes, (3) controls.

Subjects were trained on the use of their strategy from a set of pre-prepared instructions read to them by the instructor. Each strategy training session lasted 30 minutes and subjects were kept on-task for the entire 30 minute period. Subjects were trained in small groups of 3 to 6 at a time. Subjects learned and practiced their strategy by viewing a set of of 16, 2x2 slides. The slide set consisted of illustrations of a

190

water pump filtering system, with one slide showing the overall system and the 15 other slides showing each part making up the system. Each slide also contained a label naming the particular part shown. The Networks and Rotes both used the same training slides, but of course they were required to perform different tasks during strategy training. The control group also saw the set of slides used to train the other two groups. The control group was told that they were to evaluate the media quality of the slides. Their evaluation session lasted 30 minutes. The training slide set was shown to the controls to avoid contamination effect due to advance organization.

7

The following day subjects were randomly assigned to one of two slide-tape programs about the parts and functions of the human heart. The content in the two programs was identical, they varied only in the complexity of visualization. One program consisted of slides that were line drawings, the other program consisted of a set of slides that were color artist illustrations of the heart. The slide-tape plogram lasted exactly 22 minutes. After the program was over two dependent measures were given subjects. One measure was a concept learning task, the other a spatial task. The concept learning task was a 20 item multiple-choice test which tested general concept learning. The spatial task required the learner to correctly label all the parts of the heart in the drawing. There were two forms of the spatial task dependent measure. One form was an illustration drawing of the heart, which resembled the artist's illustrations in one of the slide-tape programs. The second form was a line drawing of the heart, which resembled the line drawings in the other slive tape program. This was done to eliminate any contamination due to type of cues provided in the drawing and the type of slides seen in the slide" tape program. Subjects seeing the line drawing slide-tape program

received the line drawing spatial task measure; subjects seeing the illustration slides received the illustration spatial task measure. The spatial task was a cued recall task and had 17 possible points. Both the slide programs and the dependent measures were adapted from Dwyer (1967). One week later subjects received both dependent measures again as a measure of long term retention.

#### Results & Discussion

Two separate analysis of variance with repeated measures (ANOVR) were conducted on the dependent measures, one for the concept learning task, one for the spatial learning task. The statistical design implied a 2x3x2 ANOVR. Follow-up tests were conducted on significant effects, where required using a Tukey method set at .05 alpha.

The concept learning task dependent measure represented a general concept learning ability. The measure consisted of 20 multiple-choice items of relational concept questions and conjunctive concept questions. The concept learning measure analysis yielded significance on the strategy variable, F,(2,54 df) = 5.014, p = .01. Follow-up testing found the network strategy ( $\overline{X}$ .= 12.98) to differ significantly from the control group ( $\overline{X}$ .= 9.73). The network strategy ( $\overline{X}$ .= 12.98) did not differ significantly from the rote strategy ( $\overline{X}$ .= 10.4), however, the mean's difference approached significance. The rote strategy ( $\overline{X}$ .= 10.4) did not differ significantly from the control ( $\overline{X}$ .= 9.73).

The network strategy provided for a more effective information processing of material from the slide-tape program for later performance with a concept learning task. Interestingly, the rote strategy did not differ significantly from the network strategy, indicating that even a low level information processing strategy is better than no strategy.

192

However, it can be argued that the controls did use their own idiosyncratic strategy, which may have been similar to a rote strategy since these two means are so close (e.g.  $\overline{X}$ , rote=  $10.4/\overline{X}$ , control= 9.73).

9

No significant interactions occurred in the concept task analysis. The time variable yielded significance F,(1,54 df) = 36.3, p = .004, indicating a general difference between immediate testing ( $\overline{X}$ .= 11.58) and delayed testing ( $\overline{X}$ .= 10.48). However, this is not a particularly interesting finding.

The spatial learning task was a cued recall measure. The subject had to correctly label each part of the heart discussed in the slidetape program. Analysis yielded significance on the strategy variable F,(2,54 df) = 13.904, p = .0001. Follow-up tests indicated that the network strategy ( $\overline{X}$ .= 12.98) differed significantly from the rote strategy ( $\overline{X}$ .= 8.93). The network strategy ( $\overline{X}$ .= 12.98) differed significantly from the control ( $\overline{X}$ .= 6.85). However, the rote strategy ( $\overline{X}$ .= 8.93) did not differ significantly from the control ( $\overline{X}$ .= 6.85).

The network strategy provided learners with an information processing advantage by allowing them to more effectively encode information from the slide-tape program for later retrieval for performance on the spatial learn ing task. The rote learning strategy apparently acted much like the learn idiosyncratic learning strategies in the control group. It can be conclude from this result that subjects in the control group tended to use a processing strategy quite similar to a rote strategy. This put both groups at an information processing disadvantage when compared to the network strategi

The strategy by time interaction was significant,  $F_{1}(2,54 \text{ df}) = 16.34 \text{ p} = .01$ . Follow-up testing finds the source of the interaction to be with the rote strategy and the control. The network strategy means did not

differ across the time period of one week ( $\overline{X}$ , immediate= 13.3;  $\overline{X}$ , delayed= 12.65). However, a significant amount of information was lost between the immediate and delayed testing period for the rote strategy ( $\overline{X}$ , immediate= 9.95;  $\overline{X}$ , delayed= 7.90), and the control ( $\overline{X}$ , immediate= 8.45;  $\overline{X}$ , delayed= 5.25).

The strategy by time interaction results are particularly interesting since the network group clearly outperformed the rotes and controls in terms of retrieval over the time period of one week. The conclusion from this is that an effective information processing strategy does improve the encoding of information as well as the retention of information for later retrieval. Interestingly, the control group's idiosyncratic learning strategy was quite similar to a rote strategy, since these two groups did not differ in their pattern of performance. This implies that many learners may be using a rote strategy when in a unique learning situation.

The other interactions in this analysis were not significant. Significance was found on the time variable, F=(1,54 df) = 35.34, p = .0001. However, this result is not interesting and simply indicates a general loss of information over time ( $\overline{X}$ , immediate= 10.57;  $\overline{X}$ , delayed= 8.6).

### Directions for the Future

The results of this study imply that learners can benefit from learning strategies of a content-independent nature. Additionally, strategies that are designed to facilitate the learner's encoding, retention and retrieval of information, by training them to mentally manipulate information, can be effective for typical learning tasks. Finally, it seems that learners may employ a rote type of learning strategy when left

. 194

to their own, in some cases, putting them at a disadvantage in the ing situation. Further research is needed in the area of contentindependent learning strategies. Future research efforts should re specific strategies that can be used by learners to facilitate their learning on typical academic learning tasks. A key factor in succe on academic learning tasks is the type of <u>cognitive</u> information prosing strategy used by the learner, yet little applied conclusions is been made in this vital area so learners can be provided with a variof learning strategies aimed at facilitating their learning.

### References

- Bower, G. H., A Selective Review of Organizational Factors in Memory, in Tulving, E. and Donaldson, W., <u>Memory and Organization</u>, N.Y., Academic Press, 1972.
- Dansereau, D., Long, F. L., McDonald, B. A., Actkinson, T. R., Ellis, A. M., Collins, K., Williams, S., and Evans, S. H., <u>Effective</u> <u>Learning Strategy Training Program: Development and Assessment</u>, <u>AFHRL-TR-75-41</u>, Contract F41609-74-C-0013, Lowry Colorado AFB, 1975.
- Dansereau, D., Actkinson, T. R., and Long, G. L., <u>Learning Strategies</u>: <u>A Review and Synthesis of the Current 'Literature</u>, ERIC, ED-103/403, 1974.
- Dwyer, F. M., Jr., <u>A Study of the Relative Effectiveness of Varied</u> <u>Visual Illustrations</u>, U.S. Dept. of Health, Education and Welfare, Office of Education, Bureau of Research, Project #6-8840, grant #)EG-107-068840-0290, 1967.
- Gagne, R. M., <u>The Conditions of Learning</u>, N.Y., Holt, Rinehart, Winston, 1977.
- Goldman, R. and Hudson, D. A., A multivariate analysis of academic abilities and strategies for successful and unsuccessful college students in different major fields, <u>Journal of Educational</u> Psychology, 1973, 65, 364-370.
- Hilgard, E. R. and Bower, G. H., <u>Theories of Learning</u>, Prentice-Hall, Inc., N.J., 1975.
- Mayer, R. E., <u>Thinking and Problem Solving</u>, Scott, Foresman and Co., Glenview, Illinois, 1977.
- Rigney, J. W., Learning Strategies: A Theoretical Perspective, in O'Neil, H. F., Jr. <u>Learning Strategies</u>, N.Y., Academic Press, 1978.
- Tulving, E., Theoretical issues in free recall. In Theodore R. Dixon, and David L. Horton, (eds.), <u>Verbal Behavior and General</u> Behavior Theory, Prentice-Hall, Inc., N.J., 1968.
- Weinstein, C. E., Elaboration Skills as a Learning Strategy, in O'Neil, H. F., Jr., <u>Learning Strategies</u>, N.Y., Academic Press, 1978.

# TITLE: Linking Teacher Theories to Teacher Practice

# AUTHORS: Carol Carrier Karla Melvin

### LINKING TEACHER THEORIES

TO

### TEACHER PRACTICES

Carol Carrier University of Minnesota Minneapolis, MN

Karla Melvin COMSERV Corporation Mendota Heights, MN

The authors gratefully acknowledge the support services provided by COMSEN Corporation (Mendota Heights, Minnesota) in the preparation of this paper. relationships among teaching style orientations, expressed perceptions of teaching-learning process, actual classroom behaviors and learning styles.

ix full-time faculty in a dental auxillary program at a large teaching institution agreed to be interviewed, to complete several inventories, and to ove their classroom teaching observed. Although the small sample precludes ineralization of results, the purpose of the study was to explore the estibility and yield of information from this combination of methods.

## mulicit Theories of Teaching

acher's personal theory." Such theories are idiosyncratic because the eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the environment in which he or she eacher's personal characteristics and the shory and comprehensiveness.

hese personal belief systems or theories appear to affect how teachers efform in the classroom. Evidence suggests, for example, that these sets of sumptions and beliefs are reflected in the ways teachers structure learning roups (Janesick, 1977), select curriculum materials (Duffy, 1977), and inceptualize students (Hunt, 1976). To some degree, teachers appear to plan, interact with students, and perform other teaching activities in ways that are consistent with their implicit theories.

1

Argyris and Schon (1974) contend that people may have inconsistencies between their espoused beliefs and their behaviors. The authors say that if a situation demanding behavior or theory change is to occur, "events must emphasize the conflict between espoused theory and theory-in-use in ways to overcome normal attempts to avoid noticing the conflict" (p. 31).

Understanding teachers' current perceptions, or helping them make explicit their implicit theories, is an important precursor for encouraging change. Knox (1977) confirms this notion:

Usually, when an adult sets out to learn about something it is related a large amount of experience and information that the adult already possesses. The person's current understanding of the topic or problem typically organized around his or her previous encounters with it. (Mo 1977, p. 428)

### Teaching Styles

Teaching style typologies represent another way to understand how teachers view their roles. The Teaching Style Q-Sort, developed by Michael Heikking (1977), is designed to identify teachers' tendencies toward four different teaching orientations. These four families of orientation are described by Bruce Joyce and Marsha Weil in their book, <u>Models of Teaching</u> (1977). The <u>social interaction</u> models emphasize interactions among the student, other people, and society. Priority is given to social relations and creating a better society. <u>Information-processing</u> models are concerned with how stude collect, organize, and store information as well as how they solve problem <u>Personal</u> models emphasize the personal development of students. Teachers strong on this orientation stress the personal psychology, self-concept, self-image, and creativity. <u>Behavior modification</u> models emphasize the careful delineation of goals and objectives, the measurement of observable behaviors, and the establishment of external conditions to shape student learning.

# opervation of Teaching

to examine links between teachers' perceptions of their teaching and actual teaching practices, several class sessions were observed for each teacher in the sample. A modified version of Goldhammer's (Goldhammer, 1969) method of note-taking was used. This system consists of recording in writing what is seen and heard in the classroom as completely as possible.

The role of the observer is to record perceptions, not to make inferences. Data analyses involve detecting patterns of behavior. This is done by scanning the notes for the repetitious use of particular behaviors, reading the notes for substance, and then deleting value judgments the observer has ande. Assigning patterns to catagories is then accomplished by fitting descriptions to sets of patterns.

Finally, these patterns of behavior are arranged in a hierarchy by evaluating their relative importance in terms of three criteria: saliency, fewness, and treatability. (Carrier and McInerney, 1981)

#### Learning Styles

whother factor which may contribute to how teachers deliver instruction is suggested by the research on learning styles (Price, Dunn & Dunn, 1977; Sadler Plovnick, 1978). Learning style refers to an individual's characteristic ade of gaining, processing, and storing information during an educational experience. Learning styles are considered to be relatively stable traits which affect a wide range of behaviors. A prominent theory base for the concept of learning style emerges from the work of David Kolb (1975, 1981), who proposes a model of experiential learning to explain adult learning processes. This model posits four major stages which are cyclical in nature.

In the <u>concrete experience</u> stage, the learner must become actively involved in New experiences. These experiences are then reflected upon from several Derspectives during the <u>reflective observation</u> stage. As a result of this reflection, the learner begins to formulate abstract concepts (<u>abstract</u> <u>conceptualization</u> phase). In the <u>active experimentation</u> phase, the learner

3

attempts to test the implications of these new concepts and begins to fc generalizations. Althouth a progression through all phases is considere important in the learning process, Kolb and others have found that many learners exhibit strength in some area(s) more than in others.

Kolb's research, using the Learning Style Inventory, has revealed four distinct learning "types" which he has labeled accommodators, assimilato, convergers, and divergers.

<u>Accommodators</u>. This individual's strengths lie in concrete experience an active experimentaion. Accommodators like to do things, they become invo in new experiences. This person will rely on others more often than on personal analytic abilities for information in problem solving situations the theory doesn't appear to fit, the accommodator easily discards it. To person is at ease with others but is sometimes perceived by others as bein impatient.

<u>Assimilators</u>. Unlike the accomodator, this individual is more likely to re-examine the "facts" if they don't fit the theory rather than to disrega the theory. Favoring abstract conceptualization and reflective observation the assimilator excels in creating new theoretical models through inductive reasoning. Such a person is less interested in people and more concerned models.

<u>Convergers</u>. This individual's dominant learning abilities are abstract conceptualization and active experimentation. Convergers are best at apply ideas to practical problems. They do well in situations that require a su correct response. Relatively unemotional, they prefer to deal with things rather than people.

<u>Divergers</u>. Just opposite of the converger, the diverger excels at concrete experience and reflective observation. This individual is imaginative, 900 at viewing concrete situations from many perspectives--a good brainstormer. The diverger is interested in people, tends to be emotional, and has broad cultural interests.

### METHODS

## subjects

Faculty. Six faculty members, or 17 percent of the faculty in the Dental Anxillary Program responded to the four instruments. Five of the teachers were from the Dental Hygiene Program, and one teacher was from the Dental Assisting Program. Participation in the study was voluntary. The teachers' participation was usually based on their willingness to learn more about their own teaching and learning styles.

All of the teachers were between 28 and 58. All had bachelor's degrees; five had or were working on an advanced degree. Two of the degrees were in education. The number of years teaching varied between four and fifteen, with the average being 8.5 years.

Stulents. One hundred and sixty-three dental hygiene students, or 99 percent of those enrolled in a two-year certificate program, responded to the Learning Styles Inventory. Again, participation was voluntary. Students were asked to remain after class if they were willing to complete a survey about preference for instruction.

The students in the dental hygiene program were 99 percent female, between the ages of 19 and 25. Typically, a student possesses a high school diploma or an A.A. degree.

### Instruments

ðĒ.

### Teaching Style Q-Sort

This instrument (Appendix A) allowed the investigator to examine questions related to the value and attitudes of the teachers. This inventory consists of 28 statements, each of which reflect one of the four families developed by Joyce and Weil. Examples of items from each of the four families are:
- o Social interaction. "The teacher should take a role as a part of the group and be an active inquiries with the students."
- Information-processing. "Concepts are the basis for knowledge."
- Personal. "Instruction should emphasize the maximum of unique person development."
- Behavior modification. "The sequence of learning should be broken on into small units to assure success at each step."

The Q-Sort technique forces all 28 items into a 7 point continuum ranging 1 ("most unlike my teaching") to 7 ("most like my teaching"). Two teach statements are allowed on points 1 and 7, three on points 2 and 6, four a points 3 and 5, and eight on point 4. A total score for each of the four families was derived by adding the scores for the seven statements that represent a specific family.

Teachers were given 28 note cards with one of the 28 statements. They we asked to sort out the cards into piles according to the configuration state above.

Teaching Style Q-Sort raw and mean were recorded for each teacher. The highest and lowest score by family was noted, as well as the highest and lowest score for each teacher. The mean score by family was compared to a national mean. (Heikkinen, 1977)

Through factor loading, Heikkinen (Heikkinen, 1977) has shown a close relationship between Social Interaction and Personal families and between Information-Processing and Behavior Modification. Validity and reliability this instrument has been described in detail elsewhere. (Heikkinen, 1977) Steel and Torrie, 1960; Comrey, 1973)

## Interview

The purpose of the interview (Appendix B) was to assess the attitudes, values, and teaching methods of each teacher based on a verbal self-assessment. The open-ended questions required the subjects to formulate their own answers from personal experience. Questions focused on the subjects' assessment of their teaching style, student characteristics, teaching strategies, and course and curriculum design. Examples of questions are:

- o If you could use three words or phrases to describe your teaching style, what would they be?
- o What would a successful student look like when she or he finished your course?
- Iet's suppose you could design your classes in any way you wanted. What would they look like? If you could design the academic requirements of your department, what would the focus be?

Responses to the interview were examined by classifying according to family. This classification was done by first examining the substantative content of the Teaching Style Q-Sort statements by family. Interview responses were then summarized for each teacher. Based on this summary, teacher responses were ranked according to how closely the content of the responses matched the content of the family statements. This ranking was compared to Teaching Style Q-Sort scores.

The content validity of the interview protocol was assured by pilot testing the instrument on two college professors.

#### Classroom Observation

This technique was used to identify actual classroom behaviors. The observation system was based on a modified version of Goldhammer's note-taking procedure. The purpose of this note-taking procedure is to portray the classroom activities objectively and comprehensively so activities can be

7

reconstructed with as much validity as possible. The investigator reconeverything that was seen or heard without interpretation. Data was analy by scanning the notes for repetitious behaviors, labeling patterns, and arranging the patterns in hierarchical order.

At this point, behaviors typifying each family (Appendix C) were compared classroom behaviors. Based on classroom behaviors, each teacher was assis to one of the four families. The assigned family was compared with the so on the Teaching Style Q-Sort and the interview. The purpose of this comparison was to determine if the teachers' espoused-theories-of-teaching (what they said they did) were the same as the teachers' theories-in-pract (what they actually did). The observations were also examined for teacher a group in order to make general observations about the group as a whole. test for validity or reliability was done on the modified instrument.

#### Learning Styles Inventory

To assess learning styles of both the faculty and students in our sample administered the Learning Style Inventory (Kolb, 1978), (Appendix D), a self-report instrument that can be administered in approximately ten minu-It consists of nine items with each item consisting of four words. For example, one item consists of words "feeling, watching, thinking, doing." Respondents are asked to rank order the items according to how well each characterizes their learning styles. One word in each item represents of the four learning style dimensions.

By using the Learning Style inventory, two types of information are gate from each respondent. One is the relative emphasis the respondent gives each of the four learning dimensions (Appendix E). In other words, does individual emphasize concrete experience more than reflective observation The second type of information gathered is a combination score which indo the degree to which the individual emphasizes abstractness over concrete and action over reflection.

8

plit half reliabilities for the two combination scores (AcCE and AeRO) are round .80 for the five samples reported in the manual. Reliability pefficients for the single scores (AC, CE, AE, RO) are somewhat lower and effect a greater range.

### rocedures

uring the Fall quarter of the academic year, the investigator met with the ental auxillary faculty at a staff meeting to explain the purpose and coordures of the study. Winter quarter the 38 faculty members were called to etermine their interest in participating. Late Winter quarter and Spring parter the Teaching Style Q-Sort and interviews were administered to six eachers. Spring quarter classroom observations were done. The Learning styles Inventory for teachers data and students were collected as part of nother study (Carrier, Newell, and Lange, 1981.)

the Teaching Style Q-Sort and interviews were done individually with each instructor. The Teaching Style Q-Sort was completed first, in about 20 invites. Then immediately the 45-60 minute taped interview took place.

ach teacher was observed twice for 45 minutes. One teacher was observed for 0 minutes.

n the Carrier, Newell, and Lange study, the Learning Styles Inventory eceived by faculty through the mail, was completed individually and eturned. Students completed the inventory after class time.

It the end of the study the investigator discussed the results of the study with four of the teachers and mailed results to two of the teachers. When maked, the investigator commented on the positive aspects of each teachers' ethods and made suggestions for improvement.

The Learning Style Inventory and Teaching Style Inventory scores were compared. In addition, the score of the teachers' Learning Style Inventory as compared with the score each perceived the students would receive on the Inventory. These scores were compared with students' actual scores.

9

#### RESULTS

#### Teaching Style Q-Sort

Table 1 shows the raw scores for each teacher, the high and low scores b family and by individual teacher, and the mean of the teachers compared the national mean.

Teacher 4's highest individual score (36) was in the social interaction family. This was also the highest score of all teachers for that family. Teacher 1's lowest individual score (26) was in the social interaction family. This was the lowest of all teachers for that family.

There was the same kind of consistency between scores by family and teach for Teacher 5 (Information-Processing and Personal) and Teachers 2 and 3 (Personal). Consistent low scores by family and teacher occurred for Teac 5 (Personal) and Teacher 3 (Behavior Modification).

The teachers' mean for the social interaction, information-processing, and personal families were very similar to the national mean. The teachers' score for the behavior modification family was significantly lower then the national mean.

#### Interview

Table 2 shows the ranked family orientation for each teacher after summing responses to the ten questions were analyzed.

Three of the teachers' answers to the interview questions indicate a preference to the information-processing family. Teacher 6 provided a 9<sup>20</sup> example of this kind of response.

QUESTION 1: If you could use three words or phrases to describe you teaching style, what would they be?

10

meacher 6: "Organized, structured approach, clinical application. I try to create in the students an appreciation for the subject, for the body of knowledge."

of the teachers indicated an orientation to Social Interaction. For this son, the response to Question 1 was:

Teacher 4: "Like small groups, inquiry, discussion, application oriented."

of the teachers indicated an orientation to the Personal family. Their monses to Question 1 were:

Teacher 1	1:	"Participation in students, encourage students to be self-directed, provide guidance rather than direction."					
Teacher 2	2:	"Open, questioning, enthusiastic. I think content is neat, and students are neat. I get turned on by it."					

was a difference between the responses of teachers who scored the set and lowest in each family. Question 2 serves as a good example when ring at the differences between the opinions of Teachers 2 and 5. Teacher cored highest on Personal and lowest on Information-Processing of all the chers. Teacher 5 scored highest on Information-Processing and lowest on conal of all the teachers.

QUESTION	1 2:	Some people feel that the teacher is responsible for the students' learning; others feel it is the students. How do you feel about this issue?
Teacher	2:	"I agree with both statements. They are mutually responsible."
Teacher	5:	"It's the students responsibility. Teachers only have to present material in a form students can understand."

#### rvations

in 3 of Table 3 shows the family each teacher was assigned to after the stroom observations were done. Generally, the families to which each ther was assigned for observation were the same as the interviews and

11

observations. As an example of an exception, Teacher 6 was assigned to the Information-Processing family based on the interview and to the Behavior Modification family based on the observation.

The following is a summary description of the teacher observations:

- Teacher 1. Friendly; open; lots of interaction between teacher and students and among students; lively class climate; little note-taking; interaction changed from lecture to dialogue; reinforced students for answers; open nonverbals; moved around; climate caused discipline and closure problems.
- Teacher 2. Attentive; open; affirming nods; related own experiences; turned discussion over to students; synthesized information; asked evaluation questions; varied instructional mode.
- Teacher 3. Open; supportive; creative; used examples from own experim provided feedback through paraphrase; posed open-ended questions; questions required students to synthesize and evaluate; lots of dialog and interaction; asked for students' opinions; little note-taking; whe nonverbals.
- Teacher 4. Lecture: content-oriented; seemed to be content expert; many examples showing application; asked few questions of students; in interaction; much note-taking; fast delivery; good eye contact; open nonverbals.

Seminar: Lots of question-asking; evaluated; synthesized interactive; acted as resource; open; humorous.

(Be

ACT

 Teacher 5. Rigid lecture format; went through glossary item-by-item content-centered; repetitive; much note-taking, didn't reinforce study questions; supplemented with many examples; restructured nonverbals; intonation good.

12

Teacher 6. Lecture mode; organized; minimal interaction; relied on outline; little question-asking; provided answers to own questions; questioned on recall level; lots of note-taking; students mumbled during lecture; narrow nonverbals.

# parning Styles Inventory

(Table 4) In the sample of five teachers (Teacher 5 was not given the Learning styles Inventory), two were divergers, two were convergers, and one was an commodator. With this size sample, no generalization can be made about the relationship of teaching style to learning style.

It is interesting to note though that none of the teachers perceived the students' learning styles to be like their own learning style. This is a different outcome than determined by the Carrier, Newell, and Lange study.

In their study, 82 percent of the teachers perceived the students' learning style to be like their own. Approximately 78 percent of the 26 teachers tested were accommodators or divergers, 84 percent of the students were accommodators or divergers. And, 82 percent perceived their students as being accommodators or divergers. In this study, three of the five teachers perceived their students to be accommodators; one identified their students as convergers, and one as assimilators. The difference in sample size probably contributed to the difference in results.

#### Conclusions

Because this study is not statistically based, observations about the relationships among the four instruments and the concept of implicit theories are general in nature.

The teachers of this study have different styles regardless of similarities in age, teaching experience, and educational level.

- o The teachers in this study have a similar orientation to those in the national sample in social interaction, information-processing, and personal families. For behavior modification, the national mean is significantly higher (27.45) than the dental auxillary teachers (19.8). This may be because the national mean incorporates the scores of elementary and special education teachers; these teachers are perhaps a likely than college instructors to use behavior modification technique.
- o The teachers in this study exhibit the same kind of positive relations between scores on Social Interaction and Personal families and between Information-Processing and Behavior Modification families. That is to say, for example, if a teacher scored high on Personal, they scored low Behavior Modification. If they scored highest on Personal, they also scored high on Social Interaction.
- Generally, teachers' orientations to a family (style) on the Teaching Style Q-Sort and on the interview and observation instruments were consistent.
- There does not appear to be a relationship between Teaching Style Q-Son scores and Learning Style Inventory scores.
- Teachers in this sample did not perceive students' learning styles to b like their own learning style.
- Three of the five teachers identified their students as accommodators.
  This is an accurate perception because, in fact, 84 percent of the demonstration by the students were accommodators.

#### RECOMMENDATIONS

This study serves as a pilot for future studies. While several interest<sup>105</sup> relationships were determined, major recommendations for improving the procedures should be noted.

14

orther research in this area should include:

A larger sample for increased data accuracy;

More observations for increased data accuracy;

More interview questions for a greater diversity of types of response;

videotaping of classroom sessions for more accurate recall of behavior;

the of a different observation system, using several different raters; and

Use of different instruments to identify implicit theories about teaching, teaching behaviors, and learning styles.

sed on this study, there are many implied areas for future study. Questions at are created as a result of this study are:

How do teachers learn to recognize their own implicit theories?

Now does "student pull" affect a teacher's behavior?

How do teachers learn to analyze different student learning styles?

How do teachers learn to accommodate different student learning styles?

How does the organizational structure of the institution affect the teacher's implicit theories and behaviors?

15

#### SUMMARY

This study examined the relationship of teaching style orientation, express perceptions of the teaching-learning process and learning styles. Four instruments were used on six dental auxillary faculty to assess this relationship. The instruments were the Teaching Style Q-Sort, an intervie protocol, classroom observations modified from Goldhammer's note-taking procedure, and the Learning Style Inventory.

It was found that teachers' perceptions of their teaching style were positively related to their classroom behaviors. That is, what teachers thought they did was very close to their actual behavior. No relationship determined for the teaching style and learning style inventories, although three of the five did accurately predict their students' learning style. was found that teachers in this study did not perceive their students' learning style to be like their own.

Recommendations for future studies of this kind include using a large same increasing the number of interview questions, and increasing the number of classroom observations.

215

B:

Ba

#### References

- offectiveness. San Francisco: Jossey-Bass, 1974.
- merier, C. and McInerney, R. Teacher Development. New York: McMillan, 1981.
- of Minnesota, 1981.
- 1973. L. A First Course in Factor Analysis, New York: Academic Press,
- uffy, G. A study of teacher conceptions of reading. Paper presented to The National Reading Conference. New Orleans, 1977.
- teachers. New York: Holt, Rinehart and Winston, 1969.
- eikkinen, M. W. <u>The Teaching Style Q-Sort and its use in examining</u> <u>relationships between teaching style and selected teacher variable</u>. Unpublished doctoral dissertation. University of Idaho, 1977. (77-19, 960).
- Int, D. E. How to be your own best theorist. <u>Theory in Practice</u>. Autumn, 1980, <u>19</u> (4), 287-293.
- Int, D. E. Teachers are psychologists, too: On the application of psychology to education. Canadian Psychological Review. 1976, <u>17</u>, 210-218.
- Ant, D. E. Theorists are persons, too. On preaching what you practice. In C. Parker (Ed.), <u>Encouraging Student Development in College</u>. Minneapolis: University of Minnesota Press, 1978, pp. 250-266.

17

Janesick, V. An ethnographic study of a teacher's classroom perspective. Unpublished doctoral dissertation, Michigan State University, 1977.

- Joyce, B. and Weil, M. <u>Models of Teaching</u>. Englwood Cliffs, N. J.: Prentice-Hall, 1972.
- Kolb, D. A. <u>Learning style inventory technical manual</u>. Boston: McBer Company, 1978.
- Kolb, D. A. Disciplinary inquiry norms and student learning styles: Dipathways for growth. In A. Chickering (Ed.), <u>The future American</u> college. San Francisco: Jossey-Bass, 1981.
- Kolb, D. A. and Fry, R. Toward an applied theory of experiential learning C. Cooper (Ed.), Theories of group processes. London: John Wiley, In
- Knox, A. B. <u>Adult development and learning</u>. San Francisco: Jossey-Ben 1977.
- Price, G. E., Dunn, R., and Dunn, K. Summary of research on learning strands based on the Learning Style Inventory. Paper presented at the annual meeting of the American Educational Research Association. New York
- Sadler, G. E., Plovnick, M., and Snope, F. Learning styles and teaching implications. Journal of Medical Education, 1978, 53, 847-849.

# Teaching Style Q-Sort (TSQS) Scores

Teacher	Social Interaction	1	Information Processing		Personal		Behavior Modification	
1	26	-f	27		34	+t	20	t
2	35		23	-f	36	+f +t	18	t
3	33		27		36	+f	16	-f -t
4	36	+f +t	28		27		21	t
5	28		35	+f +t	23	-f -t	26	+f
6	32		34	+t	28		18	-t
ACHERS' ME	AN	31.66	84 CP	29.00		30.66		19.83
TIONAL MEA	N	28.22		25.71		30.77		27.43
is highest score l	by family (read do	own)				84		
is highest score to	for teacher (read and reacher for teacher	d across)					TABLE	1.

# interview nesponses nanked by ramily

1

Teacher	Social Interaction	Information Processing	Personal	Behavior Modification
1	1	3	2	4
2	2	3	1	4
3	2	3	1	4
4	2	1	2	3
5	4	1	3	2
6	2	1	3	4

Teaching Style Q-Soin (1808) Scores

# Comparison of Highest Scores by Family for the 3 Instruments

Teacher	TSQS	Interview	Observation
1	Р	SI	SI
2	P SI	Р	Р
3	Р	Р	Р
4	SI	IP	IP
5	IP	IP	IP
6	IP	IP	BM

- Social Interaction Family - Information Processing Family

- Personal Family

-Behavior Modification Family

TF: For Teacher 2, there was only one point difference between P and SI on the TSQS

TABLE 3.

# Comparison of Highest Teaching Style Q-Sort (15Q5) and Learning Style Inventory (LSI) Scores

Teacher	TSQS	LSI	Teacher Perspection of Students' LSI*
1	Personal	Diverger	Accommodator
2	Personal (Social Interaction)	Converger	Accommodator
3	Personal	Accommodator	Converger
4	Social Interaction	Diverger	Assimilator
5	Information Processing		
6	Information Processing	Converger	Accommodator

shows and managed survey allow

#### Appendix A

#### TEACHING STYLE Q-SORT QUESTIONS

(etters in parenthesis refer to family identification and were not included n original TSQS.)

- Students should have control over the selection of activities so that he/she selects his/her own instructional outcomes (P).
- . Education should emphasize the importance of group problem solving (SI).

. Concepts are the basis of knowledge (IP).

- I. The teacher's task is one of establishing behaviors and then bringing out those behaviors under the control of the environment (BM).
- Instruction should emphasize the maximization of unique personal development (P).
- The social involvement of group investigation is a route to academic inquiry (SI).
- Instruction should improve the student's ability to process information (IP).
- . Effective reinforcement should immediately follow a response (BM).
- The teacher should recognize that the individual is capable of handling his/ner own learning in constructive ways (P).
- I. The teacher should take a role as a part of the group and be an active inquirer with the students (SI).

- Students should recognize the tentative and emergent nature of knowle (IP).
- The sequence of learning should be broken down into small units to a success at each step (BM).
- Teachers should provide environments which are likely to increase the student's capacity to develop himself/herself (P).
- The school has to be an active participant in the continuing developm of culture (SI).
- The "academic disciplines have a structure of concepts which form the information-processing system of the discipline" (IP).
- Postive and negative reinforcement both can increase response probabil (EM).
- Teachers should keep "the students' feelings and problems at the center the teaching process" (P).
- In a complex, interdependent world, the individual's well-being is clo related to the larger social structure (SI).
- The task of the school is to identify clear, stable, and organized bot of knowledge within the disciplines (IP).
- Teachers are able to define all goals and objectives in terms of observable behavior (BM).
- The "student must take responsibility for initiating and maintaining learning activities" (P).
- Instruction should emphasize the relationships of the person to societ (SI).

Good lectures and demonstrations can lead to meaningful learning (IP).

programmed instruction can be successfully used with any subject area, grade level, and behavior (BM).

The teacher "must be acceptant of all responses in order to insure that students feel no external judgments on their creative expression" (P).

Intellectual operations are learned when students are engaged in active dialogue (SI).

. The role of the teacher is to retain control of the intellectual structure of the classroom (IP).

Behavior modification can be used to extinguish objectionable behavior as well as to establish behavior responses in subject matter areas (BM).

#### Appendix B

#### TEACHING STYLE INTERVIEW

#### Taping Includes:

- o Teaching Style Q-Sort
- o Date
- o Time
- o Interviewee
- o Permission to tape, I'll be taking some notes.

#### Instructions

- I'll ask a series of questions.
- o Take your time when answering, answer as fully as possible.
- When answering focus on the class that you will be teaching Spring quarter, i.e., the one I'll be observing.
- After the interview, I'll summarize your answers to check that what we said is what I heard.

#### Questions:

- a. If you could use three (3) words or phrases to describe your test style, what would they be?
  - b. Can you tell me more about what you mean?

t's focus on the students for a few minutes.

- 2. Some people feel that the teacher is responsible for the students' learning, others feel it is the students' responsibility. How do you feel about this issue?
- 3. What would a successful student look like when she or he finished your course? Is there anything else?
- a. Could you describe to me your most successful relationship with a student?
  - b. If you wouldn't mind, tell me about one that you define as less than successful.

w let's switch our focus to your teaching.

- 5. a. Let's suppose you could design your classes in any way you wanted, what would those classes look like? Forget about the University constraints. You have all the money, resources, assistance, and good students that you want.
- b. Let's do the same thing with the dental hygiene department. If you could design the academic requirement of your department, what would the focus be?
- a. Which teaching strategies do you consider to be the most useful? Rank order your preferences. These are some possibilities - lecture, group discussion, individualized learning, small group projects, demonstrations.
- b. What is it about the first two items that you find useful?

- 7. a. Having said all of that, would you describe to me how your Spring quarter class is structured? What would the syllabus look like
  - b. How did you come to choose this approach?
  - c. Who set the goals for the course you, students, department?
- 8. a. How frequently do you assign papers or projects?
  - b. Do you incorporate drill-and-practice?
  - c. How frequently do you test?
- 9. a. How do you feel about the requirement to assign grades for studen performance?
  - b. Do you feel a grade is a reward for a job well done, a motivator do better, or something else?
- 10. If you could take a year off to study teaching, what aspects would ya study? How would you go about this?

#### Appendix C

#### CLASSROOM BEHAVIORS CATEGORIZED BY FAMILY

## ing Style Q-Sort Questions

ducation should emphasize the importance of group problem solving (SI).

he social involvement of group investigation is a route to academic nquiry (SI).

he teacher should take a role as a part of the group and be an active nquirer with the students (SI).

tudents should recognize the tentative and emergent nature of knowledge IP).

eachers should provide environments which are likely to increase the tudent's capacity to develop himself/herself (P).

nstruction should emphasize the relationships of the person to society SI).

ntellectual operations are learned when students are engaged in active ialogue (SI).

#### iors

achers' behaviors portray social interaction, they might:

sk open-ended questions

efer to we

ilk about person's role in discipline

- o Create group discussion
- o Role-play
- Create projects which involve the community
- o Design field trip
- o Discuss values clarification
- Encourage student to lead discussions
- o Create a model environment

#### INFORMATION-PROCESSING

#### Teaching Style Q-Sort Questions

- Concepts are the basis of knowledge (IP).
- Instruction should improve the student's ability to process information (IP).

0 0

2628

Dea

12

2.

3.

4.

5.

- Students should recognize the tentative and emergent nature of knowled (IP).
- The "academic disciplines have a structure of concepts which form the information-processing system of the discipline" (IP).
- The task of the school is to identify clear, stable, and organized but of knowledge within the disciplines (IP).
- Instruction should emphasize the relationships of the person to societ (SI).
- The role of the teacher is to retain control of the intellectual star of the classroom (IP).

" peachers' behaviors portray information-processing, the might:

- Dee a socratic method
- the a problem-solving approach
- Oke a discovery-inquiry approach
- the advanced organizers
- Require that inductive and deductive reasoning be used
- Malyze and generalize
- E phasize the cognitive
- Exphasize memorization of facts
- ask broad statements
- Present a logical organization of knowledge

#### ERSONAL

paviors

#### eaching Style Q-Sort Questions

- . Students should have control over the selection of activities so that he/she selects his/her own instructional outcomes (P).
- The teacher's task is one of establishing behaviors and then bringing out those behaviors under the control of the environment (BM).
- The teacher should recognize that the individual is capable of handling his/her own learning in constructive ways (P).
- Teachers should provide environments which are likely to increase the student's capacity to develop himself/herself (P).
- Teachers should keep "the students' feelings and problems at the center of the teaching process" (P).

- The "student must take responsibility for initiating and maintaining learning activities" (P).
- The teacher "must be acceptant of all responses in order to insure to students feel no external judgments on their creative expression" (p)

If tes

.

2

Se

o Usi

00

Use

Set

Ask

Mak

Cre

#### Behaviors

If a teachers' behaviors portray the personal family, they might:

- Use individual contracting
- Interview and consult with students
- Employ learning centers
- o Allow students to speak spontaneously
- o Allow students so choose their own activities
- o Create many choices for activities
- Develop loosely structured lesson plans
- o Accept students' ideas by paraphrasing, restating, summarizing
- o Allow students to initiate interaction
- o Ask for students' opinions
- Make students accountable

#### BEHAVIOR MODIFICATION

#### Teaching Style Q-Sort Questions

- The teacher's task is one of establishing behaviors and then bringing those behaviors under the control of the environment (BM).
- 2. Effective reinforcement should immediately follow a response (BM).
- The sequence of learning should be broken down into small units to as success at each step (BM).
- Teachers should provide environments which are likely to increase the student's capacity to develop himself/herself (P).

machers are able to define all goals and objectives in terms of observable behavior (BM).

programmed instruction can be successfully used with any subject area, grade level, and behavior (BM).

Behavior modification can be used to extinguish objectionable behavior as well as to establish behavior responses in subject matter areas (BM).

### Behaviors

If teachers' behaviors portrayed the behavior modification, they might:

- Serve as a model for desirable behavior
- Use programmed instruction
- a Control the environment
- o Die drill-and-practice
- o Set a pre-determined sequence of activities
- o Ask narrow statements
- · Make evaluative comments
  - Create external rewards
  - Repeat the content

#### Appendix D

#### LEARNING STYLE INVENIORY

This inventory is designed to assess your method of learning. As you take inventory, give a high rank to those words which best characterize the way learn and a low rank to the words which are the least characteristic of learning style.

You may find it hard to choose the words that best describe your learning style because there are not right or wrong answers. Different charactering described in the inventory are equally good. The aim of the inventory is describe how you learn, not to evaluate your learning ability.

#### INSTRUCTIONS

There are nine sets of four words listed below. <u>Rank order</u> each set of me words assigning a 4 to the word which <u>best</u> characterizes your learning sym a 3 to the word which next best characterizes your learning style, a 2 to next most characteristic word, and a 1 to the word which is <u>least</u> characteristic of you as a learner. Be sure to <u>assign a different rank are</u> to each of the four words in each set. Do not make ties.

1.	discriminating	tentative	involved	practis
2.	receptive	relevant	analytical	impart
3	feeling	watching	thinking	doing
4	accepting	risk-taker	evaluative	aware
5.	intuitive	productive	logical	quest in
6	abstract	observing	concrete	active
7	present-oriented	reflecting	future-oriented	praga
8	experience	observation	conceptualization	experim
9	intense	reserved	rational	response
FOR	SCORING ONLY			

CE	RO	AC	AE
234578	136789	234589	1367

From Organizational Psychology, an Experiential Approach, by D. A. Kolb, Rubin, and J. M. McIntyre. Prentice-Hall, 1971.



NUNDOU



TITLE: Effects of a Teleconference Experience on the Type of Concerns Expressed by Teleconference Participants

AUTHORS: Alan Chute Burton W. Hancock Rene C. Lapierre

#### EFFECTS OF A TELECONFERENCE EXPERIENCE ON THE TYPE OF CONCERNS EXPRESSED BY TELECONFERENCE PARTICIPANTS

Alan G. Chute, Ph.D. Director, Teleconferencing Network The University of South Dakota School of Medicine Sioux Falls, South Dakota

Burton W. Hancock, Ph.D. Research Associate Educational Evaluation and Research Services The University of South Dakota School of Medicine Sioux Falls, South Dakota

> Rene C. Lapierre, M.A. Research Associate Alcohol and Drug Abuse Studies Program Division of Allied Health Sciences The University of South Dakota Vermillion, South Dakota

Researchers have long been interested in the behavior of individuals involved in the change process. With the advent of innovative telecommunications systems which are being implemented today in educational institutions, there are opportunities for significant research on the change process in the adoption of sophisticated communication systems. In this article, the authors describe the effects of teleconference experiences on the types of concerns expressed by teleconference participants after their initial experiences with the teleconferencing medium.

#### BACKGROUND

Innovation is a powerful and pervasive force in our society today. Rogers and Shoemaker (1971) offered the following definition for the term innovation:

An innovation is an idea, practice, or object perceived as new by an individual. It matters little, so far as human behavior is concerned, whether or not an idea is "objectively" new as measured by the lapse of time since its first use or discovery. It is the preceived or subjective newness of the idea for the individual that determines his reaction to it. If the idea seems new to the individual, it is an innovation (p.19).

- 1 -

#### Pincus (1974) adds:

People associated with education often appear to define as innovation any new policy, process, or organizational change....a technology which improves eductional outcomes, improves working relationships or processes within the educational system....or reduces the costs of education without significantly reducing the quality of desired outcomes or processes. (pp. 115-116)

The statements by Rogers and Shoemaker (1971) and Pincus (1974) for on some of the considerations faced by the staff of the South Da Medical Information Exchange (SDMIX) as we established a teleconfering network in South Dakota. While teleconferencing is not a new structional medium elsewhere in the nation, it is new to medical estion and health care providers within the state of South Dakota.

#### Change Theory

In general, the literature on change indicates that the adopting a sophisticated innovation is a gradual process in which individual ticipants change their attitude towards the innovation and their b ior as they become more familiar with the use of the innovation. nis, Benne, Chin, Corey, 1976; Piele, Eidell & Smith, 1970; Mag. 1970). Change in a technologically sensitive system is a process an event. Hall, in 1976, maintained that the study of change in an cational institution can be accomplished by using the individual a frame of reference. That is, the degree of the success of the int tion is based on level of use of the innovation by individuals to the institution and the level of the concerns expressed by indiviwho use the innovation.

Typically, individuals in the process of change express a valor of concerns which indicate their feeling toward the innovation. According to Hall, Wallace and Dossette (1973), seven levels or stages of cerns are observable during the adoption of any innovative prograp project. See Figure 1. A profile of several different levels of of cerns can be observed for each individual involved in the innoval Over a period of time, it is expected that the profile will change cating that the individual has progressed from lower level information concerns to personal concerns and finally to impact level concerns. search by Hall and others leads to the development of the concerns b adoption model.

The model can be used to develop research studies which assess changes in the levels of concerns expressed by individuals as they come more familiar with an innovation. In addition, the model can used as a guide for a change facilitator attempting to choose appropriate

- 2 -

237

ate intervention strategies to accelerate the acceptance of an The importance of this to instructional developers and innovation. change facilitators is that the model provides them a tool which they can use to assess the current level of concerns of individuals involved in the change process and then prescribe experiences which focus on specific concerns. Use of the model in this sense makes it a valuable diagnostic and prescriptive tool in the change process. (Hall Hall & Loucks, 1977, 1978a, 1978b; Hall, Zigarmi, & Hord 1979). (Hall 1976, The concerns based adoption model with its stages of concerns hierarchy has peen used to design numerous research studies. (Hall, 1979). These studies have been used to validate assessment methodologies which include questionnaires, multiple choice tests, interviewing techniques, and other unobtrusive measures for gathering experimental data.

#### User Needs

To bring about the adoption of teleconferencing as a viable instructional tool, SDMIX has proceeded in a systematic manner. The first step was to assess the needs of potential users. Fullan (1972) has stated that in order for change to occur the user's needs must be addressed. The principle need identified was the ability to provide continuing medical education by the School of Medicine faculty to South Dakota physicians. Further, the faculty wanted these programs to be delivered cost-effectively throughout the state. This has been a perennial problem because South Dakota is a very large, rural state.

Through various techniques including faculty development workshops, SDMIX has attempted to demonstrate how instructional teleconferencing can address these problems. Eraut (1975) states:

Unless an educator perceives some discrepancy between his goals and his achievements, he is bound to regard innovation as undesirable and unnecessary; and the extent to which his expressed dissatisfaction is fundamental or trivial will determine the extent to which he is likely to entertain innovation. If an educator does not have a problem, innovation will seem irrelevant. (p. 14)

The authors of this paper decided to employ the concerns base adoption model and questionnaires to assess the effects initial teleconference experiences have on the types of concerns expressed by teleconference participants. The two studies reported herein were viewed as exploratory field studies. The purpose of these studies was to lay the foundation for later, more systematic research on the concerns of teleconference users as they become involved in teleconferencing.

#### ADMINISTRATIVE TELECONFERENCE STUDY

The first study reported in this article explains the result a field study regarding the utilization of administrative telecont ing by University of South Dakota Alcohol and Drug Abuse Studies Pro for South Dakota's Alcohol Person Power Project staff. Administrate teleconferencing is defined by the authors as the use of telephone communication to bring together people for the purpose of conduct meeting. The staff of the Alcohol Person Power Project was expering with teleconferencing in order to provide outreach services primary alcohol treatment service units throughout South Dakota, data obtained from this study was used to make decisions regarding future use of administrative teleconferencing for primary alcohol treatment ment service program administrators in South Dakota.

There are a number of factors that precipitated the utilization teleconferencing for the Alcohol Person Power Project. First, been of South Dakota's size and sparce population, many of the 52 preservice units are located in geographically isolated areas through Second, staff personnel believed it would take approximately South Dakota. mately two full weeks to visit all of the state's facilities with guarantee that the effectiveness would be any greater than by contain the sites by teleconference. Third, the amount of time it would take coordinate a two week trip to every facility throughout the state have been greater than the actual time spent at the facilities. For project staff had previously contacted approximately 40 percent of administrators, and it was felt that they would be comfortable discu ing problems, issues, and concerns via teleconferencing. Finally, statewide teleconference provided a unique opportunity to connect gram directors and allow them to interact with other program director in the past, constraints, including great distance, time, or finance considerations had precluded contact.

The project staff spent a considerable amount of time preparing the teleconferences. A meeting was held with the SDMIX staff regars the use of teleconferencing for administrative purposes. SDMIX su provided information on the design, development and delivery of teleconference presentations. After discussions with all staff personnel the teleconference consultants, an agenda was formulated. The plan group decided to conduct a series of nine teleconferences during the days connecting five or six alcohol program directors per teleconference.

#### Procedures for the Administrative Teleconference Study

A letter was sent to each of the alcohol program directors regarding the date, time, and specifics of teleconferencing. In addition, questionnaire to assess participant concerns about teleconferencing sent. The participants were provided the telephone number to call

access the conference bridge operator. They were also provided a telephone number if the teleconferencing connection could not be made on the scheduled date and time.

The questionnaire used to assess the pre-teleconference concerns of the participants was developed from an extensive list of concerns that had been expressed by previous teleconference participants. Professional staff of the SDMIX compiled this listing of concerns from interviews with previous teleconference participants and presenters, and from comments which appeared on the evaluations of previous teleconferences. The most frequently expressed concerns were selected for the questionnaire. A panel of three experts then classified these concerns according to Hall's (1979) levels of concern. The concerns expressed by previous teleconference participants, the level of concern, and the average concern level ranking appear in Table 1.

During the teleconference, information was presented regarding the Alcohol Person Power Project. Participants were given the opportunity to ask questions about the project, and encouraged to interact with any of the other participants. At the conclusions of the teleconferences, participants were notified that they would be receiving a post-concerns form about teleconferencing. The purpose of the post-form was to assess change in participants' concerns regarding teleconferencing.

#### Results of the Administrative Teleconference Study

During the three-day period of the administrative teleconferences, 21 of the 52 (40%) directors participated. Eleven individuals (21%) indicated that they were not able to participate in the teleconference at the scheduled times. Another 20 individuals (38%) did not respond to the initial questionnaire. Most participants had no previous experience with teleconferencing and therefore were concerned primarily with teleconference usage issues while a few had some limited experience with teleconferencing in the past and felt more comfortable with the experience. F-THOMP-TOW

Fourteen of the 52 program directors responded to the pre-concerns form producing 109 concerns. The average concerns per respondent were 7.78. Table 2 lists the frequency of each concern marked by the participants on the pretest. The distribution indicates that the respondents expressed concerns according to the different stages discussed by Hall (1979). Fifteen percent of the concerns were informational, 60 percent were personal, 12 percent were management and 13 were consequence oriented. See Table 3. The results suggest that prior to the teleconference, participants seem concerned with the lower level concerns; however, a few participants were concerned with upper level concerns which may reflect their prior experience and familiarity with teleconferencing.

- 5 -
Of the 21 teleconference participants, 17 returned post-concerns form. There were a total of 81 concerns or an average 4.76 expressed concerns per respondent. In Table 3, column two post-teleconference concerns distribution is presented.

The results displayed in Tables 2 and 3 suggested that the 1 or stages of concern expressed by participants changed after a si exposure to the teleconferencing medium. Not every individual char but there was a change in the entire sample frequency distribution concern levels. Five percent of the post-teleconferencing concerns informational, 54 percent were personal, 20 percent were management 21 percent were consequence type concerns.

The authors recognize the limitations associated with study change scores from pretest/post-test measures as discussed by Cronse and Furby (1970). However, the authors were forced to accept this proach because it was not possible to gain participant cooperation conduct a true experimental study. For this reason the authors conduct ed an exploratory study to gather prelimnary data which will be used develop a more comprehensive study at a later date.

### TELECONFERENCE WORKSHOP STUDY

After the administrative teleconference exploratory study, the set thors decided to conduct another exploratory study investigating the fects of a teleconference workshop experience on the type of contenwhich participants express. The staff of SDMIX developed a teleconfeencing workshop entitled "Teach Via Teleconferencing". The purpose the workshop was to familiarize participants with the medium of teleconferencing, to teach participants how to design a teleconference prese tation, and to train participants to operate the teleconference equiment.

## Workshop Organization

The SDMIX teleconference workshop was designed to address both needs and concerns of the participants. It was based on a plan derive from the change model of Havelock (1973) and the concerns based adopter model of Hall (1979). The five stage SDMIX workshop plan follows:

- 1. Determining Presenter Needs and Concerns
- 2. Creating Awareness and Interest in Teleconferencing
- 3. Providing Information about Teleconferencing
- 4. Teaching Teleconferencing Techniques

# 5. Changing Presenter Attitudes and Behaviors

# Determining Presenter Needs and Concerns

As mentioned earlier, SDMIX staff used interviews and questionnaires to assess the needs and concerns of presenters. Again those concerns expressed most frequently related to instructional effectiveness and technical capabilities of teleconferencing. These concerns were manifested in such statements as:

- 1. It is not as good as face-to-face instructions.
- 2. People don't understand what is being taught.
- 3. The equipment might breakdown.
- I sense a lack of control.

e I

e, e Cen

ofer Se I et I

e:m quiz

otie

- 5. How much can I effectively cover during a teleconference.
- Teleconferencing is not spontaneous.
- 7. Is my presentation good enough for teleconferencing.

From the above concerns SDMIX developed various presentation segments and learning activities within the workshop to address these concerns.

#### Creating Awareness and Interest for Teleconferencing

At this stage, the potential user is exposed to the new idea but does not necessarily learn specific information. The presentation is stimulating and positive because the method in which the teleconferencing is presented to the user will affect whether or not he is motivated enough to follow through to the subsequent adoption of the innovation. It is at the awareness stage that the change agent wants to present the innovation in a manner which arouses curiosity. (Havelock, 1973).

Prior to the faculty development workshops, there were several strategies SDMIX used to generate interest in teleconferencing. The SOMIX staff sponsored news conferences, provided press releases, and made presentations to organizations and institutions statewide. SDMIX staff also released pre-workshop publicity which included brochures, newsletters, announcements and word of mouth.

The workshop opens with a multi-media overview of the workshop which delineates the goals of the workshop, highlights each workshop segment, and introduces the workshop faculty. The multi-media opening Was designed to set the mood for the rest of the workshop; interesting,

- 7 -

## 2.12

entertaining, and informative. The goal was to create interest and generate enthusiasm about the workshop.

## Providing Information about Teleconferencing

After the workshop opening, a rationale for using teleconference is presented. At this time the participants are provided informate which demonstrates how teleconferencing can meet their needs. Time distance barriers and the high cost of travel affecting the deliver continuing medical education are discussed. In addition to the trancost issue, the issue of employee productivity is introduced. Part pation in continuing medical education programs can be costly for photo cians not only in terms of travel cost but also in terms of time from their practice. It is demonstrated convincingly that telecon encing is a means of reducing the loss of productive time associate with travel.

## Teaching Teleconferencing Techniques

Training teleconference presenters about appropriate teleconference techniques is essential to the adoption of instructional teleconference ing. Gross et al (1971) suggests that failure to implement an infortion is often attributable to the number of obstacles faced by the dein attempting to carry it out. One such obstacle is the appropriate and of the innovation. It is at this point in the workshop that guideline useful in designing teleconferences are presented. Strategies on how to structure teleconferences, to increase participant interaction during teleconferences, and to personalize teleconferences are discussed. No of the content is presented via teleconference to reduce participant concern over the effectiveness of instructional teleconferencing.

Also during this segment on the proper use of teleconferencing, selection and utilization of support materials is discussed. Support materials include handouts, slides, films, overheads, and videotops The use of support materials adds the visual component which is mission in teleconferencing and helps to gain and maintain attention during to teleconference.

## Changing Presenter Attitudes and Behaviors

The resolution of a user's concerns regarding implementation of innovation, often requires a change in user attitude and the developer of new skills by the user. If changes in attitudes and skill level mot part of the change process, the user will experience frustration will reject the innovation (Fullan, 1972). Goodlad and Klein (1974) of fer a similar observation:

- 8 -

Since educators usually are only exposed to ideas, whatever the intended change, and have not yet internalized their full meaning before being on their own with the ideas, it is not surprising that there appears to be a gap between what they think they are doing and what we saw them doing. (p. 103)

In accordance with the suggestions of Fullan, Goodlad, and Klien, the workshop staff separates workshop participants into small groups and assists them as they design their own fifteen minute teleconference. This segment of the workshop is intended to provide the participants with the skills necessary to develop teleconference presentations and hopefully create a positive attitude toward teleconferencing.

The first step in this process includes: the identification of the content area, the presenter, the intended audience, and the goals and objectives of the presentation. Next the workshop staff assists the group in: narrowing the topic to fit a fifteen minute time period, developing a content outline, specifying support materials and planning strategies to encourage participant interaction. The final step is to establish the criteria for evaluation and develop an instrument/procedure to assess whether or not the criteria has been met. In addition to designing a teleconference, participants are given hands on experience in setting up the teleconference equipment, dialing into the SDMIX network, and talking to other locations using the teleconference system. It is anticipated that these experiences will help reduce the concerns of users about teleconferencing and thus increase the probability of adopting this innovation.

The final strategy employed by SDMIX to reduce user concerns is to have the participants present a fifteen minute segment designed during the first day of the workshop via teleconferencing. Because the participants are encouraged to use support materials, e.g., slides, handouts, videotapes, this segment of the workshop typically takes place three weeks after the first day of the workshop. Each participant must access the SDMIX network from his location around the state. This segment of the workshop is designed to be as realistic as possible. The workshop participants follow the same protocols they would follow if they were presenting a statewide network program. Each participating location has a moderator who welcomes the other participants, conducts a roll call of all the participating locations, presents an overview of the program, and introduces the instructor. The participants present their topics following the suggestions from the first day of the workshop. When the faculty member has presented his/her program, the moderator reviews the key points of the program and participants are encouraged to ask questions of the presenter. After each presentation, the workshop staff and the other participants provide feedback to the presenter regarding the quality of the program. The feedback session is kept positive and constructive so as not to discourage the presenter from using teleconferencing in the future.

- 9 -

The goal of the workshop is to provide faculty with the skill experiences necessary for developing effective teleconferences. The accomplished in two phases. The first phase of the workshop prothe participants with information pertaining to the effective desia teleconference presentation and leads to the development of a fiminute teleconference program. The second phase, which occurs weeks later, is dedicated to the presentation and critique of the conference programs which were developed during the first phase of workshop. In order to assess the effects of the above workshop exence on user concerns, the following research question was addreduring the workshops. What effect does a teleconference workshop on user concerns?

## Results of the Teleconference Workshop Study

Prior to the workshop, participants were mailed a copy of the concerns inventory which was used for the administrative teleconferences study. After the day long workshop, the participants filled out to post workshop concerns questionnaire. Eleven of the workshop participants responded to the pre-concerns form producing 86 concerns. The erage concerns per respondent were 7.82. See column one of Table 4 a listing of the frequence of each concern marked by the participants

The distribution indicates that the respondents expressed concern according to the different stages discussed by Hall. Nine percent the concerns were informational, 64 percent were personal, 19 percent were management and eight percent were consequence oriented. See Table 5. This suggests that prior to the teleconference, participants and concerned with the lower level concerns; however, a few participant were concerned with upper level concerns which may reflect their prior experience and familiarity with teleconferencing.

Of the teleconference workshop participants, 10 returned the post-concerns form. There were a total of 68 concerns or an average 6.8 expressed concerns per respondent. In Table 4, column two, the post-teleconference concerns distribution is presented.

The results displayed in Tables 4 and 5 suggested that the entor or stages of concern expressed by participants changed after their pr ticipation in the teleconference workshop. Not every individual clave but there was a change in the entire sample frequency distribution concern levels. Seven percent of the post-teleconferencing concern were informational, 59 percent were personal, 24 percent were managem and 10 percent were consequence type concerns.

## IMPLICATIONS FOR TELECONFERENCING

The concerns based adoption model predicts that individuals are most likely to develop concerns at the awareness, informational and personal levels in the early stages of adoption. The results of these exploratory studies support that assumption. Moreover, after an initial exposure to an innovation, it is anticipated that the distribution of the levels of concerns expressed by the individuals will change. In these exploratory studies, on the average, participants reported more concerns prior to the teleconference than after the teleconference and the distribution of the levels of concerns expressed changed considerably. After the teleconference experience, the distribution of concerns shifted towards the management and consequence level of concerns away from the informational and personal levels of concerns.

It is anticipated that with additional exposures to the teleconference medium, the levels of concerns expressed would move further towards the impact concern levels of consequence, collaboration and refocusing as predicted by the concerns based adoption model. However, it should be noted that the transition from lower level concerns to higher level impact concerns frequently takes two or three years in a sophisticated innovation according to Hall (1979).

The concerns based adoption model can be used by a change facilitator to monitor the level of acceptance of the innovation by the individuals involved in the change process. This type of information makes it possible for the change facilitator to specify individualized intervention strategies which can help the individual participant accept and adapt the innovation. The utilization of the concerns based adoption model to specify interventions makes it a viable diagnostic and prescriptive model for facilitating the acceptance of innovations such as teleconferencing.

It has been emphasized that this article describes an exploratory field study conducted by the SDMIX to assess the concern of teleconference users. Field studies are typically conducted by researchers to determine the "significant variables in the field situation, to discover relations among variables, and to lay the groundwork for later, more systematic and rigorous testing of hypotheses" (Kerlinger, 1973, p. 406). The field studies conducted by SDMIX will be used for the purposes described by Kerlinger. The results of the above field studies have been used to refine and reduce the the questionnaires used to assess teleconference participant concerns.

The results from these studies suggest that a user's concerns will change after being exposed to a teleconference situation. The results were stated in terms of "gain scores" or negative change indicating a reduction in the amount of concern (e.g. subtracting post-test from

- 11 -

pre-test). Scores of this nature are often highly unreliable and useful (Cronbach and Furby, 1970). However the emphasis of this was to determine the types of concerns experienced by teleconference ers for the purpose of bringing about the acceptance of teleconfering, establishing future research questions, and designing more matic research procedures. The South Dakota Medical Infor-Exchange staff has effectively used the information obtained from exploratory studies to design and implement faculty development shops and other training activities which successfully address facneeds and concerns.

## STAGES OF CONCERN ABOUT THE INNOVATION

- AWARENESS: Little concern about our involvement with the innovation is indicated.
- INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. He/she is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects and requirements for use.
- 2. PERSONAL: Individual is uncertain about the demands of the innovation, his/her inadequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision making and consideration of potential conflicts with existing structure or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.
- MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organization, managing, scheduling, and time demands are utmost.
- 4. CONSEQUENCE: Attention focuses on impact of the innovation on student in his/her immediate sphere of influence. The focus is on the relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.
- COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.
- REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.

Figure 1. Stages of Concern about the Innovation. Original concept from G.E. Hall, R.C. Wallace, Jr., and W.A. Dossette. A developmental conceptualization of the adoption process within educational institutions. Austin: Research and Development Center for Teacher Education, The University of Texas, 1973.

- 13 -

2.18

## TABLE 1

# CONCERNS OF ADMINISTRATIVE TELECONFERENCE PARTICIPANTS\*

Concern	Average Ranking	Level
Don't like something around my neck, like a microphone	1.0	Info.
How much do I need to know	1.3	Info.
What are appropriate/inappropriate behaviors	1.3	Info.
Who can I address on the teleconference	1.3	Info.
Do I need a special room for teleconference	1.6	Info.
I feel powerlessness	2.0	Pers.
I do not know who is there	2.0	Pers.
I need a picture of person conversing with	2.0	Pers.
I feel I should know what other people look like	2.0	Pers.
How prepared do I need to be not to look like a fool	2.0	Pers.
Is it possible to teach teleconferencing skills	2.0	Pers.
Being isolated what do I do in problem situations	2.0	Pers.
What do I do if anything goes wrong	2.0	Pers.
How do I deal with interruptions	2.0	Pers.
Do I start and end at an exact time	2.0	Pers.
Is the teleconference confidential	2.0	Pers.
Am I being evaluated by someone	2.0	Pers.
Is the transmission quality good	2.3	Pers.
If the phone goes dead at a key point how do I obtain information	2.3	Pers.
What if the line is busy when I call in	2.3	Pers.
Only one person talks at a time	2.6	Pers.
I sense lack of control in the situation	2.6	Pers.
I do not know who has left	2.6	Pers.
How much can you effectively cover in a teleconference	2.6	Pers.
There are no visual aids such as body language	2.6	Pers.
The equipment might break down	3.0	Manage
It is not as good as a telephone conversation	3.0	Manage
Is my presentation good enough for the network's standards	3.0	Manage
How many people come to teleconference prepared	3.0	Manage
Teleconferencing is not spontaneous	3.0	Manage
How much experience do I need to become effective	3.6	Manage
What kinds of people are prepared	3.6	Manage
It is not as good as face to face	4.0	Conseq
Do people understand what is being said	4.0	Conseq

[ Innanul

The author acknowledges Donald Witzke, Ph.D., James Hale, Ph.D., and Joseph Ricci, Ph.D., USD School of Medicine for serving on the panel of experts and providing consultation on the field study methodolgy.

# TABLE 2

# CONCERNS OF ADMINISTRATIVE TELECONFERENCE PARTICIPANTS

Concern	Pre- Score	Post- Score
non't like something around my neck, like a microphone	1	0
How much do I need to know	4	1
what are appropriate/inappropriate behaviors	4	ī
who can I address on the teleconference	4	2
no I need a special room for teleconference	3	0
I feel powerlessness	0	1
I do not know who is there	4	0
I need a picture of person conversing with	0	0
I feel I should know what other people look likr	2	0
How prepared do I need to be not to look like a fool	4	1
Is it possible to teach teleconferencing skills	4	3
Being isolated what do I do in problem situations	1	0
What do I do if anything goes wrong	2	0
How do I deal with interruptions	3	2
Do I start and end at an exact time	2	1
Is the teleconference confidential	3	4
Am I being evaluated by someone	5	1
Is the transmission quality good	9	7
If the phone goes dead at a key point how do I obtain information	4	2
What if the line is busy when I call in	1	0
Only one person talks at a time	0	2
I sense lack of control in the situation	3	1
I do not know who has left	3	3
How much can you effectively cover in a teleconference	8	8
There are no visual aids such as body language	8	8
The equipment might break down	2	0
It is not as good as a telephone conversation	0	1
Is my presentation good enough for the network's standards	1	1
How many people come to the teleconference prepared	4	5
Teleconferencing is not spontaneous	2	4
How much experience do I need to become effective	3.	2
What kinds of people are prepared	1	3
It is not as good as face to face	11	11
Do people understand what is being said	3	6

「上市には丁

- 15 -



# TABLE 3 DISTRIBUTION OF LEVEL OF CONCERNS EXPRESSED FOR PRE AND POST TELECONFERENCE EXPERIENCE

Concern Level	Pre Teleconference (n=14)	Post Teleconference (n=17)
Informational	15%	5%
Personal	60%	54%
Management	12%	20%
Consequence	13%	21%
	100%	100%

S ODAMU

- 16 -

# TABLE 4 CONCERNS EXPRESSED BY TELECONFERENCE WORKSHOP PARTICIPANTS

Concern	Pre- Score	Post- Score	
Conserva			
non't like something around my neck, like a microphone	0	0	
How much do I need to know	2	1	
what are appropriate/inappropriate behaviors	2	4	
who can I address on the teleconference	3	0	
no I need a special room for teleconference	1	0	
I feel powerlessness	1	0	
I do not know who is there	5	1	
I need a picture of person conversing with	1	0	
I feel I should know what other people look like	2	2	
How prepared do I need to be not to look like a fool	1	.1	
is it possible to teach teleconferencing skills	4	õ	
Reing isolated what do I do in problem situations	3	5	
what do I do if anything goes wrong	2	5	
How do I deal with interruptions	4	3	
No I start and end at an exact time	1	õ	
Is the teleconference confidential	2	3	
Am I being evaluated by someone	ī	ĩ	
Is the transmission quality good	5	ĩ	
If the phone goes dead at a key point how do I obtain	5	5	
information	°.	0	
What if the line is busy when I call in	1	2	
Only one person talks at a time	2	1	
I sense lack of control in the situation	1	0	
I do not know who has left	6	2	
How much can you effectively cover in a teleconference	6	7	
There are no visual aids such as body language	2	1	
The equipment might break down	6	5	
It is not as good as a telephone conversation	0	0	
Is my presentation good enough for the network's standards	2	2	
How many people come to teleconference prepared	3	5	
Teleconferencing is not spontaneous	1	1	
How much experience do I need to become effective	3	2	
What kinds of people are prepared	1	1	
If is not as good as face to face	3	2	
Do people understand what is being said	4	5	
i the second many is setting as a	0.20		

# TABLE 5 DISTRIBUTION OF LEVEL OF CONCERNS EXPRESSED FOR PRE AND POST WORKSHOP EXPERIENCE

Concern Level	Pre Workshop (n=11)	Post Workshop (n=10)
Informational	9%	7%
Personal	64%	59%
Management	19%	24%
Consequence	8%	10%
	100%	100%

STA Real



#### REFERENCES

- Bennis, Warren G., Kenneth D. Benne, Robert Chin, and Kenneth E. Corey, <u>The Planning of Change</u>, Third Edition, Holt, Rinehart & Winston, <u>New York</u>, 1976
- cronbach, L.J. & Furby, L., How do we measure "change"-- or should we? Psychological Bulletin, 1970, 74(1), 68-80
- Eraut, M., Promoting innovation in teaching and learning: Problems, processes and institutional mechanisms. <u>Higher Education</u>, 1975, 4(1), 13-26
- Fullan, M., Overview of the innovative process and the user. Interchange, 1972, 3(2-3), 1-46
- Goodlad, J., & Klein, M.F., <u>Behind the classroom</u> door. Worthington, Ohio: Charles A. Jones, 1974
- Gross, N., Giacquinta, J.B., & Bernstein, M., <u>Implementing</u> organizational innovations. New York: Basic Books, 1971
- Hall, Gene E., <u>Procedures for adopting educational innovations</u> <u>/CBAM</u>, <u>using the individual and the innovation as the frame of re-</u> <u>ference for research on change</u>. Paper presented at the annual meeting of the Australia Association for Research in Education, Melbourne, November, 1979
- Hall, Gene E., The Study of Individual Teacher and Professor Concerns about Innovations, Research and Development Center for Teacher Education at the University of Texas at Austin, Spring, 1976
- Hall, Gene E., and Susan F. Loucks, A developmental model for determining whether the treatment is actually implemented. <u>Ameri-</u> can Educational Research Journal, 1977, 14(3), 263-276
- Hall, Gene E., and Susan F.Loucks, <u>Innovation Configurations</u>: <u>Analyzing</u> <u>the adaptations of innovations</u>. Procedures for adopting educational innovations program, University of Texas at Austin, November, 1978
- Hall, Gene E. and Susan F. Loucks, Teacher concerns as a basis for facilitating and personalizing staff development. <u>Teachers</u> <u>College</u> <u>Record</u>, 1978, 80(1) 36-53
- Hall, Gene E., Wallace, R.C., Jr., Dossette, W.A. A Developmental Conceptualization of the Adoption Process within Educational Institutions. Austin Research and Development Center for Teacher Education, The University of Texas, 1973

- 19 -

- Hall, Gene E., Patricia K. Zigarmi, and Shirley M. Hord, <u>A taxonominterventions</u>: <u>The prototype and initial testing</u>. Paper present at annual meeting of the American Educational Research Associal San Francisco, April 11, 1979, Session 27.20
- Havelock, R.G., The change agent's guide to innovation in education Englewood Cliffs, N.J.: Educational Technology Publications
- MaGuire, Louis M., <u>An Annotated Bibliography of the Literature on</u> Change, July, 1970
- Piele, P., T. Eidell and S. Smith. <u>Social and Technological Change</u> <u>Implications for Education</u>, The Center for the Advanced Stut Educational Administration, University of Oregon, Eugene, Or 1970. (ERIC Document Reproduction Service No. ED 044 833)
- Pincus, J., Incentives for innovation in the public schools. <u>Review</u> Educational Research, 1974, 44, 113-144
- Rogers, E.M., The communication of innovations in a complex institute Educational Record, 1968, 49(1), 67-77
- Rogers, E.M., Change agents, clients and change. In G. Zaltman, P. Kotler, & I. Kaufman (Eds.), <u>Creating social change</u>. New Yor Holt, Rinehart, & Winston, 1972
- Rogers, E.M., & Shoemaker, F.F., Communication of innovations, a crm cultural approach. New York: Free Press, 1971
- Witzke, D.B., Decision Oriented Evaluation In Plan for the Development of a Coordinated Learning Resources System. University of Sec Dakota School of Medicine Rural Area Health Education Centers Im gram, Vermillion, South Dakota, 1979

TITLE: Communication Conditions and Media Influence on Attitudes and Information Uses: The Effects of Media Selected in Response to Student Interest: About Mainstreaming and Disabilities

AUTHOR: Eliza T. Dresang

## COMMUNICATION CONDITIONS AND MEDIA INFLUENCE ON ATTITUDES AND INFORMATION USE THE EFFECTS OF MEDIA SELECTED IN RESPONSE TO STUDENT INTERESTS ABOUT MAINSTREAMING AND DISABILITIES

Eliza T. Dresang Manager of Media Services Madison Metropolitan School District 545 W. Dayton Street Madison, Wi. 53703

Lecturer UW-Madison Library School

Presented at the 1982 Convention of the Association for Educational Communications and Technology in Dallas, Texas.

Based upon author's doctoral dissertation completed at the University of Wisconsin-Madison under the direction of Dr. Margaret E. Monroe. Research a partially supported by a Higher Education Act Title II Fellowship and by a from the Graduate School of the University of Wisconsin-Madison. THE EFFECTS OF MEDIA SELECTED IN RESPONSE TO STUDENT INTERESTS ABOUT MAINSTREAMING AND DISABILITIES

by

## Eliza T. Dresang Madison Metropolitan School District University of Wisconsin-Madison

PERSUASIVE FILMS AND FILMSTRIPS PRESENTED TO 120 SIXTH GRADE STUDENTS HAD AN EQUAL IMPACT ON THEIR ATTITUDES AND USE OF THE INFORMATION REGARDLESS OF WHETHER THE STUDENTS' EXPRESSED INTERESTS WERE TAKEN INTO ACCOUNT DURING THE MEDIA SELECTION PROCESS.

THE USE OF INFORMATION PRESENTED IN PERSUASIVE FILMS AND FILMSTRIPS WAS THE SAME FOR STUDENTS WHO WERE OR WERE NOT COGNITIVELY INVOLVED IN A DESTIONING PROCESS PRIOR TO THE MEDIA PRESENTATION.

STUDENT #1 IN THE STUDY WAS BLIND. WHEN GIVEN A CHOICE OF FILMS AND OTHER MEDIA ABOUT DISABILITIES FROM WHICH SHE MIGHT OBTAIN INFORMATION, SHE CHOSE THOSE WHICH WOULD HELP HER TO UNDERSTAND HER OWN DISABILITY BETTER.

STUDENT #2 IN THE STUDY WAS WELL-ADJUSTED AND SEEMED CALM IN HIS RELATIONSHIPS WITH FRIENDS AND TEACHERS. THEREFORE, HIS INTEREST IN A FILMSTRIP ABOUT YOUNG PEOPLE WITH EMOTIONAL DISTURBANCES WAS MERELY ACADEMIC.

STUDENT #3 IN THE STUDY HAD NO APPARENT DISABILITY, YET SHE PICKED AS WER FAVORITE FILM ONE ABOUT BLINDNESS. THE MYSTIQUE SURROUNDING PEOPLE WHO ARE BLIND MUST HAVE AROUSED HER CURIOSITY.

All of the above statements are false. Despite all the research about communication, its effects and uses, a great deal remains to be learned about the uses people, particularly young people, make of Information and the effect it has on them. This study provides a setting In which the effects and the uses of mediated information can be examined and answers can be sought to some of the unanswered questions about the communication of a message and the result of the communication.

## Background to the Problem

Research about media and communication has traditionally concentration on the source, message, channel of communication, and the anticipated effects of the message (McGuire, 1973). In addition, researchers have become increasingly sophisticated in their understanding of the role of the receiver in a communication situation. For some researchers, the study of demographic characteristics such as age, sex and race or disability, and their use as predictors of effect has been the focus use 1977). Others have emphasized the uses people have for information (Streicher and Bonney, 1974). IN THE PAST DECADE SOME COMMUICATION RESEARCHERS HAVE INVESTIGATED COGNITIVE PROCESSES AND HOW THESE PROCESSES RELATE TO THE EFFECT OF A MESSAGE (Festinger, 1977; Perloff and Brock, 1980). STILL OTHERS HAVE FOCUSED ON THE RECEIVER. IN THIS STUDY THE STUDENT, AS AN INFLUENCE ON THE CONTENT OF THE MESSAGE. (Levonian, Mu 1962, 1963; Dervin, 1979; Threlkeld and Bernatovitz, 1979; Simonson, W 1981). THE LATTER TWO GROUPS OF RESEARCHERS, CONCERNED WITH THE USER INFORMATION, PROVIDED THE BASIS UPON WHICH THIS STUDY WAS FORMULATED. although the other elements of communcation enumerated above were all taken into consideration.

SOPHISTICATION IN STUDY OF THE RECEIVER OF INFORMATION LED TO THE HYPOTHESIS THAT COGNITIVE STATE INFLUENCES THE EFFECT AND USES OF INFORMATION. Festinger (1977) reports a number of experiments which so that when people have a feeling of dissonance, they will be very recept to communication which would reduce this dissonance. Perioff and Brock (1988) maintain that "individuals are active participants in the persuasion process who attempt to relate message elements to their

sisting repertoires of information." (p. 612)

Levonian pioneered in the user-based communication mode by producing an audience-tailored film about India. He pretested and categorized the interests and perceptions of a representative audience. WHEN THIS FILM PRODUCED ON THE BASIS OF USER INTEREST WAS SHOWN, THE AUDIENCES DID, INDEED, HAVE AN OPINION CHANGE IN THE DESIRED DIRECTION. There was no other type of films used so that the opinion change relative only to the sim could be measured.

The Threlkeld and Bernatovitz (1979) research is more sophisticated in design. The premise upon which the researchers operated was that media has little effect when it does not directly address the concerns of users. Therefore, before the production of a slide/tape set, and subsequently a ldsm film, a group of possible employers of the handicapped were interviewed, and their concerns were directly answered in the media produced. It should also be noted that when the media was produced the creators took into account what is Known about the components of the communication process, i.e., source, message, channel, etc. THE MEDIA BASED DIRECTLY ON USER INPUT, WAS DEMONSTRATED TO HAVE A GREATER EFFECT ON WHAT THE EMPLOYERS SAID THEY WOULD DO THAN DID OTHER MEDIA CONCERNING THE HANDICAPPED BUT NOT DIRECTLY ADDRESSING THE EMPLOYERS' CONCERNS.

MUNICIPI

Not only researchers, but also some producers of commercial educational media have come to the realization that user-based media is the most effective. Simonson (1981) reports the results of a survey of educational film-makers about the techniques they consider important in producing persuasive films. One of the most important characteristics listed by those who responded to the survey was that the films "be planned based on the results of a target audience assessment." (1981, p. 14) The

research with filmmakers was conducted by Simonson to attempt to verify six principles he had guidelines he had identified in a survey of the results of over 100 research studies dealing with attitudes and media. Simonson's (1979; 1981) guidelines are intended to serve as a guide for those who want to develop desired attitudes in learners. Guideline #j states that "Learners react favorably to mediated instruction that is . relevant to them." (1981, p. 5) The question is how to determine what is relevant.

According to Lesser (1974), the content of Sesame Street, a program which has had long term success in gaining and holding the attention of children, is based on child testing; it was the first children's program to use this approach.

THE UTILITY OF USER-BASED COMMUNICATION IS NOT LIMITED TO ITS ABILIN TO PERSUADE. Dervin (1979) differs from many of the other researchers looking at user-based communication in that she is not interested in persuasive messages but in the use that people make of information. It is precisely because information is irrelevant to users that it is rejected or not noticed. Dervin suggests a number of ways to make communication more relevant, including "frequent uses of random samples of users detailing their information needs to determine the content of messages." (p.40)

THIS STUDY, WHICH HAS A USER-BASED APPROACH, LOOKS AT BOTH THE EFFECTS OF A MESSAGE IN TERMS OF PERSUASION AND AT THE PERSONAL USES MADE OF THE INFORMATION PROVIDED, TAKING INTO ACCOUNT THE COGNITIVE INVOLVEMENT OF THE INDIVIDUALS IN EACH CASE. Users were not involved in the actual production of media, but their stated interests did affect the selection

#### Problem Statement

The theoretical and conceptual questions were:

 What are optimum communication and selection conditions for media on specified subjects to have desired effects in a teaching-learning environment? (Experimental)

2) Will students have uses for the media-presented information and under what communication and selection conditions? (Exploratory) The specified subjects for this study were mainstreaming and disabilities. The communication conditions (cognitive processes) consisted of user or no user input prior to media selection. The selection conditions (consideration of user input during selection) were the choice of materials based on student-expressed interests, on teacher-media specialist perceptions of student interests or unrelated to student interests on the topic.

The practical implications of receiving answers to these theoretical and conceptual questions have significance for media producers and for educators. Those who have a specific aim, i.e., persuasion, either in producing or using media, have additional evidence which will allow them to predict success of their endeavors. Educators, including teachers and media specialists, who place emphasis on meeting the needs of the users, whatever they may be, learn whether this purpose is in conflict with a more directed purpose (can information be personally useful and have a directed purpose at the same time?) and become aware of conditions which

## **Research Methods**

A PRETEST-POSTTEST EXPERIMENTAL DESIGN WITH CONTROLS FOR INTERVI EXTERNAL, STATISTICAL AND CONSTRUCT VALIDITY WAS USED (Cook and Campbell 1979) FOR THE FIRST PHASE OF THE RESEARCH. The 120 students from six sixth grade classes in two schools were randomly assigned to six conditions. School A was randomly chosen to be the school at which questioning occurred (Groups 1, 2, and 3) and School B the school at which no questioning occurred (Groups 4, 5, and 6) prior to media presentation The groups received the following treatments:

Group 1 Questioning with Materials Based on Student Interest Group 2 Questioning with Materials Based on Teacher/Media Specialist Perception of Interests (Media chosen by teachers and media specialist of classes which did not question)

Group 3 Questioning with Materials Unrelated to Topic Group 4 Non-Questioning with Materials Based on Student Interests (Media chosen by teachers and media specialists of questioning classes based on interests of Group 1)

Group 5 Non-Questioning with Materials Based on Teacher/Medu Specialist Perception of Interests

Group 6 Non-Questioning with Materials Unrelated to Topic

Two types of instruments were used in the research: implementation

data gathering. The implementation instruments were an inquiry instrument which, by the use of open-ended and close-ended questions, distincted from the students their interest about mainstreaming and disabilities, and a mediagraphy, consisting of all available media about mainstreaming and disabilities, annotated and keyed to the concepts on the inquiry instrument.(1) The data gathering instrument was a Semantic differential Test with five adjective pairs relating to disability and to anistreaming.

All students were pretested. A week later half the students were given the inquiry instrument to express their interests thereby having constive involvement with the topics before information was presented. Teachers and media specialists of these students selected media to use based on the concepts and the disabilities in which the students filling out the instrument said they were interested. (The concepts and the types of disability were rank-ordered and the selectors were given explicit instructions about how to interpret this data in making selections.) Teachers and the media specialist of the other students chose on the basis of what they believed students want and need to Know. The media selected by these two groups was substantially different both in disability imphasized and in concepts which the media included. For two groups of students (Groups 3 and 6) who served as controls media totally unrelated to the topic was chosen.

Two weeks after the pretesting, selected media were administered in a forty-five minute period. Posttesting of all students followed Immediately.

Hypotheses were related to the predicted effect of questioning versus

student interest, teacher/media specialist perception of interest, and related interest; and to the predicted effect of an interaction between questioning and method of selection.

Experimental data was analyzed with Dunn's Multiple Comparison of Means test with means adjusted for covariate from ANCOVA tests. The two by three design had the following variables: dependent variables were communication conditions (two) and selection conditions (three). The independent variable was difference in attitude. T tests were also used to examine pretest-posttest change.

AN EXPLORATORY PHASE FOLLOWED THE EXPERIMENT DURING WHICH SIXTEEN STUDENTS WERE INTERVIEWED USING AN INSTRUMENT DESIGNED TO DETERMINE THE USES THEY HAD FOR THE INFORMATION GAINED. Interviews occurred during the two days following the media presentations. Answers were coded according to a Helps and Utilities Content Analytic Scheme developed by Dervin and associates at the University of Washington School of Communications (Dervin and Atwood, 1979). (For complete explanation of interviewing and analysis methodology see Dresang, 1981)

## Results

In the experimental phase, statistically significant results (p.25) showed a more positive attitude toward disability in groups receiving media based on student-expressed interests. (Groups 1 and 4; there was w statistically significant difference between Groups 1 and 4 although the media was selected on the choices of Group 1 only.) The only statistically significant pretest-posttest change (p.85) also occurred w combined Groups 1 and 4. In this instance, it can be concluded that THE

DESIRED OUTCOME, IS THE CHOICE (OR, IF POSSIBLE, PRODUCTION) OF MATERIALS DESIRED OUTCOME, IS THE CHOICE (OR, IF POSSIBLE, PRODUCTION) OF MATERIALS DESED ON USER-EXPRESSED INTEREST. There was no statistically significant change toward the concept of mainstreaming. However, this can be explained by the paucity of media on the subject of mainstreaming. Most of the students' questions simply went unanswered in this area or answered in media that was weak in presentation. (2)

NO STATISTICALLY SIGNIFICANT DIFFERENCE WAS FOUND BETWEEN THE ATTITUDES OF THOSE STUDENTS WHO PARTICIPATED IN THE INQUIRY ABOUT INTERESTS AND THOSE WHO DID NOT. (Groups 1, 2, and 3 versus Groups 4, 5, and 6) Nor was there a statistically significant interaction between participating in questioning and receiving media content based on the results of the questioning. Thus, neither the communication condition of participation nor that of non-participation could be considered significant. If this phenomena is generally true, it provides comfort to filmmakers who must rely on random samples. The interests of the students who responded to the questionnaire were apparently representative of those of their peers. The cognitive processing occurring during the questioning and prior to the media presentation did not make the students more meceptive to the persuasive message.

The exploratory phase of the research, during which randomly selected students were systematically interviewed, added information and depth to Interpretation of the experiment phase. SOME SURPRISING AND UNPREDICTABLE USES FOR THE INFORMATION PROVIDED SURFACED IN ANALYSIS OF THE INTERVIEW DATA. The students referred to at the beginning of this paper provide examples of unexpected findings:

Page 9

STUDENT #1 Although she was blind and although her teacher repeatedly stated that this student was interested in more information about her own disability, she did not list blindness or visual impairment as one of her interests. In fact, she had a very great interest in an unrelated disability, mental retardation.

STUDENT #2 He appeared to be as well-adjusted as anyone might be, but in the course of the interview, he revealed that he identified with one of the emotionally disturbed boys in a filmstrip which was shown. Student #2's parents had been divorced the year before, and he felt he, at the time, could not cope just as the boy in the filmstrip could not. However, the boy interviewed stated that the filmstrip made him realize he himself was not emotionally disturbed because after a period of time he was able to recover and once again relate to family and friends.

STUDENT #3 Even though she had no apparent disability, this student had expressed an interest in blindness because, as she stated, "I have diabetes, and I think I might go blind some day." The film helped her realize that blind young people can lead normal lives, and it helped relieve her fears of blindness for herself.

Each of these students had personal uses for the information, but, interestingly, only one of them showed attitude difference toward the concepts tested after the media presentation. GROUP-ORIENTED DIRECTION

REFSURSIVE MESSAGES ARE NOT, APPARENTLY, ANTITHETICAL TO MESSAGES WHICH

When the responses of the students interviewed were coded and counted, it was found that the students who saw the media based on their a their peers' choices named the most uses for the information. This analysis also revealed that the students who themselves stated their. Interests and received media related to them named more personal helps for the information, e.g., "I was thinking I'm the only one who gets picked on, but I found out there are more people than me (sic) who get picked on for different reasons," as opposed to non-personal uses, e.g., "I know why people who are deaf talk the way they do." SO, ALTHOUGH COGNITIVE INVOLVEMENT IN THE SELECTION DID NOT RELATE TO ATTITUDE CHANGE, IT DID RELATE TO THE PERSONAL APPLICATION OF THE INFORMATION PRESENTED. It is possible, although by no means proven by this research, that the cognitive processing which occurred when the students were named their interests made them cognitively more receptive to the information.

## Conclusions and Implications

To summarize, the conclusions of this research are:

 MESSAGES PRESENTED THROUGH MEDIA ARE MORE LIKELY TO HAVE THE RESULT INTENDED IF THE INFORMATION IS THAT IN WHICH THE RECEIVERS ARE INTERESTED. (Selection Condition)

2) THE OVERALL INTERESTS OF A GROUP MAY BE EXPRESSED EFFECTIVELY BY A GROUP OF PEERS SO THAT THE INFORMATION RECEIVERS DO NOT NECESSARILY

HAVE TO HAVE BEEN DIRECTLY INVOLVED IN THE EXPRESSION OF THEIR INTERESTS. (Communication Condition)

3) THE COGNITIVE INVOLVEMENT IN THE ACTUAL PROCESS OF EXPRESSING INTERESTS ABOUT A SUBJECT CANNOT BE USED TO PREDICT A MORE POSITIVE ATTITUDE TOWARD THAT SUBJECT BUT IT MAY BE RELATED TO MORE PERSONAL USE OF THE INFORMATION. (Communication Condition)

Another important observation which accompanies these conclusions and which might be the subject of further study is:

TEACHERS AND MEDIA SPECIALISTS WERE NOT ABLE TO DETERMINE WHAT MOST INTERESTED THE STUDENTS, EITHER IN CONCEPT OR SUBJECT. THEREFORE, SOME OTHER KIND OF ASSESSMENT MUST OCCUR TO DETERMINE WHAT IS. RELEVANT TO STUDENTS.

The nature of the research should be kept in mind in evaluating and applying the conclusions. The experimental portion of the research was a controlled as possible. Variables peculiar to the participating school district, schools, teachers, media specialists, students or media might mean that when replicated, the study would have different results. The nature of experimental research involving human subjects is such that in most cases replications are needed before firm conclusions can be reached. There is reason to believe, however, that replication would validate the statistically significant findings in the experimental phase of this research. The positive results are in harmony with both theory and other sorewhat similar research (Levonian, 1961, 1962, 1963; Dervin, 1979; Threikeld and Bernatovitz, 1979; Simonson, 1979, 1981).

Replication of the exploratory, interview stage of the study is absolutely necessary before any firm conclusions can be drawn. It is also desirable because of the serendipitous data which emerged from the interviews.

THE CONCLUSIONS OF THE RESEARCH SUGGEST THAT IN THE PRODUCTION OR SELECTION OF MEDIA THE INTERESTS OF THE RECEIVERS AS EXPRESSED BY THE RECEIVERS DESERVE CLOSER ATTENTION. THE CONTENT OF THE MEDIA SHOULD BE RELEVANT TO THE USERS. Those persons wishing to continue to provide and use persuasive communication may need to look closer at the user as the initiation point of communication rather than the sender. Those persons who are interested in information seeking behavior and how people put to use the information they obtain need also to realize that the user-based approach will more likely assure the relevance of any media they might use or produce. THIS STUDY DEMONSTRATES THAT A COMMUNICATOR (PRODUCER OR EDUCATOR) CAN DICTATE AN OVERALL SUBJECT, SUCH AS DISABILITIES, AND STILL, NITHIN THAT SUBJECT, TAILOR THE MEDIA TO MEET THE NEEDS OF THE USERS.

More ways to assess the interests of receivers need to be developed. The implementation tools, the inquiry instrument and the media keyed to concepts, used in this study might be applied in other educational settings but would not be suitable in many situations.

THE NEED FOR IN-DEPTH KNOWLEDGE OF MEDIA IN AN EDUCATIONAL INSTITUTION IN ORDER FOR CONCEPTS AND INTERESTS TO BE MATCHED REENFORCES THE ROLE OF THE MEDIA SPECIALIST AS SPECIALIST IN MEDIA CONTENT. Maximum <sup>USE</sup> of materials and information can be assured only if the media <sup>Specialist</sup> is knowledgeable about and applies the principles of

communication to format and content of materials.

Of particular importance to media specialists is the understanding that while media based on student interests has the greatest impact in terms of attitude change and personal use, media tailored to student interest is not always commercially produced, i.e., media about mainstreaming in this study. Therefore, the production function of the media specialist is supported as essential.

A FINAL IMPLICATION OF THIS STUDY IS THAT THE DESIGNING OF TRADITIONALLY CATEGORIZED RESEARCH SHOULD BE RECONSIDERED, and rather the a study being labeled "experimental" or "case study" or "survey" research, it might employ a combination of these techniques as this study did in combining the experimental and post hoc interview stages. The interview revealed uses of information that were not apparent from any of the testing while at the same time, the testing under experimentally controlled conditions yielded information that would not have been available from the interviewing alone.

### NOTES

Defore and after the closed-ended concepts statements, an open-ended statement inviting the students to name something they would like to know about mainstreaming and disabilities appeared. Sixteen concepts, listed following this article in the CONCEPT KEY which accompanied the Mediagraphy, provided the students an opportunity to check the concepts which interested them most. A sample page of the Mediagraphy is also included to illustrate how the media was coded according to concept. A concept index was provided for teachers and media specialists who were to choose media according to concept; an index listing media by disability emphasized was provided as well.

2) Although this study emphasized the content of the media in terms of concepts and subject matter rather than in terms of presentation, factors affecting the presentation were noted when the various media items were previewed. A number of interesting suppositions also came from a comparison of the media on mainstreaming and that on disabilities. The small amount of information on mainstreaming was in print material, not in narrative form or articulated by anyone with whom the students could identify, and had to be adapted to be included in this study at all. The lack of attitude change toward the concept of mainstreaming seems to stem both from the lack of information and from the poor presentation of what information there was. One aspect of this research which would be interesting to pursue is whether presentation in narrative form is related to attitude change.

Teachers and media specialists were instructed to use at least one print item and one non-print item in the media they chose for the forty-five minute presentation. This was done to avoid any possible preference for a format of media as a cause for attitude change or influence on information use. All classes involved used some information read from a book but relied mainly on films and filmstrips.

#### BIBLIOGRAPHY

Cook. Thomas D. and Campbell, Donald T. QUASI-EXPERIMENTATION: DESIGN & ANALYSIS ISSUES FOR FIELD SETTINGS. Chicago Rand McNally, 1979. Dervin, Brenda "Information As a User Construct: The Relevance of Perceived Information Needs to Synthesis and Interpretation." Unpublished paper prepared for Research and Educational Unit, National Institute for Education, September 1979. ----- and Atwood, Rita. "Helps, Utilities and Uses." University of Washington, 1979. (Mimeographed). Dresang, Eliza T. \*Communication Conditions and Media Influence on Attitudes and Information Uses: the Effects of Library Materials Selected in Response to Student Interests about Mainstreaming and Disabilities." Ph.D. dissecrtation. University of Wisconsin-Madison, 1981. Festinger, Leon. A THEORY OF COGNITIVE DISSONANCE. Evanston, Il.: Row, Peterson, 1977. Lesser. Gerald S. CHILDREN AND TELEVISION. New York: Vintage Books, 1974. Levonian, Edward. "Development of an Audience-Tailored Film" AV COMMUNICATION REVIEW 8 (1968):62-68. "Opinion Change As Mediated by an Audience-Tailored Film." AV COMMUNICATION REVIEW 11 (1963):104-13. "The Use of Film in Opinion Measurement." AV COMMUNICATION REVIEW 10 (1962):258-54. Lin, Nan. "Communication Effects: Review and Commentary." In COMMUNICATION YEARBOOK pp.56-72. Edited by Brent D. Ruban. Brunswick, N.J.: International Communication Association, 1977. McGuire, William. \*Persuasion, Resistance, and Attitude Change.\* In HANDBOOK OF COMMUNICATION pp.216-53. Edited by Ithiel de Sola Pool, Wilbur Schramm, Frederick W. Frede

Nathan Maccoby, and Edwin B. Parker. Chicago: Rand McNally, 1973.

Per Loff, Richard M. and Brock, Timothy C. \*And Thinking Makes It So: Cognitive Responses to Persuasion." In PERSUASION, pp.67-92. Edited by Michael E. Roloff and Gerald R. Miller. Beverly Hills, Ca.: Sage Publications, 1980.

"Media and Attittudes: A Bibliography--Part 2." EDUCATIONAL COMMUNICATION AND TECHNOLOGY 28 (Spring 1980):47-61.

\*Persuasive Films: Techniques Used to Change Attitudes.\* Paper Presented at the Convention of the Association for Educational Communication and Technology, Philadelphia, Pa., 8 April 1981.

"Media and Attitudes: A Bibliography. PART 1--Articles Published in AV COMMUNICATION REVIEW (1953-1977)." EDUCATIONAL COMMUNICATION AND TECHNOLOGY 27 (Fall 1979):217-36.

Streicher, L. H. and Bonney, N. L. "Children Talk about Television." JOURNAL OF COMMUNICATION 24 (1974):54-61.

Ihrelkeld, Robert M. and Bernotavicz, Freda.

CHANGING ATTITUDES TO THE DISABLED THROUGH MEDIA: WHAT THE RESEARCH SAYS. Portland, Me,: The Disability, Attitudes and Media Project, Human Services Development Institute, Center for Research and Advanced Study, University of Southern Maine, 1979. MUDDINIE NOCOM

Above 10:124

#### SAMPLE PAGE FROM MEDIAGRAPHY - 26 -

16mm Film

NICKY: ONE OF MY BEST FRIENDS. CRM/McGraw-Hill Films, 1978. 15 min. Color.

## 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16

Visual Physical Nicky Sarames was born blind and with cerebral palsy. His parents wanted him to be accustomed to life as soon as possible, so enrolled him in a regular public school. The film demonstrates how a disabled child may be successfully mainstreamed into a regular classroom and how the similarities between non-disabled and disabled students far outweigh their differences. (The word mainstreaming is not mentioned.) Nicky, his friends and his teachers freely describe their feelings and their relationships. A typical day in Nicky's school life reveals that he excels at math. It also reveals the kinds of frustrations he experiences because of his disability.

16mm Film

NOBODY TREATS ME DIFFERENT. Films, Inc., 1977. 8 mins. Color. Best of Zoom.

#### 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Physical

Jimmy Kelly, a young teenager with cerebral palsy, describes his life at a mainstreamed school, how people meet him, his likes and dislikes, and his expectations for the future. The narrator is easy to understand yet at the same time seems as if it may be a person with cerebral palsy talking. Jimmy attends school in a mainstreamed situation. He plays hockey on a team with other disabled young people; his team successfully competes against teams with non-disabled players.

Book

ONE HANDED POWER by the Light and Bright Writers' Club a Wadewitz School, Racine, WI. Racine Unified School District, 1976.

49 pp. Illustrations and black and white photographs.

Physical

7

A spiral-bound, young people written compendium of the many, many things a person with one hand can do (ending with a section on what one can do with no hands). Illustrations are by the students themselves. The

## CONCEPT KEY

Something else I'd like to know about mainstreaming or about disabilities but did not list above is

- 1. what causes disabilities.
- what kinds of special help a disabled person needs which is different from that which a non-disabled person needs.
- 3. what disabled people can do to earn money when they get older.
- how non-disabled people should act around disabled people.
- 5. how disabled people should act aroung non-disabled people.
- whether non-disabled and disabled people are friends with one another.
- what kinds of activities disabled persons can do which are the same as those which non-disabled persons do (in other words, activities in which disabled persons are mainstreamed).
- when disabled persons want help and when they do not.
- what kind of special equipment, if any, persons with disabilities need.
- how it feels to be disabled.
- what special problems disabled persons have which non-disabled persons do not.
- what problems disabled and non-disabled persons have that are the same.
- whether disabilities can be cured.
- whether disabled people want to talk about their disabilities.
- what kinds of attitudes bother disabled persons most.
- what questions people without disabilities have about those people with disabilities.
SAMPLE PAGE FROM MEDIAGRAPHY - 26 -

6 61141 - - -

16mm Film

NICKY: ONE OF MY BEST FRIENDS. CRM/McGraw-Hill Films, 1978. 15 min. Color.

#### 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16

Visual Physical Nicky Sarames was born blind and with cerebral palsy. His parents wanted him to be accustomed to life as soon as possible, so enrolled him in a regular public school. The film demonstrates how a disabled child may be successfully mainstreamed into a regular classroom and how the similarities between non-disabled and disabled students far outweigh their differences. (The word mainstreaming is not mentioned.) Nicky, his friends and his teachers freely describe their feelings and their relationships. A typical day in Nicky's school life reveals that he excels at math. It also reveals the kinds of frustrations he experiences because of his disability.

16mm Film

NOBODY TREATS ME DIFFERENT. Films, Inc., 1977. 8 mins. Color. Best of Zoom.

## 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Physical

Jimmy Kelly, a young teenager with cerebral palsy, describes his life at a mainstreamed school, how people meet him, his likes and dislikes, and his expectations for the future. The narrator is easy to understand yet at the same time seems as if it may be a person with cerebral palsy talking. Jimmy attends school in a mainstreamed situation. He plays hockey on a team with other disabled young people; his team successfully competes against teams with non-disabled players.

Book

ONE HANDED POWER by the Light and Bright Writers' Club of Wadewitz School, Racine, WI. Racine Unified School District, 1976.

49 pp. Illustrations and black and white photographs.

- 2

Physical

A spiral-bound, young people written compendium of the many, many things a person with one hand can do (ending with a section on what one can do with no hands). Illustrations are by the students themselves. The TITLE: Educational Technology and Teacher Competence: Identification and Preservice Assessment

AUTHOR: Patricia S. Ernest

EDUCATIONAL TECHNOLOGY AND TEACHER COMPETENCE: IDENTIFICATION AND PRESERVICE ASSESSMENT

> Patricia S. Ernest, Ph.D. Assistant Professor Director of Curriculum Center College of Education University of Montevallo Montevallo, Alabama 35115

Presented at the Annual Convention Association for Educational Communications and Technology May 2-7, 1982 Dallas, TX

## Introduction

Indications of a persistent lack of confidence in American education are reflected by the publication each year of the results of the "Gallup Poll of the Public's Attitudes Toward the Public Schools." A review of the reports in issues of <u>Phi Delta</u> <u>Kappan</u> from 1974-1980 revealed a steady decline in the ratings ("12th Annual Gallup," 1980). The search for an explanation for the espoused weaknesses in the schools has focused substantial attention on the effectiveness of classroom teachers and their professional preparation.

Considerable research has identified skills, competencies, and characteristics that correlate positively with effective teaching (e.g. Medley, 1973; Rosenshine, 1976; Ryans, 1960). One of the competencies consistently identified by the intense exploration by researchers and practitioners is the teacher's ability to design instruction utilizing educational technology ("A Framework," 1978; Schmitthausler, 1975). Moldstad (1974) summarized the findings:

- Significantly greater learning often results when media are integrated into the traditional instructional program.
- Equal amounts of learning are often accomplished in significantly less time using instructional technology.
- Multimedia instructional programs based upon a "systems approach" frequently facilitate student learning more effectively than traditional instruction.

1

 Multimedia and/or audiotutorial instructional program are usually preferred by students when compared with traditional instruction. (p. 390)

However, the extensive benefits to be derived from instructional media can be attained only by teachers who are competent in their use. Wilkinson (1980) emphasized that "Media are more effectively and efficiently used, and therefore have greater impact on students, when teachers have received specific training in their utilization" (p.39).

The role of educational media competencies as a component of teacher preparation programs has been significantly impacted by three factors. One, the education profession has been subject to **(Ay**tical scrutiny by members of its own ranks as well as the public sector as emphasis on accountability and cost effectiveness has increased. Two, a rapid proliferation of technology has created an increasing array of tools and techniques of communication, entertainment, and instruction. Teachers must cope with students who are "media literates." Three, there have been myriad research studies conducted on the effectiveness of educational technology in the teaching/learning process.

ar

tž

et.

te

th

ba

The role of educational media in classroom instruction with in implications for teacher preparation has been a focal point of the the increased attention to quality of programs. In a comprehensive assessment of the status and trends of teacher preparation sponsored by the National Center for Education Statistics in 1975 in the contribution of instructional technology was one of five cet Tea tral questions investigated (Steele, 1977). The media collections of many public schools have become quite extensive due to materials and equipment purchased with the influx of federal funds allocated by the Elementary and Secondary sducation Act of 1965. The amount of money spent by public schools for audiovisual supplies, equipment, and salaries in 1966 was \$187,047,000 (Lawrence, 1969). Title III's support for innovative and exemplary programs released funds for purchase without always demanding appropriate justification and evaluation. A frequent result was that the materials and equipment remained idle because teachers had not been prepared adequately to utilize them.

3

Teacher education programs must make provisions for preservice teachers not only to have available a variety of the latest equipment and materials, but also to have experiences in which they are called upon to make decisions as to the best materials, equipment, and learning arrangements for bringing about desired responses by the learner. Teachers must learn how to select, produce, and utilize a wide variety of materials; how to employ a variety of techniques and approaches; and how to evaluate the results of their efforts. They must learn how to make instructional decisions based on consideration of the varied factors impinging upon the instructional situation (Byrd, 1978; Rogers, 1978a). To increase the probability that teachers achieve competence in these generic skills, they must become a component of teacher education programs.

The primary accrediting agency of teacher education programs in the nation, the National Council for the Accreditation of Teacher Education, has adhered to the previously documented

Q.

5,

principles of media research. Standard 2.3.3 Curricula for Basic Programs, Teaching and Learning Theory with Laboratory and Clinical Experience, stated:

There is a body of knowledge about teaching and learning that should be the basis for effective performance. Certain kinds of problems (such as planning, selection of learning resources . . .) represent recurring types of classroom situations. (p. 6)

And specific reference was made in Standard 5.2, Materials and Instructional Media Center:

Modern media and materials are essential elements in the communications system of contemporary society. For this reason, teachers need to understand the technologies that make such media and materials usable in their teaching and need to possess skills in using them . . . A program for the preparation of teachers includes the use of teachinglearning materials and instructional media (so that) . . . prospective teachers are instructed in how to devise and use modern technologies in their teaching. ("Standards for Accreditation," 1981, p. 10)

Allen and Mackin (1973) asserted that teacher education should be the first to respond to the test "the impact that advanced technology" (p. 3) will have on the staffing and curriculum of the schools. However, in a nationwide survey of 916 accredited institutions which offered elementary education curricula, only 40% required preservice teachers to complete an educational media course (Roeder, 1973).

It seems that the extent to which preservice programs provide for the development of media competencies of teachers is a fundarental concern; but, differences in perception of the field tended to cause its application in "bits and pieces" rather than as a process. Nelson (1976) exemplified this problem in the study of educational media for teachers in Oregon. He concluded: "While all newly certified teachers will have 'preparation in educational media,' their competencies will vary widely" (abstract).

5

It is logical to expect that teachers who have not had formal preparation will not possess the competencies that are needed to utilize multimedia approaches to teaching. According to research by Camp (1957), Streeter (1969), and Branscombe (1969), there was a positive correlation between teachers' competencies and their frequency of educational media utilization. A study by Rogers (1978a) of factors affecting teachers' utilization concurred, and yielded further evidence that the strongest relationships were between attitude and use.

Everson et al. (1979) also investigated attitudes toward media and supported the hypothesis that fear of automation was an important variable modifying teachers' attitudes. Their findings determined that not only did attitudes influence utilization of media but they could have interfered with student achievement from the materials. However, data seemed to suggest that teachers' fears could be attenuated by exposure to and familiarity with educational application of media. In a similar vein, Romano and Spiecker (1974) found that exposure to audiovisual experiences in courses had an impact on frequency of utilization. According to Branscombe (1969), exposure at the preservice level was critical

because utilization patterns formed there were comparatively difficult to alter later.

While the incorporation of educational technology and student achievement are positively correlated, studies have reported a large population of teachers who do not consistently utilize educational technology. The research indicates that these teachers have not been prepared in this areaat the preservin level. Preliminary research revealed that the actual practice of providing educational technology competencies for teachers in preservice programs was inadequate due to two factors:

(a) lack of an identifiable set of specific competencies correlated with teacher effectiveness; (b) lack of current measures to assess the status of teacher preparation in educational technology.

This inadequacy merits further investigation.

## Statement of the Problem

This study was designed to identify the most important teacher competencies related to educational technology in the preparation of teachers at the preservice level. In addition, the study assessed the curricular provision for the identified competencies in a selected sample of teacher education programs. The need in Alabama for specification of the competencies for teachers was illuminated when the Standards for Teacher Education and Certification included media as a requirement in the preservice preparation programs without identifying the competencies. The problem was further complicated by the lack of a measure which indicated the nature and extent of the competencies being taught in each of the programs.

The following research questions were investigated in the study:

 What educational technology competencies for teachers are identified as most important by experts in the fields of media and teaching?

7

COMPONIE INCOMENCE

- 2. What educational technology competencies for teachers are identified as most important by personnel in a selected sample of teacher education programs?
- 3. What is the relationship between the competencies identified by the experts and the competencies identified by the personnel in the teacher education programs?
- 4. To what extent are the identified competencies taught in selected sample of teacher education programs?
- 5. What is the relationship between the competencies identified by the experts and the extent to which the competencies are taught in the selected sample of teacher education programs?

#### Methodology

The study was composed of two sequential phases: identification and assessment. A two-round modified Delphi Technique was utilized in the identification phase. The data from the Delphi were used as the basis for the assessment phase.

## Identification

The modified Delphi panel. Fifty experts in the fields of media and/or teaching were selected as members of the modified

Delphi panel. Twenty media specialists from throughout the United States, and 10 teacher educators, 10 supervisors/administrators, and 10 classroom teachers, from Alabama, comprised the four sub-groups. Group membership was determined by the expert publications, research, or practical applications in technology and/or teacher effectiveness. The fifty members were randomly selected from a group of 100 who were initially identified according to the criteria.

#### Instrumentation.

The instrument, entitled Inventory of Teacher Competencies Related to Educational Media, was a questionnaire designed to be completed by the identified Delphi panel members. It consisted of four parts: (a) personal and professional background of the respondent, (b) structured items to measure the respondent's perception of the importance of media competencies in the preservice preparation program, (c) an opportunity for formulation of additional competencies, and (d) an opportunity for other comments

The first round of the instrument was formulated by the researcher from a review of research on educational technology and teacher effectiveness. It was determined from the review that no valid instrument existed to measure the desired competencies. The available instruments were of limited usefulness due to a lack of relevant content, inadequate measurement techniques, and/or an orientation to traditional materials. As stated by Rogers (1963) in a comprehensive review, "Although much is written about competencies needed by teachers in working with media . . . resources, little research has dealt with the measurement of these competencies (p. 18).

Areas of competence were identified, and some degree of consensus based on their recurring appearance was sought. Striving for uniformity of statement, the researcher translated the areas into 54 specific competencies in seven randomly ordered categories:

q

PREDORI TIMUT DOLLEY

Visual/Aural/Computer Literacies - 3 items

2. Production Techniques - 13 items

3. Equipment Operation - 10 items

4. Selection and Utilization Principles - 17 items

5. Communication Principles/Mass Media - 4 items

6. Systems Approach/Instructional Design - 4 items

7. Evaluation of Media, Instruction - 3 items

To determine the degree to which respondents felt each competency was important in the preservice preparation of teachers, they were asked to respond on a 4-point Likert-type scale with the following options:

1 = little or no importance

2 = somewhat important

3 = moderately important

4 = very important

The instrument was subjected to field test for clarity by a doctoral level class composed of classroom teachers and for content review by two media specialists.

The primary purposes of the second round were to provide each expert: (a) with feedback from Round One regarding the consensus on each item; (b) an opportunity to re-rate any item, if desired, and (c) an opportunity to justify the rating if it deviated from the mean. The instrument indicated the frequencies for each

response rating and the mean for each item. On the Round II instruments mailed to the respondents, individual responses from Round One were indicated in red. Since all of the 54 Round I competencies received a rating of "moderately important" or "very important" by 60% or more of the respondents, each competency was retained for Round Two. The respondents generated a total of 15 additional competences which were placed within categories deemed appropriate by the researcher. Response to each of these items was requested according to the original scale.

10

The nature of the study dictated the use of a mailing system to obtain the responses to each set of instruments.

## Assessment

Institutional representatives. The twenty-six institutions of higher education in Alabama with state approved teacher education programs formed the selected sample. A representative of each institution was designated by the respective dean. The criterion for designation was specified as the person directly responsible for teaching or supervising the course (or other approach) which provided for the greatest number of media competencies for preservice teachers.

<u>Instrumentation</u>. The instrument for the institutional assessment was designed to assess (a) the institutional representatives' perceptions of the importance of teacher competencies related to educational media at the preservice level, and (b) the degree to which the competencies were taught in the teacher education program in Alabama.

This instrument was formulated on the basis of the analysis of the results of Round Two. Each of the 69 competencies received a rating of "moderately important" or "very important" by 60% or more of the respondents; therefore, each competency was retained. The instrument consisted of three parts: (a) the 69 competency statements to measure the respondent's perception of the importance of their inclusion in the preservice program, and the extent to which each competency was included in the institution's program: (b) a request for a narrative description of the basic undergraduate preparation in educational media typical of future teachers who graduated from the institution; and (c) an opportunity to express other relevant comments.

In the first part, the response scale for perceptions was identical to the Round One instrument. The extent to which the competency was taught in the institution was measured according to the following scale:

- 1 = introductory awareness level in a required course/experience
- 2 = indepth knowledge acquisition level in a required course/experience
- 3 = demonstrated performance level in a <u>required</u> course/experience
- 4 = introductory awareness level in an <u>elective</u> course/experience
- 5 = indepth knowledge acquisition level in an elective course/experience

11

VTOGTUNE NOG7

- 6 = demonstrated performance level in an <u>elective</u> course/experience
- 7 = not addressed in our preparation program

The decision to use the three levels of (a) introductor awareness, (b) indepth knowledge, and (c) demonstrated perform was based on findings from the literature concerning the form lation of foundations for effective teaching. The Californ State Department of Education project on teacher education specified the developmental process from knowledge to under ing to application ("A Framework," 1978; Schalock, 1970). Data Analysis

The rank orders of identified competencies and the seven categories were calculated utilizing the item means and the ite means within categories. Relationships were measured by the Kendall tau and Spearman rho rank order correlation coefficient with the .05 level designated as the criterion for significant The significance of the differences was determined by the utilization of the chi square statistic.

#### Results

Frequencies, percentages, and means were computed for each item and each of the seven categories to provide the data to answer systematically the five research questions.

## Perceptions of Modified Delphi Panel

Analysis of these data revealed that importance ratings were very high. At the conclusion of Round Two, 64 of the 69 competencies had means of 3.00 or above, in the "moderately Important" or "very important" range. Of these 64, 36 were ranked at 3.50 or above, "very important." Therefore, of the competencies identified in the literature by the researcher, over 1/2 (52%) were considered by the modified Delphi panel to be "very important" for preservice teachers. The 69 competency statements in rank order are presented in the Appendix.

# Perceptions of Teacher Education Personnel

The perceptions of importance by personnel in the teacher education programs in Alabama were calculated from the responses by the Institutional Representatives. The analyses included establishing the rank order of the items and the rank order of the categories of items. According to examination of these data, importance ratings were very high. Of the 69 competencies, 67 had means of 3.00 or above in the "moderately important" or "very important" range. Fifty-two of the items had mean ratings of 3.50 or above, which classified them as "very important." Therefore 3/4 (75%) of the competencies were perceived as "very important" for preservice teachers by representatives of Alabama's teacher education programs, and an additional 22% were considered to be "moderately important."

#### Delphi/Teacher Education Relationship

Determination of the relationship between the perceptions of the two groups was made by the use of three statistical analyses. Correlation coefficients were computed on the rankings of the two groups by item and by category. The chi square compared the number of responses classified in each category of the importance scale by group.

292

The rank orders of the competencies for the experts and for the teacher education personnel were derived from the mean ration for each item. The Kendall's tau correlation coefficient compute on the rankings indicated a significant positive correlation between the ranks of the two groups (tau = .5665, p = .001).

The relationship between groups and perceptions of importance was tested for each item by the chi square statistic by comparing the number of responses classified in each category of the import scale by group. The results showed a significant discrepancy between groups on only four of the 69 items: use of microcomputer production of lettering and duplicating paste-ups, and use of behavioral models. The teacher education program ratings were higher in every case.

The third analysis of the relationship between the two groups was computed by comparing the rankings by categories of competencies. The rankings were derived by calculating the means of the set of items within each category. The rankings by the experts and by the institutional representatives are found in Table 1. For consistency throughout the study, the ranks of the panel of experts were used as the established rank order.

ran

(P

à co

exp.

## Table 1

Rank of Categories by Importance for Experts and

for Institutional Representatives

Categories	Ri	anks
	Experts $(\overline{X})$	Institutions $(\bar{X})$
CEquipment Operation	1 (3.65)	2 (3.70)
DSelection and Utilizat	ion	
Principles	2 (3.59)	3 (3.68)
ECommunication Principl	es/	
Mass Media	3 (3.49)	4 (3.63)
FSystems Approach/		
Instructional Design	4 (3.39)	1 (3.73)
GEvaluation of Media,		
Instruction	5 (3.28)	6 (3.42)
BProduction Techniques	6 (3.27)	5 (3.55)
AVisual/Aural/Computer		
Literacies	7 (3.19)	7 (3.33)

The Spearman's rho correlation coefficient computed on the rankings indicated a somewhat positive significant correlation (P = .750, p = .05, critical value = .714).

The results of these three statistical analyses revealed <sup>a</sup> consistent, positive relationship between perceptions of the <sup>experts</sup> and the institutional representatives.

# Competencies: Extent Taught

The identified competencies were taught in the selected sample of teacher education programs on a range from 0.0% to 57.1% of the programs. Two items were taught in 57.1% of the programs: one concerned educational goals and learning objective and the other related to the elements of a lesson on the basis of a model. Designing teaching/learning strategies for microcomputers and developing an understanding in the telecommunication area were not addressed in 61.9% of the programs.

The rank order of categories according to extent to which taught was determined by averaging the percentages of responses at level 3, demonstrated performance level in a required course. The rank order of the extent to which each category was taught is reported in Table 2.

## Table 2

Rank Order of Extent to Which Each Category Is Taught Derived from Percentages of Responses at Level 3

Category	Rank	Average %
CEquipment Operation	1	44.6
FSystems Approach/Instructional		
Design	2	39.9
BProduction Techniques	3	37.8
DSelection and Utilization		
Principles	4	29.6
ECommunication Principles/		
Mass Media	5	26.2
GEvaluation of Media, Instruction	6	21.1
AVisual/Aural/Computer Literacies	7	19.1

Analysis revealed that the range of responses for the extent o which the categories were taught was limited--25 percentage points. In addition, all the percentages were below 50%. The rategory ranked first was taught in an average of only 44.6% of Institutions.

# elphi/Extent Taught Relationship

The relationship between the variable of expert perceptions nd the variable of extent to which the competencies are taught as analyzed by comparing the rankings by categories of competencies. he rank orders were calculated by computing the means for the sets

296

MERON INNERDON

of items within each category. The rankings of the two variable groups appear in Table 3.

## Table 3 '

Rank Order of Categories by Importance According to Experts' Perceptions and Extent Taught

in Programs

	Ranks		
Category	xperts	Extent taught	
CEquipment Operation	1	1	
DSelection and Utilization			
Principles	2	4	
ECommunication Principles/Mass			
Media	3	5	
FSystems Approach/Instructional			
Design	4	2	
GEvaluation of Media, Instruction	5	6	
BProduction Techniques	6	3	
AVisual/Aural/Computer Literacies	7	7	

There was not a significant positive correlation between the rankings according to the results of the Spearman's rho correlation coefficient (P = .6071, not significant - critical value = .714).

## Conclusions and Discussion

Based on the findings in this study, two conclusions were drawn: (a) media specialists, teacher educators, administrators, and teachers perceive educational technology competencies for teachers as highly important; and (b) graduates of the preservice preparation programs in Alabama have not utilized educational technology at the levels of importance established by the experts' and institutional representatives' perceptions.

On a range from 1.0-4.0, 64 of the 69 competencies on Round II had means of 3.00 or above, in the "moderately important" or "very important" range. The five competencies whose means were below 3.00 related to the use of microcomputers, developments in the telecommunications/computer area, and production of color lift transparencies, black and white photographs, and paper color prints.

Seventy-five percent of the identified competencies process were perceived as "very important" for preservice teachers by representatives of Alabama's teacher education programs. The only two competencies rated as less than "moderately important" related to the use and operation of microcomputers.

Provision for preservice preparation has not been at a level consistent with the perceptions. No category was taught in more than 44.6% of the institutions, and no single competency was taught in more than 57.1% of the institutions.

Therefore, it may be concluded that utilization levels are lower than perception levels. Based on the findings in the

295

literature, there is a predictive value of preparation associates with utilization (Branscombe, 1969; Romano & Spiecker, 1974). In addition, a strong relationship was reported between preparation and attitude, and attitude and use (Rogers, 1978a). Everson et al (1979) found that not only do attitudes influence utilization of media, but they may interfere with student achievement from the materials. They cited data which suggested that teachers' fears could be attenuated by exposure to and familiarity with the educational application of media.

In summary, this study identified 69 educational technology competencies that are perceived to be related to teaching effectiveness. An assessment of a selected sample of teacher education programs revealed that a significant percentage of these competence are not included in the programs. This disparity offers a challenge to personnel in teacher education programs who seek to improve teacher effectiveness.

# APPENDIX

# Ranked Competencies Derived from Round II Means

	Competency	Rank	Mean
21.	Set up, operate, and take down manual and automatic 16mm		
	projectors .	1	3.93
25.	silent and sound filmstrip projectors	2	3.90
27.	Set up, operate, and take down a cassette tape recorder	3	3.86
26.	Set up, operate, and take down a record player	4.5	3.83
22.	Set up, operate, and take down an overhead projector	4.5	3.83
24.	Set up, operate, and taken down a slide projector	6	3.81
47.	Evaluate the suitability of specific media on the basis of interests, experience, maturity, and powers of comprehension of a given group of learners	7	3.79
41.	Describe the major characteris- tics, advantages and disadvantages, and appropriate teaching/learning situation for motion pictures	9	3.76
55.	Formulate educational goals and write learning objectives which specify outcomes, achievements, and evaluations for students	10.5	3.74
38.	Describe the major characteris- tics, advantages and disadvantages, and appropriate teaching/learning situations for graphics (charts, graphs,		
50.	tics, advantages and disadvantages, and appropriate teaching/learning situations for graphics (charts, graphs, diagrams, etc.)	10.5	

21

CAMPRON IMMERICATIV

	Competency	Rank	Mean
50.	Describe the role of a school media specialist in providing services for classroom teachers	10.5	3.74
16.	Produce materials for display (bulletin boards, cloth boards, or other visual displays)	10.5	3.
54.	Formulate objectives and strategies for utilizing mass media in teaching/learning situations	14	3.1
40.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for educational television	14	3.1
42.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for disc recordings/tape recordings	14	3.
37.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for physical objects and models	17	3.6
39.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for games and simulations	17	3.6
44.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for print (texts)	17	3.61
30.	Perform simple maintenance operations on equipment (such as replacing bulbs)	19	3.0

	Competency	Rank	Mean
17.	Produce graphics (chart, graph, diagram) appropriate to a specified learning objective and with evidence of technical quality	20.5	3.67
63.	Assess media utilization proce- dures in terms of student growth and achievement according to specified instructional objectives	20.5	3.67
14.	Produce audio recording (cassette or reel-to-reel) appropriate to a specified learning objective and with evidence of technical quality	23	3.64
43.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for projected and nonprojected still pictures	23	3.64
49.	Explain rights, limitations and responsibilities of users of copyrighted material as outlined in the Copyright Law	23	3.64
1.	Define and develop strategies for utilizing visual literacy skills for a specified group of learners	26	3.62
56.	Name and define the three domains of learning (cognitive, affective, psychomotor)	26	3.62
57.	Write learning objectives illustrating each of the three domains of learning	26	3.62

Competency	Rank	Me
58. Construct the elements of a lesson on the basis of a model which represents a systematic approach to teaching and learning	29	3.
35. Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for programmed instruction	29	3.
34. Verify the appropriateness of educational media for a specified teaching/learning situation by analyzing the level of sophisti- cation, the cost, the availabil- ity and the technical quality	29	
<ol> <li>Produce a handmade transparency appropriate to a specified learning objective and with evidence of technical quality</li> </ol>	31	3.
<ol> <li>Set up, operate, and take down a video recorder</li> </ol>	32	3.
32. Identify sources of educational media materials through the use of selection aids such as <u>Book- list</u> , NICEM indices, etc.	33.5	3.
<ol> <li>Set up, operate, and take down an opaque projector</li> </ol>	33.5	3.
<ol> <li>Identify and demonstrate the elements of composition in the preparation of visuals</li> </ol>	35.5	3.
<ol> <li>Define and develop strategies for utilizing aural literacy skills for a specified group of learners</li> </ol>	35.5	3.

	Competency	Rank	Mean
45.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for chalk-		
	boards	37.5	3.44
46.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for video		ч 856
	recordings	37.5	3.44
7.	Produce a laminated visual appropriate to a specified learning objective and with evidence of technical quality	30	3.43
	evidence of technical quartey	55	5.45
20.	preparation of their own media	40	3.41
53.	Analyze the techniques, processes, and impact of the mass media (TV, radio, newspapers,		
	etc.) on schools and students	42	3.40
52.	Identify, analyze, and utilize nonverbal forms of communication	42	3.40
33.	Describe the elements and procedures of a basic utilization plan (such as select, preview, use, followup, and evaluate) for	t.	
	educational media	42	3.40
51.	Define components of the communication process and iden-	<b>*</b> 2	
	accurate transmission of messages	44.5	3.38
15.	Produce a video recording (with camera and off-air) appropriate to a specified learning objective and with evidence of technical		
	quality	44.5	3.38

	Competency	Rank	Me an
65.	Employ validation procedures for commercially prepared materials	46	3.54
54.	Devise and employ validation procedures for teacher-made materials	47.5	3.3
52.	Devise media presentations to accompany commercial learning programs, i.e., textbooks	47.5	3.3
68.	Design, construct, and validate a self-instructional module in kit form	49	3.3
13.	Produce 2x2, 35mm slides appropriate to a specified learning objective and with evidence of technical quality	50	3.2
6.	Produce a dry mounted visual appropriate to a specified learning objective and with evidence of technical quality	51.5	3.2
48.	Display a knowledge base of educational media concepts by distinguishing among terms such as educational technology, instructional resources, software, hardware, and cost effective	51.5	3.2
36.	Describe the major characteris- tics, advantages and disadvan- tages, and appropriate teaching/ learning situations for computer assisted instruction	53	3.2
61.	Determine the impact of media on learners from a psychological perspective	54	3.1
28.	Set up, operate, and take down a reel-to-reel tape recorder	55	3.1

	Competency	Rank	Mean
69.	Interpret the adequacy of research findings in the media area	56	3.16
66.	Design and produce a set of visualized test items	57	3.15
12.	Produce a heat process transparency appropriate to a specified learning objective and with evidence of technical quality	53	3.14
9.	Produce a paste-up suitable for duplication appropriate to a specified learning objectiive and with evidence of technical quality	59	3.10
50.	Assess the complexity of introducing educational change into the system	60	3.03
8.	Produce three types of lettering appropriate to a specified learning objective and with evidence of technical quality	61.5	3.02
31.	Operate microcomputer to utilize commercially prepared software	61.5	3.02
59.	Develop the ability to explain and use behavioral models	63.5	3.00
57.	Design and produce an audio test	63.5	3.00
4.	Develop an understanding of current and expected developments in the telecommunications/ computer area	65	2.89
11.	Produce a color lift transparency appropriate to a specified learning objective and with evidence of technical quality	66	2.79

27

PAREDON INNITED

306

ï

	Competency	Rank
3.	Design teaching/learning strategies incorporating the use of microcomputers for a specified group 1f learners	67
18.	Produce black and white photo- graphs appropriate to a specified learning objective and with evidence of technical quality	68
19.	Produce paper color prints appropriate to a specified learning objective and with evidence of technical quality	69

#### REFERENCES

- Allen, D. W., & Mackin, R. A. Toward a redefinition of teacher education. In <u>Teacher education and</u> <u>educational technology</u>, Englewood Cliffs, NJ: Educational Technology Publications, Inc., 1973.
- Branscombe, F. R. The pre-service professional training of teachers in the province of Ontario, Canada, as it relates to instruction in the selection, production and utilization of audio-visual instructional materials. Unpublished doctoral dissertation, New York University, 1969.
- Byrd, C. R. The problem areas associated with teacher training in the use of educational technology. In Federal Interagency Committee on Education, <u>Teacher</u> training in the use of educational technology. Washington, DC: U.S. Department of Health, Education, and Welfare, July 1978.
- Camp, M. B. Some factors relating to the utilization of audiovisual materials with suggestions for teacher preparation in this area (Doctoral dissertation, The Pennsylvania State University, 1957). <u>Dissertation</u> <u>Abstracts International</u>, 1958, <u>18</u>, 155. (University Microfilms No. 25,075)
- Everson, H. T. et al. <u>Attitudes toward instructional</u> <u>media: A comparison of teacher education and computer</u> <u>science majors</u>. Paper presented at the Annual Meeting of the Northeastern Educational Research Association (Fallsview, NY, October 1979). (ERIC Document Reproduction Service No. ED 180 484)
- A framework for developing teacher competencies. Sacramento: California State Department of Education, 1978. (ERIC Document Reproduction Service No. ED 160 569)
- Lawrence, H. H. The development of a model media course for the professional preparation of elementary and secondary teachers in Arkansas. Unpublished doctoral dissertation, University of Arkansas, 1969.
- Medley, D. M. Closing the gap between research in teacher effectiveness and the teacher education curriculum. Journal of Research and Development in Education, 1973, 7, 39-46.

29

Moldstad, J. A. Selective review of research studies showing media effectiveness: A primer for media directors. AV Communication Review, 1974, 22, 387-401

- Nelson, W. K. Educational media curricula and instruction for preservice teachers in Oregon's colleges and universities (Doctoral dissertation, University of Oregon, 1976). Dissertation Abstracts International, 1977, <u>37</u>, 5759A-5760A. (University Microfilms No. 77-4747)
- Roeder, H. H. Teacher preparation and AV methods courses. Audiovisual Instruction, 1973, 18(5), 40.
- Rogers, J. V. Media center resources and Appalachian secondary teachers. <u>Southeastern Librarian</u>, 1978, 28(3), 149-157. (a)
- Rogers, J. V. Media competence of teachers. A review of measurement research. Educational Technology, 1978, 18(10), 16-22. (b)
- Romano, F. A., & Spiecker, J. <u>Educational media</u> competencies for future secondary school teachers: <u>A comparative study of views held by secondary school</u> <u>principals and academicians</u>. Fort Lauderdale, FL: Nova University, 1974. (ERIC Document Reproduction Service No. ED 111 794)
- Rosenshine, B. Recent research on teaching behaviors and student achievement. Journal of Teacher Education, 1976, 27, 61-64.
- Ryans, D. G. <u>Characteristics of teachers</u>. Washington, DC: American Council on Education, 1960.
- Schalock, H. D. et al. <u>A plan for managing the develop-</u> ment, implementation, and operation of a model elementary teacher education program. Monmouth: Oregon College of Education, 1970.
- Schmitthausler, C. M. Some components of a comprehensive competency-based teacher inservice education program for reading and mathematics. Sacramento: California State Department of Education, 1975. (ERIC Document Reproduction Service No. ED 148 736)

- Standards for accreditation of teacher education: The accreditation of basic and advanced preparation programs for professional school personnel (Rev. ed.). Washington, DC: National Council for Accreditation of Teacher Education, March 1, 1981.
- Steele, S. A. The state of teacher education, 1977 (NCES Monograph 78-409). Washington, DC: U.S. Government Printing Office, 1977.
- streeter, E. C. Teacher competency and classroom use of educational media. <u>Audiovisual Instruction</u>, 1969, 14(1), 60-62.
- 12th annual Gallup poll of the public's attitudes toward the public schools. Phi Delta Kappan, 1980, 62, 33-48.
- Wilkinson, G. L. Media in instruction: 60 years of research. Washington, DC: Association for Educational Communications and Technology, 1980.

# TITLE: Utilization of Media in Teaching by Secondary Classroom Teachers

AUTHORS: Raymond M. Gilbert Thomas L. Hennigan

## UTILIZATION OF MEDIA IN TEACHING BY SECONDARY CLASSROOM TEACHERS

Paper for presentation to the Association for Educational Communications and Technology National Convention Dallas, Texas May 3-7, 1982

#### Presented by

Raymond M. Gilbert, Ed.D. Thomas L. Hennigan, Ed.D. Northwestern State University of Louisiana
Utilization of Media in Teaching By Secondary Classroom Teachers

A media usage study was undertaken in American Secondary Schools to determine the current status of media utilization by classroom teacher. The population included teachers in secondary schools whose principals were on the current membership list of the National Association of Secondary School Principals. Through use of a specially constructed Educational Media Questionnaire 10 percent of the teachers from each school in the sample were surveyed. A randomly selected group of 1128 full-time secondary classroom teachers was drawn from the respondents of 150 schools in 38 states and in American Overseas Schools.

Data were collected about each respondent in the following categories:

- 1. Current teaching assignment
- 2. Means by which media knowledge was acquired
- 3. Type of School
- 4. Frequency of media usage
- 5. Years of experience
- 6. Effectiveness of teaching with media
- 7. Value of media

From these variables, cross tabulations were performed to determine interactive relationships in percentages or totals. Findings revealed that secondary teachers generally employ media in their teaching program. Table 1 indicates the numbers of respondents currently teaching in selected subject areas.

The cross tabulation percentages between Current Teaching Assignment and Frequency of Media Usage, as shown in Table 2, reveal that only 13%

# TABLE 1

# Number of Sample Teachers By

Teaching Subject Area

IUIAI
129
184
56
166
119
34
36
11
103
44
62
9
15
49
5
106
1128

LIBRARY

# Percentage of Teachers By Current

# Teaching Assignment and

# Frequency of Media Usage

		One-Three	More Than Three
	Not At All	Times A Day	Times A Day
MATHEMATICS	27	51	22
ENGLISH	17	71	12
FOREIGN LANGUAGE	8	69	23
SOCIAL STUDIES	8	77	15
SCIENCE	4	72	24
MUSIC	8	71	21
ART	9	87	7
SPEECH	20	80	0
BUSINESS	15	76	9
INDUSTRIAL ARTS	23	69	8
HOME ECONOMICS	4	92	4
VOCATIONAL AGRICULTURE	0	88	12
HEALTH AND SAFETY	7	62	31
PHYSICAL EDUCATION	43	52	5
JOURNALISM	40	60	0
OTHER	8	72	20
% OF TOTAL GROUP	15	72	13

of teachers use media more than three times each day. Fifteen percent on not use media at all while 72% are in the one-to-three times daily category. Home Economics, Vocational Agriculture, and Art teachers use media more frequently and in greater numbers than do other teachers.

Relative to media knowledge acquisition, the following three questions are answered by respondents and then analyzed according to current teaching assignment:

- Should school system inservice programs be responsible for media instruction?
- Have you participated in an inservice program or workshop with emphasis on instructional media?
- Do you think secondary teachers should have a media course in the required coursework of a teacher education program?

In response to the question: "Should school system inservice programs be responsible for media instruction?" large numbers as shown in Table 3 were recorded in the "Very Important" category by Social Studies (62) and English (62) teachers. One hundred ten English teachers of the total of 155 felt that it was important while 103 of 139 Social Studies teachers fell in the same categories of importance. A Percentage analysis indicated that 73% of all teachers responding felt that it was important for school systems to provide media inservice for their teachers.

To the second question (Table 4): "Have you participated in an inservice program or workshop with emphasis on instructional media?" a slight majority of teachers (52%) answered "No." Only Social Studies teachers recorded a definite "Yes" with 97 of 167 reporting "Yes."

The third question asked (Table 5) was: "Do you think secondary leachers should have a media course in the required coursework of a teacher education program?" Answers ranged from 63% up in the "Yes" category.

### TABLE 3

LIBRARY

### The Importance For The School System to Provide Media In-Service After Employment and Current Teaching Assignment

	Very Important	Moderately Important	Of Little Importance
MATHEMATICS	41	47	27
ENGLISH	62	48	45
FOREIGN LANGUAGES	23	15	11
SOCIAL STUDIES	62	41	36
SCIENCE	45	25	31
MUSIC	10	10	12
ART	13	10	11
SPEECH	7	1	1
BUSINESS	35	28	28
INDUSTRIAL ARTS	19	10	10
HOME ECONOMICS	16	20	19
VOCATIONAL AGRICULTURE	2	2	2
HEALTH AND SAFETY	6	3	4
PHYSICAL EDUCATION	16	17	8
JOURNALISM	4 '	1	0
OTHERS	38	26	23

TABLE &

TABLE 4

		YES	NO
MATHEHATICS		51	78
ENGLISH		86	97
FOREIGN LANGUATES	1% (* 1	27	27
SOCIAL STUDIES		97	70
SCIENCE		61	61
MUSIC		12	22
ART		13	25
SPEECH		4	7
BUSINESS		53	51
INDUSTRIAL ARTS		25	19
HOME ECONOMICS		28	35
VOCATIONAL AGRICULTURE		2	6
HEALTH AND SAFETY		11	4
PHYSICAL EDUCATION		16	32
JOURNALISM		3	2
OTHERS		55	51

OBSTRASS HALLINGARD

Teacher Cross Tabulations Between Participation in a Media In-Service Workshop and Current Teaching Assignment

## Percentages Showing Teachers Who Recommended Media Courses in Teacher Education

MATHEMATICS	76	BUSINESS	94
ENGLISH	76	INDUSTRIAL ARTS	86
FOREIGN LANGUAGES	80	HOME ECONOMICS	92
SOCIAL STUDIES	83	VOCATIONAL AGRICULTURE	88
SCIENCE	80	HEALTH AND SAFETY	100
MUSIC	63	PHYSICAL EDUCATION	94
ART	80	JOURNALISM	100
SPEECH	100	OTHERS	88

-15

per hundred percent of Journalism, Health and Safety, and Speech teachers responded "Yes" while only 63% of Music teachers did so. Other high percentage teaching areas were Business (94%), Physical Education (94%), and Home Economics (92%).

As shown in Table 6, teachers reported that they value media usage in their teaching. Over 96% of teachers felt satisfaction with media usage. There appears to be a relationship between frequency of usage and satisfactory value of media.

Analysis of the data related to a cross tabulation of type of school and frequency of media usage revealed that most teachers placed themselves in the 1-3 times daily category. As shown in Table 7, seven hundred eleven teachers (71%) stated that they used media 1-3 times daily in their classroom teaching. Fourteen percent used media more than three times daily. Teachers in high schools with grades 9-12 or 10-12 indicated the strongest tendency toward more frequent use of media in teaching.

Table 8 emphasizes the relationship between frequency of media usage and effectiveness of teaching because of media usage. While 72 teachers (8%) stated no change in their teaching effectiveness because of media usage, the remainder showed almost complete agreement that their teaching 415 more effective because of media usage.

Conclusions are:

- 1. Secondary teachers value media usage.
- Teaching assignments reflect a slight difference of teachers toward frequency of media usage.
- Media acquisition in the university teacher education classroom is desired by secondary classroom teachers.
- Most secondary teachers are satisfied with the value of media in classroom teaching.

8.

##P#/11/11/1

### Number of Teachers By Frequency of Use of Media and Perceived Value in Teaching

	Satisfactory Value	Unsatisfactory Value
Once-A-Day	441	20
Two Times A Day	130	5
Three Times A Day	115	1
Four Times A Day	49	o
Five Times A Day	49	2
More Than Five Times A Day	40	1

Type of School to Which Teachers are Currently Assigned

## Frequency of Media Usage and Type of School to Which Teachers are Currently Assigned

Type of School		Frequency	
	Not at All	One-Three Times a Day	More Than Three Times à Day
K-12	16	77	6
1-12	6	10	3
7-12	19	59	17
9-12	67	* 342	66
10-12	30	183	39
Other	5	40	10

IRRARY

.....

# Frequency of Media Usage and Teaching Efficiency

# Efficiency

# Frequency

	One-Three Times a Day	More than Three Times a Day
More Effective	637	133
Less Effective	5	0
No Change	65	7

- Although some teachers have experienced media inservice, school system in-service programs are not providing for media needs of teachers.
- High schools with traditional grade levels of 9-12 and 10-12 are using media more frequently in their classrooms.
- Teachers who use media daily agree that their teaching effectiveness is improved with media usage.

MERON UNVERSITY

# TITLE: An Analysis of the Consistency and Effects Reported Learning Strategy Use by Third and Fourth Graders

# AUTHOR: Michael J. Hannafin

An Analysis of the Consistency and Effects of Reported Learning Strategy Use by Third and Fourth Graders

Michael J. Hannafin

University of Colorado

Presented at the Annual Convention of the Association for Educational Communications and Technology, Dallas, May, 1982.

The consistency of verbal and/or visual learning strategy, and of such strategies on the recall of concrete and abstract prose, wen investigated. Using a learning strategy screening procedure, student were classified as demonstrating high, medium, or low dominance of your or visual learning strategies. Students then saw and/or heard an 18. minute children's story, via audiotape, slide-tape, or a synchronized audio-slide-tape presentation. Upon completion of the presentation. 24-item recall test--12 items measuring recall of abstract content and 12 items measuring recall of concrete content--was administered. As dicted, the combined audiovisual presentation yielded superior recally both concrete and abstract content. The picture-only presentation vide greater recall of concrete content than the oral-only presentation, be no differences were found for abstract content. Contrary to expectation neither strength of reported strategy nor the interaction between lean strategy and presentation modalities were significant. Implications in further research are discussed.

Abstract

An Analysis of the Consistency and Effects of Reported Learning Strategy Use by Third and Fourth Graders

2

Learning strategies, the spontaneous strategies used by learners to remember information, have received comparatively little systematic study. Although a significant number of learning strategy theories have been developed and published during the past decade (see, for example, Dunn & Dunn, 1978), little empirical research regarding such strategies has been reported.

Available research regarding cognitive schema (e.g., Johnson & Malgady, 1975; Ortony, Schallert, Reynolds, & Arter, 1978) suggests that learners possess a sort of anticipative cognitive set for processing information. Some researchers (e.g., Flavell, 1977) have described a process whereby learners modify or adjust their learning set based upon the requirements of specific learning tasks. It is unclear, however, precisely how static or malleable learner strategies are to varied instructional stimuli.

Recently, a group-administered learning strategy screening, designed to identify the visual or verbal strategies used by students, has been developed (Hannafin, 1981). Preliminary research has indicated that students can be reliably classified as visual or verbal learners (Hannafin, Note 1), and that use of such strategies is not correlated with general ability, i.e. no differences in ability were found for students reporting visual, verbal, or mixed visual-verbal learning strategies (Hannafin, Note 2). However, the effect-of such strategies in moderating learning from visual versus verbal instructional presentations has not been demonstrated consistently. While some researchers

have found significant learning strategy mode-by-instructional mode actions (e.g., Delaney, 1978, Richardson, 1978), other researchers found no such effects (DeBoth & Dominowski, 1978; Newcomer & Goodman 1975).

3

One methodological problem that has confounded the no-effect remay be the manner in which learning strategies have been operational defined, i.e., rather than simply visual or verbal learners, where all students have been classified as either one type of learner or the cuperhaps effects are more likely to be associated with the degree to us visual or verbal strategies are used by learners. Other problems is study of learning strategies may be associated with type of learning and the level or complexity (cf. Paivio, 1971; Salomon & Clark, 1977 information to be learned. The purpose of the present study was to cu the effects of high, medium, and low strength verbal and visual strate on the recall of two levels of learning, concrete and abstract, from verbally and/or visually presented prose.

### Method

### Subjects

A total of 115 third-grade and 115 fourth-grade students, select from a pool of 360 students, served as subjects. Students were select from either of two schools located in a predominately middle-class subschool district.

#### Materials

The materials used in the study included a group-administered learning strategy screening, three versions of a prose presentation, a recall test covering information presented. An audiotape learning strategy screening, consisting of directions for completing the screening, two practice words, and the presentation of five concrete nouns, was employed. The screening, which was used to determine the reported visual or verbal learning strategies used by students to remember the presented nouns, was approximately 10 minutes in duration and was presented and paced via audiotape. The nouns used during the learning strategy screening were boy, animal, book, plant, and tree. The concreteness of the five nouns was based upon the ratings provided by Paivio, Yuille, and Madigan (1968). The criteria used for word selection included: (a) high frequency (AA) based on the Thorndike-Lorge (Thorndike & Lorge, 1944) frequency index, (b) high concreteness ratings, and (c) high imagery rating.

4

Students recorded individually their response to the learning strategy screening on a student strategy sheet. The strategy sheet provided space for writing the word presented and for selecting which of seven strategy options the student used to remember the word. The options, which were identified as generic responses by Hannafin and Carey (Note 3) and Filan (1981), included three visual and three verbal response options. The positions of the verbal and visual options were systematically rotated to minimize possible response set tendencies. In addition, one openended option for "other" strategy was available for each item. The "other" strategy response, when used, was subsequently classified by the researcher as either a visual or verbal strategy.

The three presentations, each depicting an adapted children's text, <u>The Wump World</u> (Peet, 1970), included an ORAL, PICTURE, and ORAL + PICTURE story version. Each of the story versions included both concrete and abstract criterion information. The Wump World is a high interest,

animated story with a Spache graded readability estimate of 4.8. To story was slightly adapted to include both concrete and abstract information. The three presentations included: ORAL, an audiotape verbal presentation of the story; PICS, a 35-mm slide presentation of the terpictures used to depict the story; the ORAL + PICS, a combination of a audiotape and 35-mm slides. Each of the presentation versions was 1 minutes in duration and paced identically to control student time on task.

5

The criterion test measure was a 24-item short-answer test, consisting of 12 items measuring recall of abstract information presented the story and 12 items measuring recall of concrete information. Tesitems were selected from a 28-item test which was originally developed for previous prose learning studies (Carey & Hannafin, Note 4; Hannafia & Carey, Note 3). The concreteness-abstractness of the test information where possible, was based on the ratings provided by Paivio et al. (19) Test-retest reliability coefficients, which were obtained previously a the driginal 28-item test, were .84 for the abstract scale, .85 for the concrete scale, and .90 for the full-length scale. Reliability coefficients for the 24-item test used in the present study were .76 for the 12-item abstract scale, .85 for the 12-item concrete scale, and .87 is the full-length criterion test.

### Procedures

Students were administered the learning strategy screening in the home classrooms. During the screening, students were directed to rear the presented word. Students were then told to write the presented will on their student strategy sheets and to select the response option that

best described how the word was remembered. The experimenters circulated throughout the room to assist students, when needed, in completing the tasks:

6

Upon completion of the learning strategy screening, students were classified into learning strategy groups according to the strategies they reported using during the screening. Student responses were tabulated in the following manner. Each verbal option selected was assigned a weight of -1, and each visual option selected was assigned a weight of +1. Student responses were summed for the five screening items, with possible scores ranging from -5 through +5.

Since some student responses to the "other" options were not readily classifiable, a small number of even-numbered scores were obtained for the statistical analysis students with even-numbered screening scores were eliminated from the study. Classifications for personal learning strategies were as follows: HI-VERB (-5), MED-VERB (-3), LO-VERB (-1), LO-VIS (+1), MED-VIS (+3), HI-VIS (+5).

Exactly one week after completing the screening portion of the study, students went to pre-assigned rooms in accordance with their treatment group assignments. Students then heard and/or viewed <u>The Wump World</u> in accordance with presentation group assignment. Following the presentation, there was a brief interpolated activity during which the students stood and stretched at their assigned seats while test answer sheets were distributed to them. The criterion test was then administered.

### Results and Discussion

The mean recall test scores are summarized in Table 1. Corresponding ANOVA source data are contained in Table 2. As shown, significant

Attena ....

### Mean Recall Scores for Concrete and Abstract Prose Content

	Reported Learning Strategies										
esentation	Level of Learning	HI-VERB	MED-VERB	LO-VERB	LO-VIS	MED-VIS	HI-VIS	Totals			
DRAL	Concrete	2.80	3.57	2.13	3.00	3.27	2.27	2.74			
	Abstract	3.27	2.71	3.27	2.80	4.09	2.40	3.08			
PICS	Concrete	4.92	5.10	3.46	3.47	5.78	5.92	4.67			
	Abstract	3.54	4.60	3.23	2.53	3.78	5.00	3.71			
ORAL + PICS	Concrete	5.85	5.75	6.30	7.50	6.19	6.82	6.44			
	Abstract	5.15	4.92	5.90	5.69	3.75	6.00	5.15			
Totals	Concrete Abstract	4.44 3.95	5.00 4.28	3.68 3.95	4.72 3.72	5.19 3.86	4.77	4.62 3.99			

ANOVA Source Data for Concrete and Abstract Recall

df	Ms	<u>F</u>	<u>p≺</u>
2	249.51	40.46	.0001
5	4.88	.79	ns
10	9.54	1.55	ns
222	6.17		
2	89.98	18.59	.0001
5	3.10	.64	ns
10	9.79	2.02	ns
222	4.84		
	<u>df</u> 2 5 10 222 2 5 10 222	<u>df Ms</u> 2 249.51 5 4.88 10 9.54 222 6.17 2 89.98 5 3.10 10 9.79 222 4.84	df Ms F   2 249.51 40.46   5 4.88 .79   10 9.54 1.55   222 6.17 18.59   5 3.10 .64   10 9.79 2.02   222 4.84 .79

ATTAMA PROVIDENT

differences were found for presentation modality. As expected, the + PICS presentation yielded significantly greater recall of both above content and concrete content than either the ORAL or PICS presentative For concrete content, the PICS presentation resulted in greater recall than the ORAL presentation. For abstract content, however, no such differences were found.

Q

¥

No differences for either the strength or type of personal learn strategy were found. In addition, no presentation-by-learning strategy interactions were found. These findings provide support for research who have concluded that learning strategies are not powerful variables in moderating learning, neither by themselves nor in combination with instructional modality.

### General Discussion

The findings regarding the superiority of verbal-visual presentation in the learning of both concrete and abstract prose content, and the superiority of pictures over oral-aural instruction in the learning of concrete content, provides support for previous findings (Hannafin, Ma Carey & Hannafin, Note 4).

Of particular interest, however, was the effect of strength of learning strategy and type of learning strategy on the learning of compresented in the same or different modalities. Based on previous resit was suspected the high verbal students would perform best in the verbally dominated presentation, and that high visual students would perform best in the pictured dominated presentation. However, no differences--main effects or interactions--associated with either type or strength of learning strategy were found. This finding is consist?

with researchers who have concluded that learning strategies have little moderating effect on learning from similar, or dissimilar, instructional modality.

A number of questions, however, persist. For example, learning strategies as defined in the present study and in most related studies, are typically treated as traits. It is possible that such traits are highly latent and not automatically or systematically applied to novel learning tasks unless activated either by internal mechanisms or by external prompting. It is also likely that learning strategies vary from one type of task to another (cf. Flavell, 1977). For example, strategies for recalling isolated abstract words may be quite different from strategies for recalling abstract prose. In the present study, individual learning strategies were classified based upon isolated word recall while the actual remembering task was contextual prose. Perhaps procedures can be developed to classify individual learning strategies based upon type and level of criterion learning task. If individual learning strategies are important learning variables, such screening methods would be more likely to obviate such effects. Further research as to the stability of reported learning strategies across different learning tasks and the effects of task-specific learning strategies on criterion learning could be useful in answering these questions.

336

### Reference Notes

- Hannafin, M., & Carey, J. <u>Toward a procedure to identify the</u> spontaneous learning strategies of children. Presented at annual meeting of the Association for Educational Communic, and Technology, Philadelphia, 1981.
- Hannafin, M. <u>Correlates of individual learning strategy: A continue in search of meaning</u>. Presented at the annual meeting of American Educational Research Association, New York City,

### References

- Filan, G. <u>Children's memory for words under self-reported and induced</u> <u>memory strategies</u>. Unpublished doctoral dissertation, Arizan State University, 1981.
- Hannafin, M. Prose learning under variations in presentation mode and learning strategy. Unpublished doctoral dissertation, Arizan State University, 1981.
- Paivio, A., Yuille, J., & Madigan, S. Concreteness, imagery, and mean fulness values for 925 nouns. <u>Journal of Experimental Psy w</u> Monograph, 1968, 76 (1 Pt. 2).
- Thorndike, E., & Lorge, I. <u>The teachers word book of 30,000 words</u>. In York: Columbia University Teachers College, Bureau of Public 1944.

TITLE: Research in Progress II: Preliminary Data From a Group-Administered Procedure to Identify the Spontaneous Learning Strategies of Children

AUTHOR: Michael J. Hannafin

Research in Progress II: Preliminary Data From a Group-Admininstered Procedure to Identify the Spontaneous Learning Strategies of Children

Michael J. Hannafin

University of Colorado

Presented at the Annual Convention of the Association for Educational Communications and Technology, Dallas, May, 1982.

#### Abstract

Two studies, designed to establish classification procedures and the reliability of a learning strategy screening procedure, were conducted. The subjects for both studies were third-and fourth-graders from a middleclass suburban school district. The subjects were administered a 10minute learning strategy screening, during which they reported which of six generic strategies, three verbal and three visual, were used to remember presented words. In Study 1, the results indicated that roughly the same proportion of third and fourth graders reported visually dominated as verbally dominated learning strategies to remember presented words. Strategies could be readily classified as VERBAL or VISUAL, or VISUAL, VERBAL and MIXED using the results of the screening. The results of Study 2 indicated that strategy classifications were differentially reliable, depending upon the number of classifications used, being most reliable using a bi-classification system. Practical considerations for employing bi-versus tri-classification schemes are discussed.

1

TIMBUC DELL

Research in Progress II: Preliminary Data From a Group-Admininstered Procedure to Identify the Spontaneous Learning Strategies Used by Children

2

The construct of learning strategy is one that has vastly great intuitive than empirical validity. Although educators, such as the special education, largely assume the existence of personal learning strategies and plan instructional activities based upon such strategy research regarding individual learning strategies is rare and equiv

Recently, studies have been conducted in an attempt to identify a methods reported by children to remember presented information. The cedures used to identify students' learning strategies by Filan (190) study have compelling logic. Students were interviewed individually a determine the strategies by which presented pictures and words were re sumably recalled. While the logic of such a procedure may be compelle the practicality is not. Filan's procedure required a substantial are of both experimenter and learner time. Procedures that required less time to administer, but retained the accuracy and intuitive appeal of Filan's procedure, are likely to be more practical and accepted.

**ALLEWAAL** 

Hannafin and Carey (Note 1) attempted a group-administered version of Filan's procedure, during which students individually wrote their responses describing how presented words were remembered. While this procedure was more practical, a large portion of their student report data was unusuable due to the confounding effects of the requirement <sup>19</sup> written responses.

An analysis of the responses provided by students from both the Filan (1981) and Hannafin and Carey (Note 1) studies, however, revealed that students consistently reported similar types of strategies to describe verbal and visual memory strategies--referred to as "generic" responses (Hannafin, 1981). Furthermore, type of strategy, verbal or visual, was found to be independent from systematic sex, ability, and achievement influences (Hannafin, Note 2). In effect, recent studies suggest that a learning strategy screening procedure, one that is groupadministered and permits students to select from among empirically derived generic strategy options, may be a reasonable and relatively simple method to identify the individual learning strategies used by children.

3

The purposes of the present study were to develop and apply a groupadministered learning strategy screening using the generic strategy options, and to determine the reliability of the scores obtained via the procedure and the reliability of the classification of individual learning strategies.

### STUDY 1

#### Method

#### Subjects

A total of 184 third-grade and 173 fourth-grade students served as subjects. Students were selected from either of two schools located in a predominately middle-class suburban school district.

#### Materials

The materials used in the study included a group-administered learning strategy screening. An audiotape learning strategy screening, consisting of directions for completing the screening, two practice words, and the presentation of five concrete nouns, was employed. The screening,

3.12

which was used to determine the reported visual or verbal learning strategies used by students to remember the presented nouns, was appremately 10 minutes in duration and was presented and paced via audior The nouns used during the learning strategy screening were boy, animbook, plant, and tree. The concreteness of the five nouns was based the ratings provided by Paivio, Yuille, and Madigan (1968). The critused for word selection included: (a) high frequency (AA) based on 1 Thorndike-Lorge (Thorndike & Lorge, 1944) fequency index, (b) high crecreteness ratings, and (c) high imagery rating.

Students recorded individually their response to the learning sime egy screening on a student strategy sheet. The strategy sheet provide space for writing the word presented and for selecting which of seven strategy options the student used to remember the word. The options, which were identified as generic responses by Hannafin and Carey (Note and Filan (1981), included three visual and three verbal response option The positions of the verbal and visual options were systematically recorto minimize possible response set tendencies. In addition, one openended option for "other" strategy was available for each item. The "other" strategy response, when used, was subsequently classified by " researcher as either a visual or verbal strategy.

### Procedures

Students were administered the learning strategy screening in the home classrooms. During the screening, students were directed to result the presented word for five seconds. Students were then told to write the presented word on their student strategy sheets and to select the response option which best described how the word was remembered. The

experimenters circulated throughout the room to assist students, when needed, in completing the tasks.

Upon completion of the learning strategy screening, students were classified into learning strategy groups according to the strategies they reported using during the screening. Student responses were tabulated in the following manner. Each verbal option selected was assigned a weight of -1, and each visual option selected was assigned a weight of +1. Student responses were summed for the five screening items, with possible scores ranging from -5 through +5.

### Results and Discussion

The distribution of students obtained for the overall sample, shown in Table 1, was significantly different from a random distribution as determined by the Kolmogorov-Smirnoff test of distribution equality, p.<.01 (even numbered scores were deleted from the analysis).

No differences were obtained between the frequency distribution of third-versus-fourth graders. This finding suggested that no extreme shifts in reported strategies occur from one grade to the next. It was also observed that roughly equal proportions of third and fourth graders reported moderately to high use of verbal (-2 through -5), visual (+2 through +5) and no clear dominance of visual or verbal strategies (-1 through +1).

Classifications for personal learning strategy were made using the scores computed from the screening. Two classification options were developed: 1) bi-classification scheme, using VERBAL dominance (-5 through -1) and VISUAL dominance (+1 through +5) with mid-range scores discarded. The minimum percentage of responses needed to classify as a

3.1.1

5

A LINE THEN I IN THE CASE OF

6

				Lear	ning	Strat	egy S	creen	ing S	cores		100
Grade	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	Total
3rd	23	2	17	5	37	11	33	4	30	2	20	184
4th	23	0	19	1	25	6	30	6	30	3	30	173
Total	46	2	36	6	62	17	63	10	60	5	50	357

# Learning Strategy Screening Score Frequencies by Grade

# Classification Options:

1)	Bi-classification:	Verbal $(-5 \text{ through } -1) \text{ n} = 152$	
		Visual $(+1 \text{ through } +5) n = 188$	
	Minimum Percent Domin	ance (Visual or Verbal) = 60%	
2)	Tri-classification:	Verbal (-5 through -2) $n = 90$	
		Mixed $(-1 \text{ through } +1)$ n = 142	
	· •	Visual (+2 through +5) $n = 125$	
	Minimum Percent Domin	ance (Visual or Verbal) = 75%	

visual or verbal dominance was 60%. Under the other option, a triclassification scheme, students with scores from -2 through -5 were classified as VERBAL, +2 through +5 were classified as VISUAL, and -1 through +1 were classified as MIXED personal learning strategy groups. The classification scheme required that respondents report a minimum of 75% verbal or visual responses to be classified accordingly.

The results of Study 1 indicated that the group-administered, structured learning strategy screening provided a easy-to-use procedure to identify the relative visual-verbal learning strategy dominance reported by students. The results further suggested that learning strategy classifications may be made using relatively clear-cut and objective student response patterns, and that strategy use appears to be distributed fairly equally across the target population.

### STUDY 2

TLAUNU NUMBER

### Method

### Subjects and Procedures

A total of 170 third-and-fourth graders, balanced across grades, were administered the same screening procedure in the same manner described in Study 1. The screening procedure was re-administered one week later. The purpose of Study 2 was to evaluate the reliability of the learning strategy classifications under the two possible classification options.

### Results and Discussion

The results of Study 2 are summarized in Tables 2 and 3. As shown, the percent of students reliably classified was greatest for the biclassification scheme. This was expected, since a greater number of

3.16

8

#### Initial Screening Rescreening VERBAL VISUAL Totals (+1 to +5) (-5 to -1) VERBAL (-5 to -1) 78 16 94 VISUAL (+1 to +5) 14 60 74 Totals 92 76 168<sup>a</sup>

### Classification Reliability Using Bi-Classification Options

Note. 82% of students retained classifications

<sup>a</sup>2 students obtained screening scores of "O" on either screening

### Table 3

Classification Reliability Using Tri-Classification Options

Rescreening	Init	Initial Screening		
	VERBAL (-5 to -2)	MIXED (-1 to +1)	VISUAL (+2 to +5)	Totals
VERBAL				
(-5 to -2)	49	14	4	67
MIXED				
(-1 to +1)	8	30	8	50
VISUAL				
(+2 to +5)	4	10	43 -	53
Totals	61	54	55	170

<u>Note</u>. 75% of students retained classifications using 3 classifications; 79% retained VERBAL or VISUAL classification. borderline or marginal classifications points were created using a triclassification. Furthermore, the bi-classification option resulted in the discarding of all "O" scores, creating greater distance between classification crossovers. However, the practical implications of the triclassification scheme appear to outweight the apparent benefits of a more reliable procedure. If type of learning strategy is to be considered a legitimate instructional design variable, then it will likely be most potent when the influence of the strategy is strongest (at either the highly verbal or highly visual ends of the classification scheme). In other words, although a simple two-part strategy classification scheme may be more reliable than a three-part scheme, the strength of the strategies at the ends of the strategy continuum is likely to exert more of a controlling influence as an instructional design variable and provide greater certainty of interaction between learner strategy and instructional modality.

### General Discussion

The identification of the individual learning strategies used by students via a group administered screening procedure has a variety of potential uses. From a research standpoint, relatively large samples of prospective subjects can be screened easily, and prior experimental selection or assignments can be made based on known learning characteristics. It may also be possible to study empirically the effects of modality training on subsequent use of the instructed modality in problem solving or memory use. From an applied perspective, knowledge of learner strategies could affect decisions regarding instructional design, presentation, and the use of adjunct or supplementary instructional materials.

3.18

9

AND AUTO UNIVERSI
Earlier investigation of learning strategy, however, has dampened the optimism of present researchers. Previous studies of the effects of learning strategies on learning from consonant <u>vs</u> disconsonant modality instruction have produced inconsistent, and often inconclusive, results. It is unclear precisely how many of the discrepancies in reported research are related to methodological problems and abnormalities versus problems inherent in the pursuit of the construct itself. It is the author's belief that, although the learning strategy construct is likely to present a myriad of problems for researchers, further study is warrant, if only from an epistimological perspective. Knowledge of how people remember, even of how people <u>think</u> information has been remembered, can only further our understanding of the human factors involved in learning.

10

1

D

F:

F1

Ha

Jol

The present study has advanced knowledge of individual learning strategies. However, further study is still needed--with regard to the procedures described in this paper and to the study of learning strategy in general. The learning strategy screening procedures used in the present 'study need further development and refinement. Additional screening items are needed in order to strengthen the reliability of the classifications. In addition, further study is needed regarding the stability of learning styles across learning tasks (e.g., prose vs. word recall), type or level of desired learning (e.g., concrete vs. abstract), and developmental influences on strategy use. It is likely that future uses of learning strategies, both applied and experimental, cannot be determined accurately until such data are available.

#### Reference Notes

- Hannafin, M. Preliminary data from a group-administered procedure to identify the spontaneous learning strategies of children. Presented at the annual meeting of the Association for Educational Communications and Technology, Dallas, 1982.
- Hannafin, M. <u>Correlates of individual learning strategy: A</u> <u>construct in search of meaning</u>. Presented at the annual meeting of the American Educational Research Association, New York City, 1982.
- Hannafin, M., & Carey, J. <u>Toward a procedure to identify the spon-</u> taneous memory strategies of children. Presented at the annual meeting of the Association for Educational Communications and Technology, Philadelphia, 1981.
- Carey, J., & Hannafin, M. Effects of different media presentations and messages on children's learning of information. Presented at the annual meeting of the American Educational Research Association, Los Angeles, 1981.

### References

eđ

ř,

- DeBoth, C., & Dominowski, R. Individual differences in learning: Visual versus auditory presentation. <u>Journal of Educational Psychology</u>, 1978, <u>70</u>, 498-503.
- Delaney, H. Interaction of individual differences with visual and verbal elaboration instructions. <u>Journal of Educational Psychology</u>, 1978, 70, 306-318.
- Dunn, R., & Dunn, K. <u>Teaching students through their individual learning</u> <u>styles: A practical approach</u>. Reston, VA: Reston Publishing Co., 1978.
- Filan, G. Children's memory for words under self-reported and induced memory strategies. Unpublished doctoral dissertation, Arizona State University, 1981.

Flavell, J. <u>Cognitive development</u>. Englewood Cliffs, NJ: Prentice-Hall, 1977.

- Hannafin, M. Prose learning under variations in presentation mode and learning strategy. Unpublished doctoral dissertation, Arizona State University, 1981.
- Johnson, M., & Malgady, R. Some cognitive aspects of figurative language: Association and metaphor. Unpublished manuscript, 1975.

12

- Newcomer, P., & Goodman, L. Effect of modality of instruction on learning of meaningful and nonmeaningful material by auditory and visual learners. Journal of Special Education, 1975, 9, 261-268.
- Ortony, A., Schallert, D., Reynolds, R., & Arter, J. Interpreting metaphon and idioms: Some effects of context on comprehension. <u>Journal</u> of Verbal Learning and Verbal Behavior, 1978, 17, 465-477.
- Paivio, A. <u>Imagery and verbal processes</u>. New York: Holt, Rinehart, & Winston, 1971.
- Paivio, A., Yuille, J., & Madigan, S. Concreteness, imagery and meaningfulness values for 925 nouns. Journal of Experimental Psychology Monograph, 1968, 76 (1 Pt. 2).
- Peet, B. The wump world. Boston: Houghton Mifflin, 1970.
- Richardson, J. Reported mediators and individual differences in mental imagery. Memory and Cognition, 1978, 6, 376-378.
- Salomon, G., & Clark, R. Reexamining the methodology of research on media and technology in education. <u>Review of Educational Research</u>, 1977, 47, 99-120.

Thorndike, E., & Lorge, I. <u>The teachers word book of 30,000 words</u>. New York: Columbia University Teachers College, Bureau of Publications, 1944. TITLE: The Effect of Mode of Visual Presentation (Motion vs. Still) on the Brain Wave Production of College Students

AUTHOR: Stephen J. Hines

# THE EFFECT OF MODE OF VISUAL PRESENTATION (MOTION vs. STILL) ON THE BRAIN WAVE PRODUCTION OF COLLEGE STUDENTS

atrod

ienera

easur

recort

to sed

output

These

betwee

prove

media.

00 001

WSV85

state

wille.

poetr

of in

auch.

**Rean**i

of be

There

ture:

Re

by

Stephen J. Hines, Ed.D. Assistant Professor Curriculum, Instruction and Media Southern Illinois University Carbondale, Illinois 62901

Presented at The Association for Educational Communications and Technology Research and Theory Division National Convention Dallas, Texas

### juction

Research comparing motion and still pictures has had conflicting results. ally speaking, criterion or achievement tests and attitude scales for ring the effectiveness of one medium over another have produced these mixed ts. The technology now exists for measuring psychophysiological reactions diated programs. Certain physiological conditions, such as the electrical t of the brain, indicate different mental or psychological conditions. conditions can be measured unobtrusively and since relationships exist en physiological and psychological states, psychophysiological measures may to be more accurate and direct ways of measuring the effects of different . Lawrence (1972, pp. 1-155) contended that "current theories of learning t take brain waves into account. Yet, scientists have shown that brain differ and such factors as attention are definitely linked to brain wave s. One rhythm may be best suited for memorizing the multiplication tables, another brain rhythm may be best suited to creative outpourings like writing /, or painting a landscape."

CHIMINAL MOUTHING

Vogel and Broverman (1968) argued that since numerous independent factors celligence were known, relationships between psychophysiological states as electroencephalogram (E.E.G.) and particular mental abilities were more ogful. Mental concentration in human beings is indicated by the presence ca brain waves, which have a frequency of 13 to 26 cycles per second. Fore this research used E.E.G. to establish comparative effects of motion picversus still pictures on learner's brain waves.

### Purpose of the Study

The purpose of this study was to measure and analyze viewers' electronic cephalographic reactions to the audiovisual formats of videotape (represented a motion picture variable) and slide, audiotape (representing a still pict variable), and to increase our knowledge of the differential impact of motion and still modes on brain wave production. Since beta brain wave indicates focused attention, an additional purpose of this research was to determine the two media differed significantly in their potential as teaching devices as measured by the viewers' beta brain wave production. This study used pertubiofeedback equipment to collect data. Burtschi (1978) maintained that bioteback equipment is underutilized in educational research.

In order to establish an experimental rationale, the following hypothesh was developed: There is no significant difference in E.E.G. scores, as mean by portable biofeedback equipment, between groups who view still and motion pictures.

### Interpretation of Collected Data

In order to fully understand the meaning of the collected data, an explotion of data sources is necessary. Although electrical waves are produced for the entire cerebral cortex, the waves measured during the treatment session of those emitted from the occipital lobe. Signals received by the eyes are train mitted to the occipital lobe and translated into information the brain can use Hence, physicians and researchers often refer to the occipital lobe as the "vision center" of the brain.

Therefore beta brain wave production during the treatment session was thought of as a "score" on a "test". However, it was important to remember t

**Nethodo** 

groups.

the oth

This pr

notion

group w

treatme

Th

Si

Nº 5001

erel vec

ere 20

ellec C

reating

moun t

er Ha

500

ents a

ebeta.

of time

Derefo

cluston.

rust be

: the

ST

was not comparable to an achievement test score where the test taker ne "point" for each "correct" item. Rather, the resultant scores erage of microvolt seconds of beta wave production during the data period. If a subject received a score of 175 during one of the , this did not refer to the number of correct responses, but to the averaged microvolts per second that he or she had spent producing during the treatment. The score only had meaning when compared to of the alternate treatment.

3

the E.E.G. recorder used in the study was designed for alpha experitraining, the controls were adjusted to collect or monitor alpha, ta waves and whatever "noise" is present. Hence, the greater amount ent in alpha, the less time spent in the desired beta and vice versa. the lower the "score", the more time spent in beta wave. In cone E.E.G. "score" cannot be thought of as a typical test result, but ven consideration as a more innovative method for measuring the success atment.

### L

randomly selected subjects were randomly assigned to two treatment ne two experimental treatments one, a motion picture presentation and a slide tape presentation were alternately shown to each subject. dure created two experimental groups the group which received the ture treatment first and the still picture second,  $(M_1 - S_2)$  and the n received the still picture treatment first and the motion picture second,  $(S_1 - M_2)$ .

erived data were subjected to a two-way analysis of variance. No

significant main effects or interactions were identified. The data were subjected to a post hoc analysis using  $\underline{t}$  test procedures, with the results reported below.

creatment comparison	t value	2 tailed probabilit				
M <sub>1</sub> - M <sub>2</sub>	-0.62	0.540				
1 <sub>1</sub> - S1	-1.21	0.236				
1 <sub>1</sub> - S <sub>2</sub>	-1.15	0.260				
S1 - S2	.84	.411				
51 - M2	2.23	.034				
52 - M2	-0.23	.817				

Table 1

While there was a significant difference beyond the .05 level for the for the comparison S<sub>1</sub> - M<sub>2</sub>, this comparison refers to the order in which the treatments were administered to a randomized group. This was not sufficient evidence for rejecting the null hypothesis. Since no significant differences were found between M<sub>1</sub> and S<sub>1</sub> or M<sub>2</sub> and S<sub>2</sub>, the null hypothesis ( $H_0 : X_m = X_1$ ) was retained.

Neither motion nor still pictures differentially affect the production of beta waves, which are necessary for focused attention and mental concentration Although there was a significant difference found between S<sub>1</sub> and M<sub>2</sub> but not for any of the other comparisons referring to the order of treatments, no conclusion were drawn pertaining to the order in which the presentations were shown to set jects. Therefore, the null hypothesis was retained.

## scussion

Some researchers have suggested that what is in question is not which redium is more effective, but how the traits and aptitudes of the individual reteract with the treatment or medium. More research on the subject is necessary. He part of that research should be aimed at new ways of measuring the effects of various media.

Research comparing the media attributes of motion picture and still picture has been inconclusive. Both gross comparisons and the so-called aptitude r trait and treatment interaction studies have produced conflicting results. Exychophysiological measurement offers the opportunity to unobtrusively measure individual's reactions to instructional media. Although this experiment found no evidence to show that still pictures are more effective than motion dictures in eliciting the type of brain waves (beta) indicative of focused extention, the experiment did demonstrate the successful use of psychophysiolagical measuring devices in media research.

358

### References

Burtschi, R.J. <u>A survey of psychophysiological instrumentation and of its</u> <u>applications in education, educational psychology, and communication</u>. Doctoral dissertation, Michigan State University, 1978.

Lawrence, J. Alpha brain waves. New York: Avon, 1972.

Vogel, W., Broverman, D., & Klaiber, E. <u>EEG and mental abilities</u>. <u>Electroencephalography and Clinical Neurophysiology</u>, 1968, <u>24</u>, 166-175. TITLE: High School Students' Attitudes Towards the Media Program - What Makes the Difference?\*

AGHLERON UNRELL

AUTHORS: Yvonne A. Hodges Judy Gray William J. Reeves

# HIGH SCHOOL STUDENTS' ATTITUDES TOWARDS THE MEDIA PROGRAM - WHAT MAKES THE DIFFERENCE?\*

by

### Yvonne A. Hodges Judy Gray William J. Reeves

During the sixties, school media centres began to creep across North America sustained by an influx of human and physical resources. Some schools even to purchase audio-visual materials which were made available to teachers (and occasionally) to students through the schools' media centres. Such effort undoubtedly encouraged through national media associations such as the America Association of School Librarians, the Association for Educational Communication and Technology, the Association for Media and Technology in Education in Canadian the Association.

The American and Canadian standards published by the above groups have frequently formed the base for evaluation used across the continent particularly the American standards. For example, most recently the Associate for Educational Communications and Technology (A.E.C.T.) has published Evaluating Media Programs: District and School. (Committee on Evaluation of Media Programs Association for Educational Communications and Technology, 1981 American Library Association and Association for Educational Communications Technology, 1975) However, A.E.C.T.'s standards-based evaluation is not necessarily empirically based. That is, the standards have been developed as a product of "consensus by committee" and that committee has been composed of people like you and me - believers who know what should be. You and I know in our hearts that media programs must provide expertise in the availability and production of films, filmstrips, slides, graphics, recordings and reprographe Apparently we also know in our hearts exactly how many filmstrips, slides, filmstrip projectors, cameras, copy machines, etc., are needed in a base collection. (American Library Association and Association for Educational Communications and Technology, 1975, p.73) Unlike innovative curriculum evaluators such as David Hamilton and Barry MacDonald, we cannot boast that have moved beyond the numbers game. (Hamilton, 1977)

Nor have we taken up the challenge to conduct research regarding the relationships of media program services and student outcomes. In spite of persistent challenges by media specialists such as Janet Stroud and Anna Lowin the res arch remains thin. (Aaron, 1979; Lowrey and Case, 1979) We have not followed through on the work of researchers such as Lillian Wight and Clyde Greve and we persist in using the cardiac method of evaluating media programs

\* This research was conducted as part of a District-wide Media Centre Program Evaluation commissioned by the Calgary Board of Education and completed in Spring, 1981.

C/PAF2

MARC

Gros ipec

eval

tles

lfob 1bea

bet ni

Why :

sake.

In Al

PEGAS

The R

in pe

progr attit

high

Laco.

the p

servi-

The Si

The re

Ichoo)

1980 s

sixter

staffe

In th

from c

+1Locs

cover

##larf

the ra

betwee

Mample Migh s educat

C/PAF2.1

seed on consensus amongst ourselves, as to what is right and good. (Wight and rossman, 1977; Greve, 1974) All of this, in spite of the fact that media specialists such as Ernest Deprospo pointed out, as long ago as 1975, that such evaluation was only functional in times of sustained economy. (Deprospo and liesener, 1975) We must expect that, when school boards face limited public dellar support, trustees and school-based administrators will ask whether or not midia programme services are making a difference to student outcomes. That time this come. Competition for the shrinking dollar is as intense as the questions being raised by educators who are not like us - who are not media specialists. Why should money be allocated for media programmes? What difference does it ake?

These were the two questions raised recently by the Calgary Board of Education in Alberta, Canada. Consequently, a broad evaluation of school-based media programs was designed and implemented. (Hodges, Gray and Reeves, 1981)

The goal of this Evaluation was to ascertain what services were being provided in media programs, to measure the resources required to establish media programs, and to assess the impact of media programs on student skills and attitudes. This paper focuses on the effect of the audio-visual component of high school media programs on student attitudes and behaviours. It was discovered that media program use, and the instrumental importance placed upon the program used by students, was much greater in those high schools with media programs which make audio-visual materials, equipment and media specialist services available to the students.

### Procedures

THE WY AND A MANAGEMENT

### The Sample

The results reported below are based on data collected from fifteen senior high schools (Grades X to XII) in the Calgary public school District during the 1979-1980 school year. The enrolment in most schools was from nine hundred to sixteen hundred students. The media centres in these schools were typically Maffed by one full-time teacher-librarian and two full-time library clerks. In the fall of 1979, the number of full-time teacher-librarians was increased from one to two in four of these schools. The number of library clerks ranged from one to three full-time staff equivalents.) The media centre budget is allocated by the principal in each high school from a school budget which is to cover instructional needs of the school (i.e., general expenses other than salaries for teaching staff or capital expenses). Most schools have a budget in the range of \$50,000 to \$100,000 (1979 Canadian) and most media centres receive between \$9,000 to \$25,000 from the school budget. All fifteen schools in the sample provided a variety of academic and non-academic programs. (Three special high schools serving only handicapped students or providing only vocational Education were excluded from the sample.)

C/PAF2.2

### Media Centre

The Leisener Inventory was used to catalogue services provided by the media centre in each high school. (Liesener, 1973, 1976, 1978) A checklist or inventory of resource centre services originally developed by Mary Gaver (and administered in Calgary public schools in 1971) was refined in consultation Liesener. (Gaver, 1971; Gaver <u>et al</u>, 1971) In each high school, the Liesen Inventory was administered to a committee composed of the teacher-librarian least four classroom teachers and the principal. Each of the 413 questions involved a categorical "yes/no" answer. (The question measured the presence absence of each service or item, not its intensiveness or extensiveness in the media centre program.) If the administrator and teachers confirmed the librarian's assessment that a service was available, that service was scores being present in the school. The 413 scores yielded by the Inventory provide profile of the socially recognized and acknowledged media centre services.

### Student Attitudes and Media Centre Use

Each school was represented by two Grade XII classes in the academic program, twenty-two item questionnaire was administered to students in both classes, each item, students were given a statement about their attitude or behaviour vis-a-vis the media centre and then asked to indicate whether they "strongly agreed", "agreed", were "undecided", "disagreed", or "strongly disagreed" viu the statement. The percentage of students with a response favorable to the media centre was calculated and assigned as the school score on that item. The coding procedure did not measure the intensity of individual sentiment or the frequency of individual use of the media centre. Rather, these scores was indicative of the prevalence of favorable attitudes and behavior in the student body.

### Site Visits

liffe As a check on these quantitative measures, site visits lasting two days were some carried out in each school. Impressions of library arrangement, organization hit n and day-to-day operations were obtained from students and teachers as well # analy from media centre staff. The goal-free evaluation methods of observation a nat advocated by Eisner and MacDonald were employed. (Eisner, 1973; MacDonald, attit 1974) Because of possible implications for individual careers as well as in th District policy, only very obvious and cross-validated results of the lervi quantitative data analyses were reported. Quantitative results were consider stude only if affirmed by qualitative observations. Conversely, qualitative exist impressions were reported only if confirmed by the quantitative findings of D serv. survey. tude

C/PAF2.3

C/PA

An fi Were

Media .

ar almo

Service

Access.

and gr

aud aud

period

studen

are pr

en an poidan

found

lefore

tools

identi

ident:

citat:

media

inter-

Thus

Acces

into hasic Consu

### Results

### a Centre Services

on Library Program. Three service areas were found to be common to all almost all senior high media centres: Access, Instruction and Reference vices for Teachers and Students.

ess included general services such as the provision of space for individuals groups to use a variety of media. An array of materials are provided, such audio-visual equipment and software, books, newspapers, pamphlet files, iodicals and charts all of which can be used in the resource centre by ients and teachers. In addition, reservation, renewal and overdue procedures provided so media hardware and software can be circulated.

truction provided individual and group instruction for students and teachers an "as-needs-arise" basis regarding reference and research skills. Reader dance through individual student conferences and displays/exhibits was also and to be a common service.

erence Services for Students and Teachers included provision of reference ls (e.g. dictionaries, subject indexes, encyclopedia) as well as ntification and acquisition services. For example, student needs are ntified through personal contact, students are directed to existing lists of ations, and arrangements are made for students to get materials not in the is centre. Similar services are available for teachers and, in addition, er-library loans are made and bibliographies prepared.

s all, or almost all, senior high school media centres provide a core of ess, Instructional and Reference services. None of the core services extend o Production or Consultation. Thus every media centre is able to provide a ic program independent of "extended services" (<u>i.e.</u>, Production and sultation). Intration Extension

ferences in Media Centre Program. Some services were found to exist in a but not all schools. Those services that were present in at least four, no more than eleven of the fifteen, schools were singled out for additional lysis. This variation between schools provided us with what might be termed atural experiment to assess the impact of media centre services on student itudes and behavior. The schools with a service could be regarded as being the "experimental" or "treatment group", while the schools without the vice would constitute a "control" group. If a media centre service affected dent responses to the media centre, a difference in student responses should st between the schools receiving the service and those not receiving the vice. The media centre services that appeared to make a difference for dent attitudes and behavior are listed on Table 1.

Inspection of the items presented on Table 1 reveals that most, if not all, e explicitly related to the audio-visual (AV) functions of the media centre.

F2.4

### TABLE 1

- 5 -

### Media Centre<sup>1</sup> Services<sup>2</sup> Related To Student Attitudes and Media Centre Use

	Number of Sch			
Basic AV Services	With Service	W11 Servit		
"Teachers are directed to existing lists of citations that include 'nonprint' materials where possible."	11			
"Students may check out AV materials for use outside school."	11			
AV Production				
Stock "still picture cameras".	9	-		
"There is a photography function available to teachers and to students," and "materials may be used by teachers and by students in				
" outside school."	10	His.		
"The Resource Centre <sup>1</sup> provides assistance to teachers and to students in the production of materials or adaptation of commercially produced materials."	8			
"Students may check out AV equipment for use outside school."	9			
Prepackaged AV Materials		1		
"As a regular service, the Resource Centre undertakes to evaluate for teachers the quality of user materials				
relevant to a given request, besides providing a selected list of references."	9	6		
"Students have direct access to filmstrips (silent and				
sound) (through materials systematically organized on the shelves)."	8	1		

- <sup>1</sup> "Media Centre" is the label used by standard setting bodies in the United States of America. As Canadian standard setting bodies use the pur "Resource Centre", the Liesener Inventory was modified to reflect Canadis terminology.
- <sup>2</sup> Questionnaire items have been changed from interrogatory sentences to declaratory statements. Serial or contingent questions have been concentrated into one statement.

C/PAF2.5

vations in the schools suggested that these services might be grouped under headings: Basic AV Services, AV Production, and Prepackaged AV Materials.

asic AV Services involved making teachers aware of nonprint materials and llowing students to check out AV materials. In practice, these services ppeared to be geared to meeting classroom needs, with student awareness of he AV holdings of the media centre being linked to the awareness of their lassroom teachers. These Basic AV Services supported an AV Production unction and/or an emphasis on the circulation of Prepackaged AV Materials.

he services grouped under AV Production focussed on photography. In some ases, photography was part of classroom-based enrichment programs for tudents who consistently completed assigned work before the others. In ther schools, alternative formats for classroom projects catered to lternative learning styles of particular students, allowing them to select V projects in place of more typical book-based reports. Librarians ssisted classroom teachers in developing these projects by pointing out a ide range of resources that may be keyed to curriculum guidelines. The xistence of photography in the media centre tended to be indicative of this ore general, learning style orientation of teachers and librarians.

n contrast to this emphasis on production, the services grouped under the eading Prepackaged AV Materials appeared to involve a more conventional use f AV in the classroom. Librarians helped teachers by previewing films and ideotaped programs, evaluating their relevance to units being taught in the lassroom. Students used filmstrips to introduce and illustrate class resentations, perhaps emulating their teacher's use of AV resources or esponding to a requirement that assignments include multi-media resources. hile AV Production tended to centre on generating alternative styles of earning for selected students, the use of prepackaged AV materials tended o involve individual or group projects assigned to the class as a whole. n practice, the reference and access services identified as Basic AV ervices took on a slightly different form depending on whether they were ustaining an AV Production function or the use of Prepackaged AV Materials. owever, in both instances, media centre services related to student ttitudes and behavior supported classroom-based programs of instruction.

FUILD THE PROPERTY

### nt Attitudes and Media Centre Use

items, two measures of student opinions and two indicative of the nature of nt use of the media centre, were strongly correlated with most of the above lated services. The wording of these items and an indication of the extent riations from one school to another is presented on Table 2. The item with ighest scores concerns use of the library\*\* outside of class.

e footnote 1 on Table 2 on terminology (<u>i.e.</u>, "library" versus "media ntre").

2.6

### TABLE 2

- 7 -

### Student Attitudes and Media Centre<sup>1</sup> Use

Percentage of Grade XII Students

	With Favourable Response				
	Average School Score	Score of Highest School	Score of Lowest School	Standar Deviat	
Student Attitudes:					
"In my opinion, the school library <sup>1</sup> is very important for success in school"	54%	78%	20%	161	
"I don't use the library very often because it is too much of a hassle" (Percent disagreeing)	59%	75% .	39%	112	
Media Centre Use:					
"I only use the library when I go there with the rest of a class" (Percent disagreeing)	72%	90%	52%	117	
"I go to the library only when I have to"					
(Percent disagreeing)	59%	74%	44%	10%	
		(N = 15)	high schools	s)	

<sup>1</sup> "Media Centre" is the label used by standard setting bodies in the United States of America. "Library" is the everyday word used by students in the schools surveyed. The student questionnaire therefore refers to the "library" rather than the "media centre".

C/PAF2.7

while most Grade XII students report using the media centre outside of class time, the percentage who did so varied from 90% of the students in one school to 52% in the school with the lowest score. A similar range of about 30 percentage points separated the most favorable and least favorable schools on items related to **climate** (<u>i.e.</u>, no hassle) and **non-required use** of the media centre, with the highest scores being 75% and 74% and the lowest scores 39% and 44%, respectively. However, the greatest variation between schools has to do with attributed **importance of the library to success in school**. In the school with the lowest score, only one student in five agrees with this statement. Almost eight in ten agree with this statement in the school with the highest score. (The frequency distribution of all four items approximates a normal distribution, with the score of two-thirds of the cases falling within one standard deviation of the average school score.) We shall see that the presence of AV-related services is associated with more favorable attitudes and extended use of the media centre by students.

### Correlation Between AV-Related Services and Student Responses

Almost all of the AV-related services are strongly correlated with the four indicators of student attitude and media centre use. (See Table 3). On average, the percentage of Grade XII students who report that the library is important for success in school, that library use involves no hassle, they use the library outside class, and that they use the library on a nonrequired basis is higher in schools with AV-related services. The presence of such an AV program appears to make a difference to the students. The strongest correlations tended to be with student climate (i.e., no hassle). The lowest correlations on Table 3 are between non-required use of the library and services supporting the use of Prepackaged AV Materials. Classroom presentations involving Prepackaged AV Materials frequently generate assigned work for students. With this in mind, we can see that these results suggest that the use of Prepackaged AV materials in assignments is only moderately associated with further non-required use of the media centre. However, these moderate correlations only serve to emphasize the magnitude of the other correlations between AV-related services and student responses.

したないないないでしたうとうないの

C/PAF2.8

### TABLE 3

- 9 -

### Student Attitudes and Media Centre Use Correlated With AV-Related Services (Pearson's r1)

		Student Res	ponses	1000	ather
	Important for Success	Climate (No Hassle)	Outside Class	Nor- Requin	part ( preven
a Centre Services:					photog al
c AV Services					0.55 (
st nonprint for teachers an materials to students	.73 .73	.83 .83	.66 .63	.65 .63	ontel
roduction					
ock cameras otography materials	.65	.80	.63 .59	.65 .57	
an equipment to students	.67	.63	.62	.52 .62	Mdia C
ackaged AV Materials					Jasic A
aluate lists for teachers lmstrips available to students	.64	.62	.51	.33	1. Lis 1. Loa
		(N = 15 high s)	chools)		# Prod
					1. Sto 4. Pho 5. Phot 5. Loan
		5			Itepacka
e percentage scores of student and continuous	responses (the	e dependent vari As such. Pearso	ables) are n's r is th	both	7. Eval 8. Film
ppropriate correlation coefficie	nt. This sta	tistic has the	added advan	tage of	Midget:
ariable is associated with the v tatistically "explained" variati	ariation in the on is equal to	the variation he independent o the squared P	variable. earson's r	The	<sup>9</sup> . AV e

C/PAF2.10

A Media Ce

# wedia Centre AV Program

correlation between listing nonprint materials for teachers and loaning AV erials to students for homework and/or personal use (<u>i.e.</u>, **Basic AV** wices, Tables 1, 3, and 4) is perfect (r = 1.00). (See Table 4) While the er correlations listed on Table 4 are not perfect, many are extremely high, disting that most of the identified services and holdings tend to co-exist as t of an integrated program. (Indeed, this problem of multicolinearity wented us from using multivariate regression analysis to isolate the extendent effects of each library service.) The stocking of cameras, tography and loaning equipment to students all have to do with AV Production, all intercorrelations among these services are greater than or equal to r =5 (80% of the correlations are greater than or equal to r = 0.72). Services ated to the use of Prepared AV Materials are not as strongly or consistently related with elements of AV Production.

### TABLE 4

### Intercorrelations Among Elements of an AV Program (Pearson's r)

is Centre Services:	Basic	Production			Packaged		AV \$	
	2	3	4	5	6	7	8	9
ic AV Services								
List nonprint for teachers	1.00	74	.85	.64	.74	.74	.64	.62
Loan materials to students		74	.85	.64	.74	.74	.64	.62
Production								
Stock cameras			.86	.87	.72	.44	.60	.57
Photography materials				.75	.58	.58	.47	.50
Photography assistance					.60	.33	.46	.67
Loan equipment to students						.44	.60	.58
packaged AV Materials								
Evaluate lists for teachers							.60	.16
Filmstrips available to students							Suratu	.12

### get:

AV expenditures

(N = 15 high school)

AF2.10

Library expenditures on AV materials and equipment clearly have a different relationship to these two different components of an AV program. The correlations are moderately strong with AV Production, particularly with assistance in photography (r = 0.67). In contrast, the correlation between expenditures and Prepackaged AV Materials is all but nonexistent (r = 0.160.12). It would seem that AV Production, but not accessing Prepackaged AV Materials, is contingent upon the level of funding.

A search was made to discover other possible preconditions or inputs that size be required to establish an AV program. Such factors as: (1) experience and qualifications of the librarian, (2) the number of librarians and clerks, (1) seniority of the principal, (4) bussing of students, (5) average ability score of the student body, (6) the number of students enrolled, (7) the socio-econ status of the neighborhood, and (8) the age of the school were simply uncorrelated with the presence or absence of any of the elements of the AV program identified. Campbell and Stanley give us some basis for assessing the import of these non-findings. They stated that while "... correlation does necessarily indicate causation ... " causation "... does imply correlation". (Campbell and Stanley, 1963: 64) Unless measurement error is a significant problem, these non-findings suggest that an AV program does not depend on a number factors that have served to limit the introduction of other education programs. The size of the school budget and of the overall media centre builder were correlated with the size of library AV expenditures (r = 0.60) and, in the way, may have an indirect effect on the possibility of AV production in the media centre. However, the surprising conclusion is that an AV program may h dependent only on AV expenditures, and then only for the production of AV materials and not use of prepackaged materials for classroom presentations.

#### Discussion

Topics related to the work we are interested in are learning styles, models it teaching and curriculum implementation as explored by people such as Anthony Gregorc, Rita and Kenneth Dunn; Bruce Joyce and Marsha Weil; the Institute for the Development of Educational Activities (I/D/E/A), and Jack Gibb.

Firstly AV production, as enrichment, caters to learning styles. In turn, catering to student learning styles appears to be related to teachers' abilitites to recognize and accommodate individual student learning preferences not provided for in the classroom. In schools where the AV component was present, classroom teachers were offering students a wider variety of research opportunities. For example, students were observed gathering and reporting des by independently listening to audio tapes or reading, watching a movie in a large group, participating in a small group discussion, making posters, seving period costumes or making a set of slides with a friend. In turn, students reported positive attitudes. This lends some support to Rita and Kenneth Dunn's and Anthony Gregorc's theories that successful learners are those whose learning preferences are accommodated. (Dunn and Dunn, 1977; de Luna, 1982)

C/PAF2.11

secondly, the models of teaching adopted by the majority of teachers in a school will likely determine Basic AV Services. In those models of teaching where the escher motivates and initiates student inquiry, then media programs are exjected to provide a variety of resources in response to a variety of learner teaands as needs arise. Examples of such models are Herbert Thelen's "Group investigation: Democratic Process As A Source" and Bryon Massialis and Benjamin (ax's "Inquiry in Social Studies". (Joyce and Weil, 1980 pp. 226-240, pp. 310-11) Our observations revealed that in schools where teachers focussed on learning through student inquiry, then Basic AV Services were provided. This was particularly evident in the Social Studies and Language Arts areas. It is surprising that in the same schools where the Humanities teachers relied heavily on the media program, that the AV budgets were high.

mirdly, certain organizational models are likely to nurture an AV Program. models such as the I/D/E/A Change Program for Individually Guided Education I.G.E.), promote the AV component because a basic premise of such a model is that students assume increasing responsibility for their own learning. Implementation Guide, 1975) Independent student enquiry assumes that at least reachers are oriented to prepackaged materials for individual student access as exposed to provision of class sets of textual materials. Furthermore, carriculum implementation which recognizes and rewards student discovery appear to be facilitated by media programs which include opportunities for students to be actively engaged in creativity. Media production offers to students such caportunities if students are encouraged to do some risk taking - to explore alternatives and thereby "make sense" of new curriculum knowledge. (Swarthout, 1966) Of course risk-taking by students also requires risk-free teachers, a sotion applauded by Jack Gibb, Charlene Swarthout and Ralph Peterson. (Gibb, 1961; Swarthout, 1967; Peterson, 1979)

Too often, teachers harried by perceived curriculum demands feel that there is no time for a mediated approach to learning - no time to adapt instruction to student characteristics, no time to appraise how students feel about their schooling. But as John Goodlad asks, "How many institutional curricula have been influenced by student reactions to and perceptions of the programs they are experiencing? (Goodlad, 1979) Those schools willing to support the AV component may be validating the Personal Domain in their actual practice of curriculum.

In practical terms, teachers who feel less bound by a curriculum may also be teachers who have a high integration index as described by David Hunt (Joyce, 1980). Teachers with a high integration index are more likely to be able to see opportunities for simultaneous alternate student approaches in response to students' immediate interests and abilities. This has organizational implications for both teachers and students.

C/PAF2.12

### CONCLUSION

71

111

Cav

Gav

615

Foo.

Grev

Ut

milte Pr

FAF2.

Initiated as part of a larger evaluation of school library programs by the Calgary Board of Education, this paper focusses on the impact of the AV component on students. We found that the existence of the AV component was associated with students valuing, and extensively using, the library program These findings may have some implications for those concerned with studen: learning styles, provision for models of teaching and curriculum implementation.

C/PAF2.13

#### BIBLIOGRAPHY

, Shirley L., "Current Research," School Media Quarterly, VII (Summer, 1979), 277-279.

can Association of School Librarians, A.L.A., and Association for Educational Communications and Technology. <u>Media Programs: District and</u> School. Chicago: A.L.A. and A.E.C.T., 1975.

combe, Frederick R., and Harry E. Newson, eds., <u>Resource Services for</u> Canadian Schools. Toronto: McGraw-Hill Ryerson, 1977.

ell, Donald T. and Julian C. Stanley. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally, 1963.

na, Phyllis, "Identify Your Style, Teachers Told," The A.T.A. News, Vol. XVI, (February 22, 1982), 4.

spo, Ernest R., and James W. Liesener, "Media Program Evaluation: A Working Framework," School Media Quarterly, III (Summer, 1975), 289-301.

Rita and Kenneth Dunn, Administrator's Guide to New Programs for Faculty Management and Evaluation. New York: Parker, 1977, p. 87-96.

r, Elliot W. "The Perceptive Eye: Toward the Reformation of Educational Evaluation." Paper presented at the meeting of the American Educational Research Association Division B, Curriculum and Objectives. Washington, D.C., 31 March, 1973.

ating Media Programs: District and School, Washington, D.C.: Committee on Evaluation of Media Programs Association for Educational Communications and Technology, 1980.

, Mary V., <u>Services of Secondary School Media Centers</u>. Chicago: American Library Association, 1971.

, Mary V. and Others, <u>A Survey of the Educational Media Services of Calgary</u> Public Schools. Edmonton: University of Alberta, 1971.

Jack R., "Defensive Communication," Journal of Communication, XI (September, 1961), 141-148.

ad, John, Curriculum Inquiry: The Study of Curriculum Practice. New York: McGraw Hill, 1979.

, Clyde LeRoy, "The Relationship of the Availability of Libraries to the Academic Achievement of Iowa School Senio" (Ph.D. dissertation, versity of Denver, 1974).

, David et al., <u>Beyond the Numbers Game</u>. Berkeley: McCutchan lishing, 1977.

- Hodges, Yvonne, Judy Gray and William J. Reeves, School Library Program Evaluation. Calgary: Calgary Board of Education, Spring, 1981.
- Hunt, David, "A Model for Matching Environment to People: Conceptual System Theory," <u>Models of Teaching</u>. eds., Bruce Joyce and Marsha Weil, New Jersey: Prentice Hall, 1972.
- Implementation Guide: I/D/E/A Change Program for Individually Guided Educate Dayton, Ohio: Institute for Development of Educational Activities, 1976
- Joyce, Bruce and Marsha Weil. eds., <u>Models of Teaching</u>. 2nd ed., Englewood Cliffs: Prentice-Hall, 1980.
- Liesener, James W. "The Development of a Planning Process for Media Programs, School Media Quarterly, I (Summer, 1973), 278-287.
- Liesener, James W. Planning Instruments for School Library Media Programs. Maryland: American Library Association, 1974.
- Liesener, James W. <u>A Systematic Process for Planning Media Programs</u>. Chicara American Library Association, 1976.
- Lowrey, Anna Mary and Robert N. Case, "Measuring Program Effectiveness," Drezel Library Quarterly, XIV (July, 1978), 12-23.
- MacDonald, Barry. "Evaluation and the Control of Education." Ford Foundation Safari Project. University of East Anglia: Centre for Applied Research & Education. (Mimeographed). 1974.
- Massialis, Bryon and Benjamin Cox, "Inquiry in Social Studies," <u>Models of</u> <u>Teaching</u>. eds., Bruce Joyce and Marsha Weil, New Jersey: Prentice-Hall. 1972, 310-323.
- Peterson, Ralph L., A Place for Caring and Celebration: The School Media Center. Chicago: American Association of School Librarians, 1979.
- Swarthout, Charlene R., The School Library as Part of the Instructional System Metuchen, New Jersey: Scarecrow, 1967.
- Thelen, Herbert, "Group Investigation: Democratic Process as a Source," Model of Teaching. eds., Bruce Joyce and Marsha Weil, New Jersey: Prentice-Hall, 1972.
- Wight, Lillian and A. Grossman, Maximum Utilization of School Library Resources (ERIC Document Reproduction Service, ED 154 781, 1977).

C/PAF2.15

TITLE: A Theoretical Model for Understanding the Visual Event

AUTHOR: John A. Hortin

3'76

## A THEORETICAL MODEL FOR UNDERSTANDING

THE VISUAL EVENT

ЪУ

John A. Hortin

Kansas State University

Visual Event ii

### ABSTRACT

This paper provides a theoretical model for understanding the visual event. The premise is that a visual event has two levels of understanding: the surface (descriptive) level and the deeper (experience) level. A person needs both levels to comprehend and appreciate images, and each level affects the other. A person's perspective or point of view is an important part of the visual event: the perspective depends upon the background of the person, the actual experience of the visual event in terms of amount of involvement, sensations, effects, etc., and the reflection afterward. What an individual perceives in terms of structure and elements also influences and is influenced by the background of the individual, the experience of the "seeing," and the reflection upon that "seeing" experience. The model presented here is far from complete and the empirical evidence necessary for its support may well be too difficult to obtain until we know more from other research efforts in psychiatry, neurophysiology. brain chemistry, visualization and emotional/cognitive structure about how man thinks.

It is important to teach students that knowing and seeing involve these two levels of understanding and that seeing a visual event is more than a process of collecting data. By using mental images, exploring intuition and examining their visual perceptions, students can find a deeper level of understanding that lays the groundwork for concept formation and thinking. We need to take another step in the development of creative thinking by including practices, research and theory on strategies for understanding the visual event and thinking visually.

# Visual Event

With this step, the visual event becomes not just an external realing perceived by the learner, but a means to creating his own visual event in the mind.

and g
manne
visua
refi:
surp
image
inst
exter
certa

formi

prop

Deast

as,

why :

diff

anal

educ

Lear

comp

1000

not.

can

to d

1121-521

modi

Visual Event 1

A THEORETICAL MODEL FOR UNDERSTANDING THE VISUAL EVENT

### Introduction

Educators practice theory consciously or unconsciously and often formulate and generate theory from practice, refine theory by research and give theory credibility through both practice and research. In like manner, I present here the theoretical model for understanding the visual event as a proposition to be tried, questioned, researched and refined. Since visual events are everywhere in our lives, it is not surprising that there has been much research on visualization, mental imagery, dual coding, visual learning, visual literacy and visual-based instruction. However, the concept of the visual event, whether it be external or internal, has been elusive. Perhaps this is so because of certain research traditions.

Traditionally, theory building requires the researcher to test propositions and hypotheses by observation, examination, and measurement, but human behavior is not as easy to measure or categorize as, for instance, the properties of a given chemical. How, when, where, why and what we learn involves inner mental processes that remain difficult to catalogue and explain. Though the brain and computer analogy is often made by behaviorists, instructional designers, and educators to explain the learning process, I cannot accept this analogy. Learning is more than a process of collecting data, and while the computer has two distinct systems, hardware and software, the mind does not. The hardware components of a computer have specified functions and can be replaced when they wear out, but thus far we have not been able to do this with the brain. The software of the computer, which can be modified by man or another computer, tells the computer what to do.

Visual Even

110

whi

hel

vis

Harth (1982) wrote that the living brain has no such instructor:

The brain does not follow instructions, it simply functions. Nietzsche remarked that 'a thought comes when it wills, not when I will.' Memory, motivation, associations - all the changes which in a computer would require instructions occur in the brain as a result of changes in the structure itself - the hardware. (p. 232)

In the brain, the structure or system (which is the brain itself, undergoes continuous physical changes, interacts with itself, and has its information residing within itself. The system is thus organs rather than mechanical.

Just as we cannot say that the brain corresponds completely to the stress of human learning and their practice conform completely the scientific method. Educators would feel more comfortable and secure even if they could prove all learning theory by empirical research, but the empirical proof may not be possible.

WPO The ultimate question that has to be asked by educators is how much hot does traditional empirical research contribute to the advancement of knowledge on learning? The "bales of published research" (Goodman, ma: 1962, p. 225) have satisfied administrators, professors and researchers, 0b but how much do we know about how we learn and think? Sometimes strict Ef adherence to empirical research for theories in education may have we stifling effect on innovation and practice. Although the model 11 presented here is far from complete, the empirical evidence necessary or for its support and credibility may be too difficult to obtain until xe think through psychological and know more about how we ex. neurophysiological research.

ou

(1

### Visual Event 3

The model of the visual event consists of the surface level, which includes perspective and structure and elements, and the deeper level, which is the experience of truly "seeing."

### Visual Event

Images arouse interest, motivate us to action, trigger emotion, and help us to recall past experiences. We can learn to read or understand visual language through the study of the visual event - its elements, structure, syntax, and subtleties. Through images we see meanings, metaphors, analogies, categories, qualities, and interpretations. If we are visually literate, we are able to understand (read) these visual events and get meaning and pleasure from them. Also, we can use visual events to convey our own messages, thoughts and feelings.

Advertizers are adept at manipulating us with images. Key (1976) wrote about the hidden implants of images in America's mass media and how these images program and condition our subconscious minds.

Many political groups have been able to use images to control and manipulate people through mass rallies, pageantry, and visual symbols. Obviously, we must guard against these visual and verbal manipulations. Effective education means that we can understand, use and appreciate the wealth of visual information that is available to us: we must become literate in the use of visual information and the images we see and create in our own minds.

The visual event occurs not only as a result of stimuli in the external world, but there are also visual events or images created by our own minds. Psychologists and researchers such as Bry (1978), Paivio (1969, 1971, 1975), McKim (1972), Patten (1973), Haber (1968, 1969,

# Visual Even

1970), Hagen (1974), Winn (1980) and Fleming (1977) have been concerwith these mental images. In fact, Samson (1965) said, "We must fine realize that 'things' exist not in the 'outside world' but in the mine (p. 28). We do interpret waves of sensation from stimuli of the outside world, but we also invent our own stimuli within our minds thro daydreams, mental imagery, imagination, and visualization (Watking 1976; Singer & Switzer 1980; Lazarus, 1977; Singer, 1966; Winn, 1980 Hortin 1981a, 1981b, 1982).

Visualization or mental imagery offers individuals creative ways a preparing for the future and for problem solving (Hortin & Bailey, a press). Visual rehearsal of future events in one's mind is a strateg for coping with change or the experiences of new technology. Suppose, for example, a school decides to purchase microcomputers for is mathematics program. The adoption of this new curriculum could a visually rehearsed by the members of the curriculum committee u anticipate problems, advantages, disadvantages, consequences, choices and strategies.

Another example of visualization in education would be to base students mentally rehearse the process and sequence of performing scale psychomotor skill before they actually perform the skill. In a story class a student might visually rehearse the steps to working on a wood lathe before he performs the task.

I believe that understanding the visual event involves (1) the description of the visual event and (2) the experience of the viewer before, during and after the event. The description involves the viewer's examination of the visual event from different perspectives and the awareness of the structure and elements of the visual event.

Visual Event 5

### Perspective

Perspective in this model refers to the conditions that affect point of view of the visual event. Such conditions include time, space, assumptions and objective/subjective continuum. An event manifests itself depending upon one's time and space conditions. When one "sees" and where one "sees" the event affects his perspective. A popular television show, "The Twilight Zone," presented story after story about confused characters who were out of step with reality because of changes in their time and space conditions.

Another old television show, "You Are There," "interviewed" people (some of them famous) on the scene at major historical events and thus played upon the television viewer's distanced perspective. Transporting oneself to a different time or space opens up different perspectives, brings new knowledge, and is a possible step toward alternative, creative thinking or intuitive wisdom (Quick, 1981).

There are many ways the classroom teacher can offer experiences in changing point of view. Ambrose Bierce's short story "An Occurrence at Owl Creek Bridge" and the excellent film made of that story are good examples of changing time and space conditions and thus changing perspective.

Getting students to understand this concept of time and space in its relationship to mass media is critical and fundamental if our society is to remain free from images that have the potential to manipulate us.

Other conditions of the perspective are assumptions and an objective/subjective continuum. A teacher might, for instance, compare the flow of information via mass communications about three wars: World
# Visual Ever

War II, Korea, and Vietnam. The conditions for viewing these wars and are very different. A war in Europe in the 1940s is perceived with a certain objectivity or subjectivity that differs from the Vietnam not only because of the greater time distance but also by virtue of the symbol systems and technology used to present the visual events. 1940s American citizen received news of the war from newspapers and newsreels. In some respects film footage from the 1940s with its black and white, grainy film and documentary style seems more real to us to and more acceptable than the small screen, clearer, color television news clips of Vietnam that we watched every night. Admittedly, me differences in the conditions surrounding the two wars play a part is our perspective, but also the symbol system and technology affect to objective/subjective condition of our perspective and the assumption about the veracity of those visual events. The images of the Viet: War made us shocked, incredulous, questioning, angry and tired. Work War II visual events caused the same range of emotions, but the inage did not become as overwhelming and finally numbing because the run media technology was not as advanced.

## Structure and Elements

Another apsect to the descriptive level is that of structure and elements. Writers from art philosophers such as Arnheim (1967, 1965) and Eisner (1972) to symbol systems and communications experts such m Goodman (1968), Olson (1974), Gardner, Howard and Perkins (1974) and Salomon (1979) have written much on structure and elements. Arnheim (1969) wrote:

The visual medium is so enormously superior because it offers

structural equivalents to all characteristics of objects, events, relations. The variety of available visual shapes is as great as that of possible speech sounds, but what matters is that they can be organized according to readily definable patterns, of which the geometrical shapes are the most tangible illustration. The principal virtue of the visual medium is that of representing shapes in two-dimensional and three-dimensional space, as compared with the one-dimensional sequence of verbal language. This polydimensional space not only yields good thought models of physical objects or events, it also represents isomorphically the dimensions needed for theoretical reasoning. (p. 232)

Reading visual events involves an understanding of their structure and elements. The quintessential study of structure and elements for teachers can be found in the feature film. For example, color, direction of light, illumination, movement of people and objects within a frame, placement of people within a frame, and sequence of frames are used in cinematography to produce certain meanings on the screen. These are the elements that describe a visual event which affect our experience and hence our understanding. Ingmar Bergman's film, "The Seventh Seal," an allegory of the Middle Ages, presented the viewer with variations of light and subtle gradations of tone from black to white (Bobker, 1979, p. 55). The use of these tones gave the film a mood of foreboding, mystery, darkness and despair. The deeper structure of the film was thus realized not only from the characters, plot and acting (subject content), but from the dark images and mood created by the lighting elements. Roman Polanski used the elements of lighting and color tones (brown, yellow and gold) to duplicate the lighting of the 1930s in his film Chinatown, the 1930s being the time which the story occurs (Bobker, 1979, p. 80). In Bound for Glory, Hal Ashby and his cinematographer, Haskell Wexler, captured the imagery of the Depression years through control of color and film grain (Bobker, 1979, p. 76). The dusty look in the film makes the viewer to believe he is seeing the

b

r

P

m

(.

+1

11

(

pj

**#**j

at

31

tc

th

re

it

it

on

su

Dust Bowl of the 1930s. Sequence of shots, composition, color, angle, and lighting all immerse us viewers in the symbol system medium so that we no longer just see the visual event; we live it; we experience the visual event. All of this depends on whether the director, actors, cameramen and editors are successful in handling structure and elements of the visual event.

### The Experience

The experience of the visual event is on three levels. The first level might be called "before-the-event" and this level is based on the background and previous experiences of the viewer. Paul Wendt (1962) said, "The meanings of pictures are not in the pictures themselves, but rather in what we bring to the pictures." The second level is the "straightforward experience" (Inde, 1979, p. 45) or the event/experience as it happens. An individual experiences a visual event and becomes involved with it; he attends to the experience; the experience is real. The third level is thinking about the experience or reflection on the visual event.

A model for the visual event is provided in Figure 1. The premise is that a visual event has two levels of understanding: the surface (descriptive) level and the deeper (experience) level. Both levels are needed to comprehend and appreciate images and each level affects the other. A person's perspective or point of view is an important part of the visual event, and perspective depends upon the background of the person, the actual experience of the visual event in terms of amount of involvement, sensations, effects, etc., and the reflections afterward. Structure and elements also influence and are influenced by background,

the actual experience and the reflection upon that experience.

Salomon and Cohen (1976) theorized that coded messages are never a raw message, but represent a format as well as content. The code used biases the information. Handling of coded messages has two requirements: "The activation of mental skills relevant to the psychological requirements of the representational format used in the message, and the acquisition of the knowledge entailed in the message" (Salomon & Cohen, 1976, p. 6). Some ability is needed to handle the code of the information, whether it is verbal mediation or visual mediation. A strategy or training for understanding the experience of the visual event is a possible solution to handling some coded information. One direction for empirical research in this area might be to continue the memory and dual coding research conducted by Paivio (1971) and Canelos (1980).

Paivio (1971) reported on some memory experiments comparing pictures (imagery), abstract words and concrete words and found "imagery-concreteness" a better predictor of memory performance than abstract words (p. 242). "The number of items correctly remembered in such tasks uniformly increases from abstract words, to concrete words, to pictures" (Paivio, 1971, p. 242). Paivio's (1971) research supports the view that either images or words, or both, serve as memory codes for remembering items effectively.

Paivio (1971) explained that dual coding aids in recall because items are stored in both the verbal and nonverbal code, or at least the items are experienced in both forms of coding (p. 207). Words are not only read or heard, but evoke referent images. For instance, if the subject knows that verbal recall will be required in an experiment, the

subject may verbally label pictures (Paivio, 1971, p. 207). increased availability of both codes increases the probability of m recall because the response can be retrieved from either code--one could be forgotten during the retention interval, but verbal recal would still be possible provided that the other is retained" (Pair 1971, pp. 207-208). Such research linked with introspective approac-(Hortin, in press) to the visual event experience could have importaimplications for understanding imagery processes.

Canelos (1980) conducted research on three types of strategin dealing with visualization and their effect on learning. The first type of strategy was called Copy Strategy which "required the subject to fin a mental image of the perceived visual stimuli information" (Canelos 1980, p. 17). The second was called Relational Strategy, which involve coding information in visual and verbal modes. Canelos (1980) also use the "peg-mnemonic system, a memory technique used to facilitate memory and recall" (p. 17). Ausubel (1966) provides the theoretical basis for the peg-mnemonic system. "The Hierarchical Strategy employs " processing advantages of both imagery mediation and the peg-mnemotic system" (Canelos, 1980, p. 17). The Hierarchical Strategy allows the learner to store the information logically. Canelos (1980) defined the Hierarchy Strategy:

Hierarchy--the formation of a cognitive or mental hierarchy means that information is stored in a structured network. Inclusive information will form nodes with related information subsumed under each node. All the information will interrelate. (p. 18)

Canelos (1980) found that the "Hierarchical Strategy general! facilitated learning significantly better than the Relational Strates or the Copy Strategy" (p. 18). In the study, retention was also

considered and after one week, Canelos (1980) found that the Hierarchical Strategy had "little loss of acquired information" (p. 19). Related mnemonic and image memory studies include those of Hadamard (1945), Whorf (1956), Pressley (1976), Paivio (1975), Bower (1972), Collins and Quillian (1972) and Fleming (1977).

Fleming (1977) wrote:

In sum, I assert that the <u>way</u> in which pictorial stimuli influence thought and memory processes is becoming an increasingly pivotal issue in the media field. It is also becoming a research and theory issue in other fields of education such as reading, cognitive development, special education, and vocational education. It may be necessary to generate new learning theories, new ways of thinking about learning, in order to explain and understand the memory effects of picture. (pp. 48-49)

In summary, there is a connection between the description and experience of the visual event. Perception involves the active processing of information by the perceiver in response to stimulus (Murch, 1973). Turbayne (1970), Taylor (1960), Dondis (1974), Gregory (1970) and others agree that an important aspect of perceptual development is the understanding of visual structure and elements that make up the visual event. Visual imagery and symbolic systems are thought to be means to visual thinking (Fleming, 1977; Salomon, 1979; Majure, 1976; Arnheim, 1967, 1969; Paivio, 1969, 1971; Samples, 1976; Bry, 1978; Hortin, 1981a, 1981b, 1982; Hortin & Bailey, in press).

Teaching students to be cognizant of the experience of the visual event involves sharing mental strategies that use mental imagery, visualization, mnemonics, dual coding and symbolic systems to store information, interpret and develop new ideas, and solve problems. We need to take another step in the development of creative thinking by including the research and theories on strategies and methods for

Visual Event to

understanding the visual event and thinking visually. With this step, the visual event becomes not just an external reality perceived by the learner, but a means to creating his own visual events in the mind.

## Description

- 1. <u>Perspective</u> Time Space Assumptions Objective/Subjective Continuum
- 2. <u>Structure and Elementa</u> Features Classification Quality Operation Analysis (changes) Analogy Metaphor Movement

### Experience

- <u>Background</u> History Knowledge Sociological aspects Psychological aspects Economical aspects Intelligence
- 2. <u>Straightforward Experiences</u> Character Involvement Reality Sensation Effect

1

c

D

Ε

F.

G

Gc

Gc

 <u>Reflection</u> Thinking about the Visual Event

Figure 1. Model for Understanding the Visual Event

73505

語

ANTON.

#### REFERENCES

- nheim, R. <u>Toward a psychology of art</u>. Berkeley and Los Angeles: University of California Press, 1967.
- nheim, R. <u>Visual thinking</u>. Berkeley and Los Angeles: University of California Press, 1969.
- subel, D. Meaningful reception learning and the acquisition of concepts. In H. Klausmeier & C. Harris (Eds.), <u>Analysis of Concept</u> <u>Learning</u>. New York: Academic Press, 1966.
- bker, L. R. <u>Elements of film</u> (3rd ed.). New York: Harcourt Brace Jovanovich, 1979.
- wer, G. H. Mental imagery and associative learning. In L. W. Gregg (Ed.), <u>Cognition in learning and memory</u>. New York: John Wiley, 1972.
- y, A. <u>Visualization: Directing the movies of your mind</u>. New York: Barnes & Noble Books, 1978.
- nelos, J. J. Three types of learning strategies and their effects upon learning from visualized instruction consisting of varying stimulus complexity. <u>Research and Theory Division Instructional</u> <u>Communications and Technology Research Reports</u>, 1980, <u>10</u> (4), 16-21.
- Ilins, A. M., & Quillian, M. R. How to make a language user. In E. Tulving & W. Donaldson (Eds.), <u>Organization of memory</u>. New York: John Wiley & Sons, 1972.
- ndis, D. A. <u>A primer of visual literacy</u>. Cambridge, Massachusetts: Massachusetts Institute of Technology, 1973.
- sner, E. Educating artistic vision. New York: MacMillan, 1972.
- eming, M. L. The picture in your mind. <u>AV Communication Review</u>, 1977, <u>25</u> (1), 43-62.
- rdner, H., Howard, V., & Perkins, D. Symbol systems: A philosophical, psychological, and educational investigation. In D. R. Olson (Ed.), <u>Media and symbols: The forms of expression,</u> <u>communication, and education</u>. Chicago: The University of Chicago Press, 1974.
- odman, N. Languages of art: An approach to a theory of symbols. Indianapolis: Bobbs-Merrill, 1968.
- odman, P. <u>Compulsory mis-education</u> and the community of scholars. New York: Vintage Books, 1962.

- Gregory, R. L. The intelligent eye. New York: McGraw-Hill Box Company, 1970.
- Haber, R. N. <u>Contemporary theory and research in visual perception</u> New York: Holt, Rinehart and Winston, 1968.
- Haber, R. N. Eidetic images. <u>Scientific American</u>, 1969, 220 (4), 36-44.
- Haber, R. N. How we remember what we see. <u>Scientific American</u>, 1970, 220 (5), 104-112.
- Hadamard, J. S. <u>An essay on the psychology of invention in the</u> <u>mathematical field</u>. Princeton, New Jersey: Princeton University Press, 1945.
- Hagen, M. A. Picture perception: Toward a theoretical model. <u>Psychological Bulletin</u>, 1974, <u>81</u> (8), 471-497.
- Harth, E. Windows of the mind. New York: William Morrow, 1982.
- Hortin, J. A. A confluence of theories for visual literacy theory development. <u>Reading Improvement</u>, 1981, <u>18</u> (3), 194-209. (a)
- Hortin, J. A. Employing visual literacy techniques. Educational Considerations, 1981, 8 (3), 15-17. (b)
- Hortin, J. A. Introspection and visual thinking for instructional technology. <u>Educational Technology</u>, in press.
- Hortin, J. A. Visual literacy and visual thinking. In L. J. Ausburg (Ed.), <u>Australian Society of Educational Technology National</u> <u>Yearbook 1981</u>. Hawthorn, Victoria: ASET, 1982.
- Hortin, J. A., & Bailey, G. D. Visualization: Theory and application for teachers. <u>Reading Improvement</u>, in press.
- Ihde, D. <u>Experimental phenomenology: An introduction</u>. New York: G. P. Putnam's Sons, 1977.
- Key, W. B. <u>Media sexploitation</u>. New York: The New American Library, 1976.
- Lazarus, A. In the mind's eve. New York: Rawson Associates, 1977.
- Majure, W. C. Visual literacy: The problem of externalization. And <u>Research and Theory Newsletter</u>, 1976, 5 (3), 16-17. Washington, D.C.: Association for Educational Communications and Technology, 1976. (ERIC Document Reproduction Service No. ED 136 822)
- McKim, R. H. <u>Experiences in visual thinking</u>. Monterey, Californis: Brooks/Cole, 1972.

L'ALTING ALL

- Olson, D. R. (Ed.). <u>Media and symbols:</u> The forms of expression, <u>communication</u>, and education. Chicago: The University of Chicago Press, 1974.
- Paivio, A. Mental imagery in associative learning and memory. <u>Psychological Review</u>, 1969, <u>76</u> (3), 241-263.
- Paivio, A. Imagery and verbal processes. New York: Holt, Rinehart and Winston, Inc., 1971.
- Paivio, A. Perceptual comparisons through the mind's eye. <u>Memory and</u> <u>Cognition</u>, 1975, <u>3</u> (6), 635-647.
- Patten, B. M. Visually mediated thinking: A report of the case of Albert Einstein. Journal of Learning Disabilities, 1973, 6 (7), 15-19; 420.
- Pressley, G. M. Mental imagery helps eight-year-olds remember what they read. Journal of Educational Psychology, 1976, 68 (3), 355-359.
- Quick, S. The need for recognizing and developing intuitive wisdom. <u>College Student Journal</u>, 1981, <u>15</u>, 378-383.
- Salomon, G. Interaction of media, cognition, and learning. San Francisco: Jossey-Bass Publisher, 1979.
- Salomon, G., & Cohen, A. A. The effects of TV formats on mental skills. Nashville, Tennessee: Paper presented at the Visual Literacy Conference, March 1976. (ERIC Document Reproduction Service No. ED 119 691)
- Samples, R. The metaphoric mind: A celebration of creative consciousness. Reading, Massachusetts: Addison-Wesley Publishing Company, 1976.
- Samson, R. W. Thinking skills. Stamford, Connecticut: Innovative Sciences, Inc., 1965.
- Singer, J. L. The inner world of davdreaming. New York: Harper & Row, 1966.
- Singer, J. L., & Switzer, E. <u>Mind-play</u>. London: Prentice-Hall International, 1980.
- Taylor, I. A. Perception and visual communication. In J. Ball & F. C. Byrnes (Eds.), <u>Research. principles. and practices in visual</u> <u>communication</u>. Washington, D.C.: Department of Audiovisual Instruction, 1960.
- Turbayne, C. M. The myth of metaphor (2nd ed.). Columbia, South Carolina: University of South Carolina Press, 1970.
- Watkins, M. M. <u>Waking dreams</u>. London: Gordon and Breach Science Publishers, 1976.

- Wendt, P. R. The language of pictures. In S. I. Hayakawa (Ed.), Ita <u>Use and Misuse of Language</u>. Greenwich, Connecticut: Fawcest Publications, 1962.
- Winn, W. Visual information processing: A pragmatic approach to the "imagery question." <u>Educational Communication and Technology</u> Journal, 1980, <u>28</u>, 120-133.
- Whorf, B. L. Language, thought, and reality. Cambridge, Massachusetts: The M.I.T. Press, 1956.

TITLE: The Relationship of Cognitive Style to the Frequency of Proctor/Student Interactions and Achievement in a PSI Course

30364 XOT

AUTHOR: Ronald L. Jacobs

# THE RELATIONSHIP OF COGNITIVE STYLE TO THE FREQUENCY OF PROCTOR/STUDENT INTERACTIONS AND ACHIEVEMENT IN A PSI COURSE

by

Ronald L. Jacobs, Ph.D. Assistant Professor Curriculum, Instruction and Media Southern Illinois University Carbondale, Illinois 62901

## Presented at

The Association for Educational Communications and Technology Research and Theory Division National Convention Dallas, Texas

May 5, 1982

This study investigates the relationship between cognitive style, field independence-field dependence, proctor/student interactions and achievement of undergraduate students in a Personalized System of Instruction (PSI) course (Keller, 1968). The results should help identify how cognitive style influences behavior in different instructional settings and may further reveal the importance of matching students' learning styles and instructional methods.

### Cognitive Style

Field independence-field dependence, the cognitive style examined in this study, was measured by the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin, & Karp, 1971). This test measures a persons ability to identify a simple geometric figure visually embedded in a complex design. The higher a person scores on the test, the more field independent the individual. Field independent persons are those who tend to process information with greater isolation from their environment. Thus, they have been shown to have less sensitivity to social cues and less developed interpersonal skills; they tend to process information more analytically since parts of their environment are more apparent to them. Field dependent persons (lower score on the GEFT) are those persons who tend to process information with a greater connectedness with their environment. This has been shown to foster the development of a more personal orientation and an ability to get along With others, which is used, in many instances, to help them structure their experiences (Witkin, Moore, Goodenough, & Cox, 1977). In regards to achievement, Wachtel (1968) stated that tests of field dependence can be viewed as tests of ability and cited correlations with some standardized tests and

academic ability to support this argument.

Since field dependent persons rely on external sources of information to help them structure their experience, and since the PSI setting provides an opportunity for interaction to occur which might be helpful in obtaining this information, the social behaviors of field dependent students in PSI setting can be expected to differ from those of field independents. Specifically, the question to be answered by the present day study was: Will course achievement be affected by the differing social behaviors of students?

adjoin

Group

the GE

tive s

used i

person

tion t

Barret

classi

fied a

Depend

A

and Gr

intera

in the

or obj

relate

concer

record

T

D

# Method

### Sample

Subjects of the study were 53 male undergraduates enrolled in three sections of a college course using a PSI methodology. The participants wer sophomores, juniors, and seniors majoring in either industrial teacher educ tion or industrial technology. The course is required for both academic majors.

## Instructional Methods

The course, Cybernetics, met six hours a week for 10 weeks. Most of a instructional activities involved the use of sophisticated laboratory equipment; thus, students performed most course requirements in an open laborator setting.

In the laboratory, students were free to interact with each other and provid often entered and left at will. Three proctors were stationed in the laboral tory to assist with the performance of the instructional activities, answer follow questions, and administer tests. Lectures were conducted periodically in a the in adjoining classroom.

# Procedures

3

During the first class period of the three sections of the course, the Group Embedded Figures Test (GEFT) was administered to students. Scores on the GEFT can range from zero to 18. Witkin, et al. (1971) report a normative score of 12 for males in a liberal arts college. This score has been used in numerous studies to identify field dependent and field independent persons. The participants in this study were assumed to represent a population that characteristically scores higher on tests such as the GEFT (e.g., Barrett & Thornton, 1967). Therefore, a score of 13 or below was used to classify field dependent students while those scoring above 13 were classified as field independent students.

### Dependent Variables

Achievement was measured through the use of the final grade in the course and Grade Point Average (GPA). To measure the frequency of proctor/student interactions, three categories of interactions which were assumed to occur in the PSI setting were identified: a) Specific to the course activities or objectives; b) Related to the content in some manner, but not directly related to the course activities, and, c) Unrelated to the course interactions concerned with non-academic matters.

These variables were operationalized by having proctors observe and record the interactions which students initiated with them. Proctors were Provided with a pocket-sized notebook which they carried with them during the laboratory sessions. After an interaction occurred, the proctor recorded the following information in the notebook: the name of the student, the date of the interaction, and the category of the interaction. The reliability of proctors observations was of special concern in the study. As such, proctors were trained before the course and provided opportunities to discuss special cases during the course. In addition, proctors were observed in the laboratory setting by the investigator. At the end of each observed session, the observer and the proctors compared their records. The reliability of proctors' observations was computed from these comparisons.

### Results

The results of the study were as follows:

- There was a total of 23 field dependent and 30 field independent students from the three sections of the course.
- There were no significant differences between groups of students in their final grades (<u>t</u> (52) = 1.01, <u>p</u> = .99) or GPA's (<u>t</u> (52) = 1.15, <u>p</u> = .41).
- 3. There were no significant differences between groups of students in their final grades while using GPA as a covariate, ( $\underline{F}$  (1, 50)\* .676,  $\underline{p}$  = .41).
- 4. There was significant rating agreement between the interactions recorded by the proctors and the observer, r = .94 (p $\angle$ .01).
- 5. Using the MANOVA procedure, there was a significant multivariate pratio between field dependent and field independent students and all sections were combined. The univariate <u>F</u> ratio for the Social interaction variable was significant in all sections.
- Using the discriminant analysis procedure, the number of Section interactions initiated by students was significant in discriminat between the two groups in all three sections.

The res differences the PSI cour field depend specific cour Bare were no Interactions. The resu vary in the e ritkin, et a free those pe field depender and used their aformation. theither obta stre shown to

The resul

chievement.

earning style

e one way in w

should be

Th

th

in

7.

7. The standardized discriminant function coefficient loaded in the heaviest for field dependent in all sections. The Unrelated interaction variable was significant in one of the three sections.

5

# Discussion

The results of this study indicate that there were significant differences in the social behaviors between the two groups of students within the PSI course. And, the groups did not differ in their achievement. Among field dependent students there was a significantly greater tendency to obtain specific course information through social contacts initiated with proctors. There were no significant differences in the frequency of Related or Unrelated Interactions.

The results may provide a case in point of how persons' behavior will vary in the extent to which they rely on external referents in the setting. Witkin, et al. (1977) report that field dependents tend to seek information from those persons who are seen as valid sources of information. Presumably, field dependent students viewed the proctors as valid sources of information and used their (the students') more developed social skills to obtain this information. Field independents have learned to rely on internal referents to either obtain information or to structure their experiences. Thus, they were shown to initiate fewer interactions with proctors.

The results have added meaning since students did not differ in their achievement. Therefore, within this PSI self-paced course, a wide range of "learning styles" were accomodated. This suggests that social behavior may be one way in which students adapt to various instructional settings and, thus, should be of concern to course developers and instructors.

Ē

Lic.

104

While the results are consistent across three sections, the same sizes were much smaller than recommended. Cronbach and Snow (1977) commend that in order to achieve statistical power, at least 100 subbe used per treatment. Therefore, the results reported must be view with caution. It would be fruitful and prudent to conduct additional research with larger smaple sizes.

# TITLE: How Are ITV Users Different?

404

. 303

# AUTHORS: Paul F.G. Keller Kerry A. Johnson

### HOW ARE ITV USERS DIFFERENT?

### Paul F.G. Keller, Ph.D. Kerry A. Johnson, Ph.D.

### The College of Library and Information Services University of Maryland

### College Park, MD 20742

IA paper presented before the Research and Theory Division at the Annual Convention of the Association for Educational Communications and Technology, Dallas, Texas, May 19823

### INTRODUCTION

It is ironic that Maryland, a state that was a pioneer in the use of television for instruction, never undertook a comprehensive, systematic investigation of the extent and nature of this powerful and pervasive medium's use in its schools until quite recently. That study (Johnson 3 Keller, 1981) included a mailed-questionnaire survey of 200 schools throughout the state chosen by means of a stratified random sampling algorithm with selection probability proportionate to school size. The school was regarded as the basic sampling unit, and within each school information was solicited from the principal, the library media specialist, and five randomly chosen teachers. Separate questionnaires were developed for each of these three groups using as a starting point the instruments developed by Dirr & Pedone (1979) for their national study as well a set of prototype instruments -intended for use in a future nationwide survey. Unlike the mational study, the Maryland study included a sub-population of library media specialists because the state has fairly articulated media programs integrating book and non-book materials with varying degrees of We were interested in knowing to what extent these professionals success. played a gatekeeper role in the utilization of ITV.

The Maryland study emphasized four areas of investigation: 1) Availability of programming, signal, pre-recorded materials, local production activities, and hardware.

 Conmitment to ITV use, including financing, support and advisory personnel, opportunities for in-service training, and research and evaluation projects.

 Actual use of ITV including time used, numbers of students involved, programs and series regularly viewed, and related media.

4) Attitudes toward ITV, such as perceptions of facilitating and hindering factors, potential uses of the medium, and value judgements of instructional technologies in general.

The Maryland ITV Study achieved a relative high response rate for surveys of this type 470% of teachers, 84% of principals, and 85% of Media the non-l compt by F chart who, use many

spec: the stat: inver

facto

rece; desc: incl:

The

were makir conde

sorte

teach

there

and

and

but

USC

indic

resu]

quest The subse

of s

princ

for

analy indiv indep deten This

sink\*

SUPVE

usual.

listi

analy

CONSE

exper

Varia

Inter

Samp!

specialists), allowing a reasonable degree of confidence to be placed in the data. The final project report, however, provides only descriptive statistics on the separate sub-populations. A number of finer-grained investigations of the data are in order, particularly in the area of factors which influence productive use of ITV in the classroom. What are the various attributes of ITV users which differentiate them from In a recent paper, Johnson & Keller (1982), seeking points of non-users? comparison with an analysis of the data from the national survey undertaken by Korb & Pedone (1980), viewed only data from teachers to determine the characteristics of ITV users. Teachers who regulaly used ITV were those who, among other factors, had been using it regularly in years past, would use it even more under optimum conditions, find it easy to get a set, see many positive educational outcomes from its use, enjoy a high quality of reception, have easy access to the accompanying program guides. This paper describes an exploratory study delving somewhat deeper into the data by including information from principals and library media specialists.

#### METHOD

The data from the teacher, principal, and library media specialist files were compressed by deleting some items useful only for local decision making and management information. In addition, some discrete items were condensed into arbitrary additive indexes. The individual files were then sorted on a common key and merged so that selected data from the principal and library media specialist were appended to the data record for each teacher -- in effect regarding the characteristics of a teacher's principal and media specialist as attributes of that teacher's environment. Because there were schools in which at least one teacher responded to our survey, but the principal or media specialist did not, the new file thus created was reduced somewhat in size. In addition, all records were culled which indicated that no means for receiving ITV programming were available. The resulting file contained records for 592 teachers out of the 696 teacher questionnaires originally returned.

ł

s

£

ç

5

ē

đ

£

đ

2

ð

5

1

١đ

51

13

٥ſ

<u>7</u>5

18

The amount of ITV use per week was regarded as the dependent variable in subsequent analyses. Based on simple correlation analysis and examination of scatterplots, the 10 most robust independent variables in the teacher, principal, and media specialist subsets of characteristics were retained for further examination. A series of forward-stepping multiple regression analyses was then performed on the dependent variable using first the individual subsets and then combinations of subsets based on those independent variables which appeared to yield the largest coefficients of determination and at the same time have stable regression coefficients. This cautious, probing method we believed was superior to the "kitchen sink" methods sometimes used in multiple regression analysis. Because surveys exhibit the imperfections found in the real world, there are usually missing data, and because the computational procedures do a listwise deletion of missing data, each independent variable added to the analysis serves to reduce the usable' sample size with far-reaching consequences for the reliability of the statistics obtained. On an expensive whim we did run one analysis in which virtually every independent variable was a candidate for inclusion in the regression equation. Interestingly, the resulting regression was able to account for over 98% of the variance in the amount of ITV viewed per week, but the size of the sample had been reduced to 29 cases! Needless to say, the probability of

type II error had risen astronomically.

#### RESULTS

Page

Because of the exploratory nature of the investigation and the fact that many of the variables are ordinal rather than interval scales, these results should be regarded with appropriate caution. We prefer to view them as pointers to areas within the data which must be subject to more rigorous investigation.

Viewing several facets of a teacher's attributes enhances our ability to predict that the amount of that teacher's weekly use of ITV. Based on our criterion for retaining only predictor variables that added at least 12 to the value of the coefficient of determination (R squared), data from teachers only accounted for 312 of the variance in the dependent variable, while data from principals alone accounted for 212, and data from library media specialists alone accounted for 42. Combining the best predictors is all three subsets of a teacher's attributes accounted for 35%.

Those variables are shown in their order of contribution to the proportion of variance accounted for with their associated coefficients of determination and Beta weights in Table 1.

Almost tautologically, the extent of a teacher's use of ITV is explained in large part by that teacher's disposition toward the medium, past and As indicated by the first and second predictor variables, IN present. users are those who have been using it in the past and would use it even more if conditions were right. They also tend to see a variety of positive outcomes from integrating the technology with their teaching. Matters of availability do play some part, albeit a lesser one (variable 4). The newer capabilities to provide recorded video programs to the teacher also show a small effect as seen in variable 7. It is interesting that when viewed in isolation, data from principals accounts for far more variance than data from media specialists, but when combined with information from teachers, characteristics of the principal add no new information, while media specialists' attitudes and practices do covary with teacher use of «ITV (variables 3, 6). Although experience makes a small contribution, it is in a negative direction, with less experienced teachers being slightly heavier ITV users (variable 8). Also of interest are some of the variables that did not emerge as viable predictors of ITV use. All three groups were given the opportunity to indicate whether they had had training in ITv utilization. In mone of the groups did its effect manifest itself. It is often supposed that users of one instructional media format will tend to be users of others as well. Again, these data do not bear it out.

#### CONCLUSIONS

As we stated in the previous section, our conclusions at this juncture are highly tentative, for there are several refinements to the analysis that ought to be purgued. School type was shown to have a strong relationship to ITV use in the cross-tabulated data of the Maryland ITV Study final report, with the predictable finding that elementary schools were heavier consumers than middle and junior high schols, and these in turn used more ITV than high schools. Neither does this investigation account for users vs. non-users. Finally, the present study does not take note of the subject matter with which ITV is used. These matters of scrutiny we leave to a subsequent exploration. In the meantime, we would observe that if it is desirable to increase the use of the kind of information that ITV can bring into the classroom, then the important step is to introduce teachers and prospective teachers to a few positive experiences with it. Such an approach should be geared to integration with the day-to-day business of teaching rather than focusing on ITV per se. Finally, the role of the media specialist as change agent and consciousness raiser should not be underestimated. It appears that in many instances the transition from books alone to an integrated media program has indeed been made, and that this professional can enhance the electronic classroom.

### TABLE 1 REGRESSION RESULTS WITH BETA WEIGHTS

Variable R sou		bene	Reta
	(cumulat	(cumulative)	
1	Years used ITV	.18	.24
2	Time used if optimum conditions	.26	-24
3	Appropriate amount of ITV per week (according to media specialist)	.28	.12
4	How easy to get a set	.31	14
5	Sum of outcomes seen from ITV use	.32	.15
6	Media spec. practices toward ITV	.33	02
7	How often use pre-recorded shows	.34	12
8	Sum of experience in teaching	.35	08

#### REFERENCES

Dirr, P., & Pedone, R. USES OF TELEVISION FOR INSTRUCTION 1976-77: FINAL REPORT OF THE SCHOOL ITV UTILIZATION STUDY. Washington, DC: Corporation for Public Broadcasting and National Center for Education Statistics, 1979.

Johnson, K., & Keller, P. TELEVISION AND THE CLASSROOM. Paper presented at the Annual Meeting of the American Educational Research Association, 1982.

Johnson, K., & Keller, P. TELEVISION IN THE PUBLIC SCHOOLS: FINAL REPORT OF THE MARYLAND ITV UTILIZATION STUDY. Owings Mills, MD: State Department of Education Division of Instructional Television, Maryland Center for Public Broadcasting, 1981.

Korb, R., & Pedone, R. INFLUENCES ON THE USE OF INSTRUCTIONAL TELEVISION IN THE CLASSROOM. Paper presented at the annual meeting of the American Educational Research Association, 1980.

# TITLE: Inside the Black Box: Making Design Decisions for Instruction

AUTHOR: Stephen T. Kerr

Inside the Black Box: Making Design Decisions for Instruction

Stephen T. Kerr

Associate Professor

Department of Communication, Computing, and Technology in Education

Teachers College Columbia University

Paper Presented to the Annual Conference of the Association for Educational Communications and Technology

> Dallas, Texas May 5, 1982

Inside

1

### Abstract

The literature on instructional design argues that curricula, educationst materials, and instructional strategies are best created using a "system approach." Models for the systematic design of educational programs have proliferated over the past decade. But these models are prescription and not based on research into how designers actually think when they approach a design task. Important theoretical and empirical studies from the fields of art, architecture, and artificial intelligence are summarized here as a prelude to presentation of findings from a study of design activities among a group of 26 novice instructional designers. Among other things, the study investigated: (1) the prevalence of initial generation of more than one possible design solution; (2) the basis on which candidate solutions were accepted or rejected; (3) the constraints encountered in proceeding with the design; and (4) the way in which designers knew that they were finished with the design. Results indicate that novice designers have difficulty entertaining multiple possible solutions, especially for more than a few steps into design work; that alternatives are eliminated very rapidly; that designers are not proficient in representing design problems to themselves or to others; and that the have trouble saying what a reasonable stopping point is. Suggestions for further research, and for contributions that ID might make to the ongoing research effort on human problem solving, are presented.

Inside the Black Box: Making Design Decisions for Instruction

Inside

2

What do we do when we design? The question has long been a puzzle for philosophers and psychologists concerned with aesthetics and 1 creativity. More recently, engineers, architects, and commercial designers have also become interested in how humans select elements 1 from a large universe of possibilities and combine them to form a solution that is both functional and at the same time pleasing to the senses. For such professionals, the notion of design is inextricably linked to the notion of quality; the purpose of design is not merely to select some combination of elements that contribute to a solution, but s. 18] to select a better combination, one that seems simpler, more functional, more aesthetically satisfying, more elegant.

ts

ate

citt

hey

for

ing

Those working in the field of instructional design (ID) often discuss their work in similar terms: identifying a wide range of educational strategies and materials that <u>might</u> contribute to the solution of a design problem; setting up criteria for the elimination of some elements and the selection of others; and making design decisions in light of those criteria. What is not clear is just how those choices of one medium or strategy over another, ceteris paribus, are made. What, in other words, goes on inside the "black box" of the designer's consciousness when solving an instructional problem? And would it make any difference if we knew?

My purpose in this paper will be to: (1) briefly review the models of instructional design (ID) found in present day literature and identify

some problems common to those models; (2) provide an introduction to the issue of design <u>qua</u> problem-solving activity as seen in work currently being done in art, architecture, and artificial intelligence; (3) present data from an empirical exploratory study of how novice instructional designers cope with making design decisions; and (4) speculate on the implications of the observed results (and the work being done in those other fields) for ID--what ID is, how ID workers might be better trained, and how they might better perform their roles.

Inside

3

### The Contemporary Model of Instructional Design

It is difficult to identify a single model of ID in the current literature. Each author seems to prescribe a process that has at least some distinctive elements. Nonetheless, there are a number of general features that most of these models share in common: the use of algorithm or flow diagrams as a way of suggesting the steps to be taken and the orim in which to take them when making instructional decisions; a concern for evaluation of programs while they are under development and for their subsequent revision; and, most importantly for our discussion here, an insistence that the aims of instruction be well specified, that strategies and materials be developed with those aims in mind. It is this latter point--the development or selection of instructional strategies and materials--that I want to discuss further here, for I see this as a key problem for ID.

Few would argue that the identification of which materials or strategies to use lies at the heart of ID. Even with the best of charts, tables, and decision trees, there are still likely to be many possible

answers to the question, "What instructional approach should I take?," for any given situation. And so it is at this point that the instructional designer's abilities <u>as a designer</u> are most on view.

Inside

4

The treatments of this critical point of selection in most of the standard ID sources make the procedure look deceptively easy. Witness several of these:

There now comes the point at which all events must be brought together to make up a successful lesson. The designer now considers the practicality of using all the theoretically best media.... The designer visualizes the instructional environment to determine whether so many media are used that they may create management problems in the classroom, or so few that they may produce monotony for the learners. Surely one would not wish to change media for each instructional event in the series, nor to allow attention to lag because of an overuse of one medium.

The designer considers the practical factors...as well as the nature of the learners and the nature of the lesson's objective.... In making this series of decisions, the designer aims: (1) to stay within the resources and constraints of both the media... available and the classroom environment, (2) to use a medium long enough for efficiency but to aim for interest and effectiveness, and (3) to make good use of the capabilities of the media. (Gagne & Briggs, 1979, pp. 190-191)

To apply a systematic model of media selection, we will be concerned more with first identifying essential media characteristics rather

than with a search for the 'ideal medium.' This will limit our choice considerably. Then we will proceed to eliminate from this short list any media which are impractical, unavailable, or do not conform to those optional media characteristics which we love most dearly. In this way we will progressively limit our choice more are more closely: 'selection by rejection' will be our motto. (Romiszowski, 1974, p. 65)

Inside

5

10

61

ŝ'n

ou:

asi

fie

Components of a learning system are selected on the basis of an evaluation of their capability to accomplish functions required for the mastering of learning tasks. (Banathy, 1968, p. 69)

Not all media seem to be as well adapted to a given lesson content of and [this] suggest[s] that one should match media choice to the the particular lesson content or the objectives of the lesson. The dec problem is how to do this. This has led to complex systematic act schemes for the analysis of individual learner differences, in how how they react to different media and schemes for the analysis of whe lesson content so that it can be matched to appropriate media and in Some of these schemes have proved to be rather difficult so on. are to use in practice and certainly difficult to teach to all teachers, rig so we are going to steer a middle course and try to suggest some mak basic rules which might be applied in order to: fab

 Eliminate any media which would be quite inappropriate for a given lesson or part of a lesson. We use here the

Inside

6

principle that an appropriate medium should be capable of supplying all the stimuli essential for learning....

 Select from the short list of media left, on the basis of the economic and practical constraints and teacher and

learner preferences and skills. (Romiszowski, 1981, p. 340) A recent survey of instructional design models further highlights the importance placed on strategy and media selction in most models. Of 40 models examined, some 34 were found to deal explicitly with selection of strategies, and 24 with selection of media. The only ID tasks included in this group of models with greater frequency were specification of outcomes and tryout and revision of courseware (Andrews & Goodson, 1980).

Now there is really nothing that can be said to fault the descriptions of the selection process cited above, at least insofar as they go. But the problem is that they do not go far enough. While ID algorithms and decision tables attempt to outline the realm within which the designer's actions take place, they tend not to provide a clear picture of just how the designer operates during those few crucial minutes or seconds when the heart of an instructional solution first appears. The process, in other words, is made to appear overly mechanistic. Although there are a few caveats, the process is made to appear one of filling out the right tables and identifying all the constraints, rather than one of making decisions that may ultimately be personal and based on some ineffable sense of "what's right" in a given context. (Let me note as an aside that I realize that few instructional designers or authors in the field would maintain that the entirety of the process of design is actually well represented by algorithms and flow diagrams. What I do sense from several years of teaching introductory and advanced ID courses however, is that students often have trouble grasping this from the ways ID texts present the crucial steps of media and strategy selection.)

Inside

7

What we seem to have, then, is a model of design in only a weak sense. The conditions surrounding design decisions--needs assessment, task analysis, specification of objectives, and evaluation and revision procedures--are treated in great detail. The sense of precision imparts by charts and tables may lead the novice coming to the process for the fitime to believe that the steps that ID texts prescribe to reach a design decision are sufficient, when in fact they are only necessary. After the universe of possible choices is described and then limited by awareness of all the budgetary and time constraints, all the knowledge about student and instructor background and predilections, there still may be more (and quite often many more) than one feasible approach remaining when all the heuristics provided by the model have been exhausted.

A strong-sense model of ID would offer not a precise recipe for how such decisions are to be made, for that is likely impossible given the nature of the problem. Rather, it would provide a picture of how designers as individual problem solvers approach those "black box" tasks of conceiving a universe of possible solutions, narrowing the solutions down to a manageable few, and making a final choice. Having such a strong-sense ID model available would contribute to a growing base of ke ledge about how humans work as problem solvers and creative designers; it might also make it easier to train those who will actually work as instructional designers.

Perspectives on Design as Problem Solving

Where might we turn in searching for ideas on the nature of design as a problem-solving activity? Some relevant work has recently been done in the field of education. Other studies from art, architecture, and artificial intelligence may also contribute some valuable insights.

Inside

8

Teachers as designers. There has been a recent flurry of interest around the question of how classroom teachers actually plan for instruction, think while teaching, and modify instructional decisions based on feedback received during classes. It is not my purpose here to review this research in depth, for other surveys are available (Kerr, 1981; Shavelson & Stern, 1981). But a few key points should be noted here. First, instructional activities in day-to-day teaching most often flow from an early specification of general objectives followed by more immediate generation of an image of how the classroom should operate; preparation and use of concrete objectives on a daily basis is comparatively rare. Second, an initial selection of materials or strategies is often the critical decision for how a particular class will run for a day, week or year; curriculum and objectives tend to come from materials, not the other way around. Finally, and most important for the purposes of this paper, there has been very little research on the particular tactics instructors use when they come to the point of actually designing and selecting media and teaching approaches.

Artistic design. The design of a work of art likely differs in Many ways from the creation of a sequence of instruction. Nonetheless, there do appear to be some commonalities. Artists and artisans have

Inside

9

recently begun to publish discussions of how a design develops and evolve one interesting such exploration is by Needleman (1979). And Harrison's (1978) fascinating analysis of how artists operate when they "design while making" warrants special consideration here.

Harrison notes that the artist faces a critical problem almost from the beginning: "How does the maker of the artifact recognise that his work is done, that the thing is made?" (p. 124). Since most artists do, at some point, put down brush or chisel and declare themselves finished, there must be a growing sense of purpose as a designer proceeds. That sense of purpose expresses itself in terms of a series of choices and the artist's preferences between the alternative design elements he imagines. Those preferences, however, become progressively more constrained as the design evolves and as the effects of previous choices narrow the range within which decisions can be made. The "design become complete when there is no further room for manoeuvre" (p. 137). Such an effort Harrison characterizes as "free design," in which a definitive goal is not present from the start, and in which the designer's vision is always in a sense "to the rear" toward decisions already made and preferences already incorporated in the design.

An alternative approach is what Harrison terms the "means-ends project," a design effort in which a definite goal is in view, and in which entire sequences of actions are considered separately before starting. Here, the designer's view is forward-looking, focused solely on what is to be achieved. A combination of "free" and "means-ends" design approaches yields a "closed means-ends lozenge" in which an aim

Inside

10

is known, but precisely how to achieve that aim must be worked out as one proceeds. The free form, however, "represents the most primitive system of practical intelligence in the sense that it underlies any more sophisticated thought in action" (p. 140).

Harrison's key point, then, is that "free design" is somehow a necessary precondition for any more ordered method of designing. And the ability to tell when one is finished--or at least to recognize when further elaboration would only spoil what has already been done--is a critical feature of that elementary approach to design.

Architectural design. A different view of design may be seen in recent work on how architects work. Sundor (1980) gives a useful summary of some of this work. Eastman (1973), a pioneer in this field, notes: Just because a methodology is explicit does not mean it is superior to intuition. Little is known about what makes a superior designer or a superior design process. By comparing processes and what they produce we may learn the unique capabilities of the superior designer. (pp. 21, 23)

Eastman uses an information-processing model of thinking in conjunction with recorded protocols of architects thinking out loud while designing (a method also commonly used in the teacher thinking research) to investigate intuitive design practices. In one study, architects were given a problem--to redesign a bathroom that was perceived by potential house buyers to have certain basic flaws. Several common features were observed in the ways architects attacked the problem. First, most viewed the problem as one of "designing a bathroom" rather than "correcting errors in an existing design." Second, all the architects proceeded by first selecting a design
element (e.g., position of the wash basins) and testing its qualities, rather than by first specifying an abstract set of relationships among the various possible elements. Third, in testing elements, four kinds of mental operations seemed to be involved: (a) logical manipulations, including arithmetic and verbal logic; (b) corroboration and possibly enpansion of information by gaining similar information from another source (c) manipulation of or application of a constraint to the current information to produce a new form; and (d) association of a manipulation with a constraint (e.g., location of a partition to provide visual privacy). Finally, the architects automatically sorted the design problem into two phases, one in which the major elements were treated as a "stack," or "deck of cards"--each element was manipulated by trial and error, followed by a test to see whether constraints were met---and a second phase in which smaller aesthetic touches were added (e.g., placement of towel racks).

Eastman found that the method of representation used (words vs. symbol overhead views vs. cross-sections) influenced the way in which and speed with which a solution was derived. Those designers able to see more different ways of representing the problem appeared to be more successful in less time than those who used fewer ways of viewing the problem.

A second finding was that designers who had in memory well-organized "packages" of constraints associated with particular design elements seemed to be more successful in a shorter time than those who had to rely on external aids or descriptions to generate constraints. Eastman noted, "We tend to assume that designers utilize all the information mentally

available. It can be shown, though, that designers are quite at the mercy of a fallible memory" (p. 30).

The essential points of Eastman's study of architects as designers, then, are that the initial problem-solving step is likely to be the test of a particular design element, that there is a logical order in which possible design elements are tested for fit, that the representational language used affects the rapidity and quality of the solution, and that the ability to call up readily constraints associated with particular design elements also aids in finding a solution.

Design in artificial intelligence. Herbert Simon offers a further perspective on the process of design in his <u>The sciences of the artificial</u> (1981). Although starting from a base in computer science, Simon makes it clear that he is concerned with design in general---"how to make artifacts that have desired properties" (p. 129).

Simon describes the search for a solution to a design problem as a process of maximizing the utility of "command variables" (or means), given a particular combination of constraints (ends) and "fixed parameters" (laws). The way one does this is to "consider all possible worlds that meet the constraints" (p. 136), and then identify the particular world that maximizes utility. Such a process attempts to find the best possible solution to the design problem; he terefore terms it an "optimizing" decision model.

Unfortunately, real-world conditions are usually too ill-defined, or involve too many complex variables, to allow one to find the one best solution (or to be sure one has found it when one thinks one has). In

422

#### Inside

such situations, we search for a satisfactory solution, a solution that will be acceptable and entail "only moderate search."

Inside

13

Given the large number of elements that must be taken into account in searching for a solution to a design problem, the process is rarely one of mere assembly, more often one of search for an appropriate (thous likely not a "best") combination of elements. One is not sure, especially at the start of a search, which of the many possible solutions is likely to work out, and so part of the search strategy is to collect and store information with respect to one possible solution with the idea that one may need to recall it later with respect to another possible solution. The designer must also calculate the costs of exploring various options and figure these into decisions about which possibilities to investigate further and which to discard.

A critical step in the initial part of the design cycle is figuring out how to "decompose" the entire problem into a set of related subproblems. While this may be helpful, it further adds to the complexity of the solution, for there may be many alternative ways of decomposing the problem. The way of representing the problem (verbally, mathematical diagrammatically) may also have an effect on the way in which these alternative decompositions are generated.

The design process then becomes one of "first, the generation of alternatives and, then, the testing of these alternatives against a whole array of requirements and constraints" (p. 149). Each set of alternatives may be generated by a different way of decomposing the problem, and these generate-test cycles may be nested within one another. The solution

Inside

14

copes when the designer obtains a set of alternatives that meets all the constraints, that leads to the desired ends, and that conforms to the fixed parameters of the situation. Those elements must be connected (or connectable) to one another, and they must represent a satisfactory (though probably not "the best") solution to the problem.

The particular insights that Simon's model offers are: first, that the designer usually must try for merely satisfactory, rather than optimal solutions; second, that the designer, while searching for that satisfactory solution, must take this uncertainty into account by exploring alternate paths, and by storing and reexamining information on each of these as the design is developed; and third, that decomposing the problem into a set of related sub-parts is a desirable strategy to use in seeking a solution, but that there are different ways of doing that decomposition, each of which may lead to a different set of alternatives to be tested.

What three diverse approaches to design suggest. The three approaches to design presented and discussed here stem from quite different traditions. Harrison's treatment of artistic design is focused on the development of pattern and form in an environment that is very free and constrained only by the need to define an end, a point beyond which further elaboration Would merely detract from the final product. Eastman and Simon both concentrate attention on the sequential aspects of problem solving in design and on the question of how design problems are represented internally by the designer. But Eastman's approach deals more with the manipulation of individual elements within the context of a bounded Problem, while the latter places his emphasis on choices among alternate design paths.

# A Study of Instructional Designers' Thoughts

Are the general descriptions by Harrison, Eastman, and Simon of here designers work applicable to the situations instructional designers for Can we learn anything about ID by using some of the theoretical principles they propose? In an effort to find answers to these questions, conducted a further study of how novice instructional designers approace their tasks. (For several earlier exploratory studies, see Kerr, 1961)

<u>Methodology</u>. The subjects in this study were 26 students in a graduate-level introductory course on ID. The subjects' backgrounds varied considerably--several had already worked in the field of ID for a number of years, others had been exposed informally to ID through work in publishing companies or educational broadcasting facilities, while perhaps half the group had no prior experience with ID. Most is to group had taught at some point, although levels varied from early childs through college and included such diverse settings as special education and business-industrial training.

During the first part of the course, the students were asked to decide on a design project to be elaborated as the course progressed. The instructor collected an initial statement of the topic, "candidate media," and constraints that students felt they would need to overcome: students completed this statement by the second class meeting. During the sixth class meeting, students submitted a preliminary design and the instructor interviewed each of them briefly. The interview dealt with four aspects of the initial design process: (1) the presence or absence of alternate design solutions for the problem on which the student chost

425

Inside 15 to work; (2) the method of selecting the particular solution the student chose to elaborate; (3) the constraints that the student considered or encountered (especially as compared to those identified on the statement of initial topic choice); and (4) the presence or absence of a definable end point to the design effort.<sup>1</sup> Following the interview, the investigator amplified the notes on each schedule using tape recordings of the interviews. Responses were then collated onto single coding sheets and categories developed using simple content analysis procedures. I will deal with each set of results separately below.

91

100

2

228

Thook

rith

e.

Inside

16

<u>Multiple solutions</u>. The first question asked students, "As you thought about the topic that you worked on in this project, did several possible solutions (combinations of specific objectives and media/techniques) occur to you?" Table 1 shows the responses students gave to this question.

Table 1 about here

Most of these novice instructional designers clearly did consider more than one possible approach to their topic--even among those few who indicated that they did not, two of three said that others might have done so. The interesting aspect of these responses is that relatively few of them (9), even with a prompt, were able to say much about the other alternatives they had at first considered. The preliminary choices, then, of a general approach to take, what objectives to pursue, and how to present material, appear to be made very early on, perhaps without the subject's even being aware that some initial selection and discarding

17

of options has already occurred.

Among those 9 who were able to discuss their initial mental states in more detail, only a few indicated that they had really proceeded in "systematic" fashion (in spite of repeated injunctions from the instant that they do so, a series of explicit textbook models of systematic ID procedures, and a required needs assessment!) These few differed anona themselves in how they worked. One said, "I just started listing [optiwhile another offered, "I made a chart, then cancelled the trivia and [approaches] I thought were too hard." A more-or-less visible ID strate was visible in one response: "I thought of the subject first, then [developed] measurable objectives, then [considered] media." But, of us entire class, this group was a minority.

<u>Winnowing the possible solutions</u>. The second question required students to describe how they decided which design elements to keep working on, and which to discard. The results are presented in Table 2

## Table 2 about here

The most interesting thing to emerge from these figures is the very strong weight these novice designers apparently place on their immediate working environment. They often cited their own experience (% the needs of their students as they define them (35%), failings of exist methods or approaches (27%), and constraints of the situation (19%) as critical elements in helping to eliminate possible solutions.

Relatively fewer students (35%) indicated a desire to try a particul

approach about which they knew but which they had not tried ("I wanted to use some new media"), or a need to deal with a particular subject or topic (31%). And, as with question one, only a relatively small percentage indicated that they had narrowed their focus using a careful, rational process of weighing decisions and considering the merits of the various alternatives.

<u>Constraints encountered in working on the design</u>. In this question, students were asked if they had to deal with constraints other than those identified in the initial topic statement. Table 3 summarizes these results.

#### Table 3 about here

There was a good deal of variety in the types of constraints students encountered when working on their designs. Many of these constaints had to do with the feasibility of the approach(es) chosen. Students seemed basically to be asking, "Will the financial, administrative, and social supports needed to carry out this project be available when it is eventually finished?" In several cases, the choice of project design was apparently influenced by previous failures in similar areas. A further situation-specific constraint had to do with the meaningfulness of the content or the approach to students; one designer indicated, "[I needed to] formulate in my mind what the student would be thinking of, what was going on in the student's mind." Others admitted to difficulties with subject matter or topic selection (12\$).

428

Inside

These novice designers identified a separate set of constraints in the ID process itself. Fully 35% reported problems in defining objection or specifying measurable outcomes, and some had further problems. One expressed frustration with having to "stay to safe objectives," while another wondered "how to design a project when you already know what you want to use?"

Inside

19

"When were you finished?" The last interview question was also the shortest: "How did you decide when you were finished?" The question was to say the least, an unexpected one; many of the students broke into laughter on hearing it, or made animated remarks such as, "That's a good question!" These results are shown in Table 4.

#### Table 4 about here

Clearly one of the benefits of using an ID approach is that, for many designers, it allows an end point to be more easily discerned. More than half (14, or 54%) of the students said that they knew they were done when they had dealt with each of the objectives or tasks sufficiently (Given Simon's comments about design as a satisficing strategy, perhaps the next question to ask would have been, "What was sufficient?") Another large group (42%) indicated they felt that they were not finished, but had been forced to call a halt (many used the phrase "an arbitrary stopping point") by time pressures. Some also admitted that they had simply "burned out."

An interesting detail is the distribution on this question of those

nine subjects who said in their responses to question three that they had had trouble specifying objectives. On this question, five of the nine fell into the first category ("When all objectives had been dealt with"), with only two saying they felt they had not finished. Wrestling with objectives at the start of a project does indeed seem to be a way of assuring that a definable end will be in view.

#### Implications of the Study

This study of novice designers' thinking as they confronted and worked with a systematic ID model for the first time offers some new insights into the design process. Certainly the use of an ID approach tends to steer educators more in the direction of an architectural or artificial-intelligence solution to design problems, in contrast to the looser, artistic, "free design" model described by Harrison. But just as certainly there are many differences between the model of how ID is supposed to work and the model as these educators and students apparently understand and apply it.

Speed of winnowing alternatives. First, the process of selecting a particular design alternative for further exploration and elaboration appears to happen very rapidly--likely within the first few days (or perhaps even minutes) of working on a design problem. And in many cases, the constraints of a particular instructional setting are accepted as being fixed and rigid, rather than seen as being susceptible to influence and change. While it is probably desirable to be able to call up and deal rapidly with sets of constraints attached to particular design elements (recall Eastman's argument), it is probably not desirable for the con-

430

Inside

straints of the existing situation <u>always</u> to determine the future course of action too early.

Also apropos here is Harrison's conclusion that "free design" is a necessary prerequisite to any more applied design effort, for these educators found it difficult to avoid fixing the design near the beginning of the process. The implication here is that ways need to be found to help designers maintain an open set of options for longer into the initial phases of design work.

Inside

21

ref

con

stu

min

the

sit

res

rat

and

fir

mit

fo:

20

in

to

st

th

ve

in

tł

0Ţ

St

WC.

\$1

Method of winnowing alternatives. A second important problem that arises from the results discussed above is that most designers (novices, at any rate) do not have good ways of representing the problem to themselve Both Eastman and Simon note the value of sketches, diagrams, or formulae for dealing with a design problem. But, even with the help of texts and examples, the educators studied here found it difficult to describe and characterize how they made decisions about alternative courses of action. Perhaps more attention needs to be devoted to developing new symbol systems for decomposing problems as part of ID. Flow diagrams are probably not the universal solution we have assumed them to be.

A related problem is that most of the subjects in this investigation were simply not very aware of their own ways of making decisions. In futur investigations of this sort, it might be wise to use simulations of design situations (just as many teacher-thinking researchers have used simulations of classroom teaching situations) rather than to try to capture what has happened with the sort of "stimulated recall" approach used here. A related concern is the need simply to encourage designers to be more reflexive in their actions, more aware of how they are proceeding, more conscious of their own thoughts, reactions, and decisions.

Inside

22

Assuring a broad range of alternatives. A third problem that this study illuminates is the difficulty of encouraging designers to hold in mind a broad range of possible design elements. As noted above, many of the subjects tended to stick with known approaches, tailored to a known situation, rather than try either to use a different approach or to restructure the situation. If one of the goals of ID is to encourage rational selection from as broad a range of potential approaches, strategies, and media as possible, then it behooves those working in the field to find ways to assure that many candidate solution elements are kept in mind, even those with which the designer may not feel personally comfortable. How to do this is another question--lists and charts seem not to be terribly effective. Perhaps what is called for is some sort of initial sensitizing experience in which the designer is not only exposed to but actually required to work with as broad a variety of media, strategies, and teaching situations as possible.

Seeing the end clearly. Finally, some attention needs to be paid to the question of how designers know when a design is done. In some relatively well-defined situations, this may be easy. But for many of the subjects interviewed here there was obviously not a clearly presented finish to the work. In any approach to design based on satisfactory (rather than optimal) solutions, there will be problems in figuring out what <u>is</u> satisfactory. Perhaps end-defining heuristics could be developed that would allow something to be used as a criterion other than that old stand-by, "I ran out of time."

Inside

23

The future of research on designer thinking. There are many puzzles that this study leaves unresolved. An essential question is how the thinking and design practices of experienced designers differ from those of novices. Interesting comparative studies might also be done to see if designers' thinking varies according to the type of problem representation they were trained to use, according to their strategies for testing solution elements against constraints, or according to other variables in the design process. Specific studies could investigate whether training in some of the specific techniques discussed here-for example, keeping a wide range of options open until late in the design project--would produce designers with a different (if not necessarily better) style of work from those trained by more conventional methods. Ferhaps most fascinating would be to compare the style of those designers whose work is widely recognized as being superior with that of run-of-the-mill designers.

But this study really only marks another step in the opening phase of a research effort that has goals much broader than simply examining how designers work to develop instructional programs. The intent must be to treat carefully and systematically the question of how humans act when they deal creatively with all sorts of novel situations, puzzles, and problems. This is a challenge that involves researchers from many disciplines. In addition to the fields considered here, for example, we might profitably examine how design is conceived of, taught, executed, and evaluated in such areas as commerical product design, interior design, musical composition, writing, and urban planning. The large

existing literature in the psychology of creativity and problem solving is also relevant here, and needs to be considered more closely.

In these investigations, instructional design has an advantage (though some might mistakenly see it as a disadvantage) in that it is inherently an extremely complex process encompassing a whole series of situational variables, material factors, and interaction among the various instructor and student roles. What we have to contribute is a unique set of insights into how complex designs are generated, tested, revised, and carried into practice. What we stand to gain is a reflexively conscious model for instructional design.

Inside

Inside

25

of

nt

10

#### References

Andrews, D.H., & Goodson, L.A. A comparative analysis of models of instructional design. <u>Journal of Instructional Development</u>, 1980, 3(4), 2-16.

Banathy, B.H. Instructional systems. Belmont, Calif .: Fearon, 1968.

- Eastman, C.M. On the analysis of intuitive design processes. In G.T. Moore (Ed.), <u>Emerging methods in environmental design and planning</u>. Cambridge, Mass.: MIT Press, 1973.
- Gagné, R.M., & Briggs, L.J. <u>Principles of instructional design</u>. Second edition. New York: Holt, 1979.

Harrison, A. Making and thinking. Plymouth, England: Latimer Trend, 197

Kerr, S.T. How teachers design their materials: Implications for instructional design. Instructional Science, 1981, 10, 363-378.

Needleman, C. The work of craft. New York: Knopf, 1979.

- Romiszowski, A.J. <u>The selection and use of instructional media</u>. London: Kogan Page, 1974.
- Romiszowski, A.J. <u>Designing instructional systems</u>. London: Kogan Page, 1981.

Shavelson, R.J., & Stern, P. Research on teachers' pedagogical thoughts, judgments, decisions, and behavior. <u>Review of Educational Research</u>, 1981, 51, 455-498.

- Simon, H.A. <u>The sciences of the artificial</u>. Second edition. Cambridge, Mass.: MIT Press, 1981.
- Sundor, A. Universing design solution: A generalized design process. Design Methods and Theories, 1980, 14 (3-4), 135-152.

26

## Footnote

<sup>1</sup>Copies of the form used to collect the initial topic statement and of the interview schedule are available from the author, Stephen T. Kerr, at: Box 113, Teachers College, Columbia University, New York, New York 10027 USA.

Inside

27

# Table 1

## Was There More than One Solution?

	N	Z
Yes	18	69
Yes, but one was selected early	11	42
No	3	12
No, but others might have seen one	2	8
Unsure	5	19
Evidence of winnowing	9	35

<sup>1</sup>Total of "Yes," "No," and "Unsure" is 100%.

# Table 2

On What Basis Were Candidate Solutions Selected?

	N	Z1
My own experience	10	38
Student needs	9	35
Desire to try a particular approach	9	35
Need to deal with a particular subject/topic	8	31
Failure of existing materials/approach	7	27
Through use of systematic ID process	6	23
Constraints of the situation	5	19

<sup>1</sup>Percentages total more than 100 because each response statement was coded separately.

28

# Table 3

## What Constraints Were Encountered?

	N	ž
Difficulties in specifying objectives/outcomes	9	35
Meaningfulness of approach to students	5	19
Problems with media/materials/approaches	5	19
Administrative/bureaucratic problems	3	12
Difficulties in selecting subject matter	3	12
None	3	12
Teacher/user resistance	2	8
Time constraints	2	8
Cost/resource problems	2	8
Other problems with ID procedures	2	8

<sup>1</sup>Percentages total more than 100 because each response statement was coded separately.

#### Table 4

## When Were You Finished?

	<u>N</u>	Zl	<u>N/9</u> 2
When all objectives were dealt with	14	54	5
Not finished	11	42	2
Arbitrary stopping point	5	19	2

<sup>1</sup>Percentages total more than 100 because each response statement was coded separately.

<sup>2</sup>Distribution of those 9 respondents who had trouble specifying objectives (from line 1, Table 3).

TITLE: Instructional Media, Attitude Change and Field Dependence

AUTHORS: Ms. Terryl R. Kloock Dr. Michael Simonson Stephen Cook

ţ

TITLE: Instructional Media, Attitude Change and Field Dependence

AUTHORS: Ms. Terryl R. Kloock, Media Specialist

Dr. Michael Simonson Associate Professor Iowa State University Ames, Iowa

n d

Stephen Cook, Media Specialist Fort Dodge Community Schools Fort Dodge, Iowa

A research paper presented for the Research and Theory Division at the 1982 Convention of the Association for Educational Communication and Technology, Dallas, Texas Teachers have long suspected that their students' attitudes were important in the learning process, and researchers have tried mostly in vain to prove a definite cause and effect relationship between a positive attitude toward course material and achievement in that area. Common sense would seem to indicate that if students like something they will do it well. However, the elusive relationship between attitudes and behaviors has not been clearly identified (Simonson, 1979). This relationship need not be the only reason that educators should concern themselves with shaping or changing the attitudes of their students. There are situations, especially social, when the need to change or shape an attitude is the primary goal of the learning activity.

- 1 -

According to Simonson's (1980) extensive review of research dealing with learner attitudes and media, students liked to learn from media and, all other things being equal, were more likely to experience attitude change when the media type used to deliver a persuasive message was concrete, realistic and had many visual cues for the learner. However, media professionals cited agreed that there was no "best way" to change attitudes for all students.

Researchers have recently been investigating Aptitude-Treatment-Interactions (ATI) in order to obtain a better idea of the relationship between learner characteristics and instructional treatments. Scientists investigating this area have worked under the assumption that sub-groups of learners do learn better under certain circumstances. Wager (1975) went even further by saying that learning style and media or mode of presentation may be more highly related to attitude change than to cognitive or knowledge growth.

Because realistic media have been used to change attitudes and because different groups of learners have been shown to react differently to the same stimuli, it was decided that the broad purpose of this study would be to take

.1.11

two types of media (sound film and still slides with audio-tape) and evaluate their effectiveness when being used to change the attitude of students. The inpact of these media on students with different levels of the learner characteristic field dependence was also examined.

- 2 -

## Definitions

Attitude:

SCAT:

١ť

rse

hat

rs

r

١

e٣

tions

petter

A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related (Thomas and Znaniecki, 1918). (Soil Conservation Attitude Test) Attitude-measuring instrument developed to determine attitude toward soil conservation. This measure was administered immediately after treatments.

Treatment Groups:

: (1) Multi-cue group, a 23-minute 16mm color film with sound, titled "We Are of the Soil."

(2) Moderate-cue group, a 23-minute 2x2 color slide set with audio-tape derived from the 16mm film, "We Are of the Soil."

(3) Control group, given no treatment, only the attitude measure.

field-dependent:Learner characteristic typified by learners who rely ontoexternal referents as guides in information processing,<br/>as determined by the Group Embedded Figures Test (GEFT;<br/>Witkin, 1971). For this study field dependent learners<br/>were operationally defined as those with GEFT scores<br/>from the low 40% of all subjects' scores.

Field-independent:

Learner characteristic typified by learners who rely internal referents as guides in information processing determined by GEFT. For this study, field independent learners were operationally defined as those with GEFT scores from the high 40% of all subjects' scores.

# Pilot Study

The study described here was a modified replication of a pilot study by Cook (1979) titled "Persuasive Messages With Varying Amounts of Stimuli and Their Influence on the Attitude Changes of Learners". In this study, Cook used three types of media (16mm film, slides and

audio-tape, and audio-tape alone) as treatments to test the amount of attitue change produced in high school students toward the topic of the media present tion, soil conservation. The slide presentation was produced from the 16m film. The key frame of each scene of the motion picture was copied and made into a color slide, and the audio track of the film was dubbed onto an audiatape. A team of raters evaluated both presentations and considered them to b of comparable technical quality.

Cook's study was an attempt to identify any relationship between learners grouped according to social background, IQ, pre-attitude toward soil conservation, and the media treatments. Unfortunately, no significant differences a attitude change were found between the various treatments for any of the group However, the trends of the data did support the hypothesis that film would be more effective than a slide/audiotape presentation at changing attitudes, even though the required level of statistical significance was not reached.

For this experiment, Cook's study was modified by rewriting and fieldtesting the measure of the dependent variable (SCAT), by selection of a learst

- 3 -

4.13

caracteristic more likely to be related to attitude change and media treatment mield dependence), and by the random assignment of subjects to treatments.

# Reinforcement Theory

45

9

504

ita-

9

)-

D6

rs.

10

05

ē.

eñ

181

Hovland's Reinforcement Theory, this study's theoretical basis, states that the number of incentives or cues in a message is related to the amount of attitude change produced in an audience. The greater the number of cues, the greater the possibility of attitude change. In order for attitude change to eccur, the learner first must attend to, comprehend, and accept the message. A greater number of cues present tends to increase attention, comprehension, and ecceptance. It was hypothesized that a greater number of cues in a persuasive ressage would tend to produce more attitude change (Insko, 1967).

### Media and Attitude Change

A convincing number of studies in the literature have shown that media were capable of changing people's attitudes (Simonson, 1979b). Many researchers seemed to agree that in certain situations the more realistic forms of media, or those with more cues, were more likely to produce attitude change than the less realistic media types. Both film and slide-tape were found to be effective in changing attitudes, but film, the more realistic of the two, was reported to be more effective in more instances, all other things being equal (Simonson, 1979).

## Field Dependence

Field dependence has been shown to be a pervasive, stable cognitive style that affects the perception of messages (McLeod, et al., 1978). Field dependent learners have been reported to be influenced by the environment, while

4.1.1

- 4 -

field independent learners have a greater tendency to respond to internal stimuli. Field dependent individuals are reported as being socially oriented. Field independent learners seem more able to disect ideas, while field dependent learners viewed concepts as a whole entity.

- 5 -

There seems to be some relationships between the topics of Reinforcement Theory, media type, attitude, and field dependence. Hovland's theory that the more cues there are in a message, the greater is the possibility of attention, comprehension, acceptance, and eventually attitude change, has been upheld by media research. Studies have shown that the more realistic (multi-cue) media have tended to be more effective at attitude change than media with fewer cues In particular, films and slide-tapes were found effective in changing attitude: However, film was generally more effective than slide-tape because motion pictures had more cues.

tory

rand

TABL

Leve

Fiel

Fiel

Tota

1101

nea:

att

from

Thi

dev

det

What effect media types have on learner characteristics has been studied but not sufficiently to draw general conclusions. According to Wager (1975), not enough research has been reported to determine if learning style was related to the media preferences of a learner.

## Experimental Design

Campbell and Stanley's (1963) experimental design number four, the Randomized Control-Group Posttest Only Design, was used in this study. Students were randomly assigned to treatment groups, treatments were administered, and a post-test was given. The scores of each group's post-tests were compared to determine the impact of the treatments.

Dependent variable ----- measure of subject's attitude toward soil

## conservation (SCAT)

Independent variables -- A. method of presentation:

multi-cue (film)

4.15

moderate-cue (slide with audio-tape)

control

6 -

B. learner characteristics:

1. field dependent

field independent

#### Subjects

The subjects were all college students who were enrolled in an introduccory instructional media course for teacher education students. Subjects were randomly assigned to treatments.

TABLE 1 - Assignment of Subjects

levels	Film	Slide/Tape	Control	Total
field dependent	13	12	14	39
field independent	14	13	16	43
lota l	27	25	30	82

## Measure of Attitude

No measurement instrument for the dependent variable, the need for soil conservation through minimum tillage, could be found in reference books listing attitude Teasures. Therefore, an instrument was developed to measure the students' attitudes toward soil conservation. To construct this measure, procedures from the book, <u>How to Measure Attitudes</u>, by Henerson et al. (1978) we're followed. This Likert-scale attitude measure, Soil Conservation Attitude Test (SCAT), was developed through test-piloting and item analysis. The reliability of SCAT was determined to be .85. Experts in soil conservation rated the instrument a

alid one.

## Procedure

- 7 -

To begin the experiment, a test of field dependence (GEFT) was given to the one hundred forty-eight randomly-selected students. Eighty-two subjects no scored at the high and low extremes of GEFT were then randomly assigned the of three groups--control (no treatment), multi-cue (film), and moderateslide with audio-tape). The treatments were administered, followed immediate y SCAT, this study's dependent variable. SCAT scores were then used to test ypotheses.

## Results

Table 2 shows the descriptive statistics produced from the post testing f all treatment groups using the Soil Conservation Attitude Test (SCAT). An alysis of variance test showed that the students in the film treatment had significantly more positive attitudes towards soil conservation than did certa abjects (p < .05). Slide treatment subjects reported more positive attitudes han control subjects, also, but this difference was not statistically signifiant.

A multiple analysis of variance test showed a significant treatment effect <.05). A Duncan's test was used to determine where significant difference are located. It was found that field independent subjects who watched the ersuasive film had significantly more positive attitudes towards the need for oil conservation than did any of the other five groupings of subjects.

The results of this study indicate the existence of a relationship etween media, field dependence and attitude. Field independent learners in the film treatment scored significantly higher on the measure of the dependent Levels

Field de subjects

Field in subject:

Total

TABLE 2

Conservation

т	r	e	a	tr	ne	àğ,	11	ŧ.	
٠	۰.	÷	u	-		- 1	•	۰.	

evels.	Film	Slides	Control	Total
Field dependent subjects	$\overline{X} = 64.69$ N = 13 SD = 6.76	X = 65.33 N = 12 SD = 7.39	X = 61.14 N = 14 SD = 8.47	X = 63.62 N = 39 SD = 7.64
Field independent subjects	$\overline{X} = 69.86$ N = 14 SD = 4.85	X = 65.31 N = 13 SD = 7.96	$\overline{X} = 63.69$ N = 16 SD = 7.95	$\overline{X} = 66.19$ N = 43 SD = 7.42
Total	$\overline{X} = 67.37$ N = 27 SD = 6.31	X = 65.32 N = 25 SD = 7.53	$\overline{X} = 62.50$ N = 30 SD = 8.16	X = 64.96 N = 82 SD = 7.59

ATT 102, UK, 7, 111

4.18

variable, than all other groups of subjects. In other words, the film seemed to influence the attitude of field independent subjects significantly more than subjects who viewed any of the other treatments, or the control subjects.

inde

fiel

esen!

lear

sind

and .

rend

the

2 5]

the

in f

## Discussion

In general, this study supports Hovland's Reinforcement Theory. Film treatment subjects tended to score higher on SCAT than slide-tape treatment subjects, who in turn scored higher than control subjects. Therefore, as was theorized, the multi-cue treatment (film) seemed to influence subjects' attitudes more than the moderate-cue treatment (slide-tape). Since the primary difference in the two treatment groups was the number of visual cues offered in the message, it can be hypothesized that a message presented with a greater number of cues (film) is more likely to promote attitude change than a message with a lesser number of cues (slide-tape), at least for subjects with a tendency towards field independence.

This study also supports the findings of researchers such as Simonson (1978) who found that a message delivered by a media type with more visual cues was more likely to create a positive attitude toward a subject, and Wager (1975) who used Dale's Cone of Experience (1946, page 39) to hypothesize that realistic media (media with more cues) were more apt to show a positive attitude response when a "new idea" was suggested to learners.

Not much research has been done on how learner characteristics relate to the persuadability of subjects or if there is any preference toward media type exhibited by learners of one learning style or another. This study found that overall, field independent subjects tended to have more positive attitudes after the treatments than field dependent subjects, but that this difference was not statistically significant. However, field independent subjects in the film treatment tended to have significantly more positive attitudes than field

449

- 8 -

independent learners in the slide-tape group and also more positive ones than field dependent learners in either the film or slide-tape groups.

Why field independent learners reacted more to the film than field spendent learners, and why they reacted more than other field independent learners who watched the slide/audio tape presentation is the most interesting finding of this study. Superficially, the only differences between this group and all others was the fact they participated in the film treatment, and had a tendancy to be field independent. One might conclude that in order to change the attitudes of field independent learners, a film will be more effective than a slide presentation of comparable quality, at least if soil conservation is the topic. Certainly, this conclusion warrants further scientific investigation in future studies.

8)

Ö

## References

- Campbell, D. T., and Stanley, J. C. Experimental and quasi experimental designs for research on teaching. In N. L. Gage (Ed.) <u>Handbook of</u> Research on Teaching. Chicago: Rand-McNally, 1963.
- Cook, S. B. <u>Persuasive messages with varying amounts of stimuli and their</u> <u>influence on the attitude changes of learners</u>. (Master's degree thesis, witk Iowa State University, 1979).
- Dale, Edgar. <u>Audio-visual methods in teaching</u>. New York: Dryden Press, 1946.
- Henerson, M. E., Morris, L. L., and Fitz-Gibbon, C. T. <u>How to measure</u> attitudes. Beverly Hills: Sage Publications, 1978.
- Insko, C. A. <u>Theories of attitude change</u>. New York: Appleton, Century, and Crofts, 1967.
- McLeod, D. B., McCornack, R. L., Carpenter, T. P., and Skvarcius, R. Cognitive style and mathematics learning: The interaction of field independence and instructional treatment in numeration systems. <u>Journal of Research in Mathematics Education</u>, May 1978, <u>9</u>, 163-174.
- Simonson, M. R. Designing instruction for attitudinal outcomes. <u>Journal</u> of Instructional Development, Spring 1979, <u>2</u>(3), 15-19.
- Simonson, M. R. Liking and learning go hand in hand. <u>Audio Visual</u> <u>Instruction</u>, March 1978, <u>23</u>, 18-20.
- Simonson, M. R. <u>Instructional media</u>, attitude formation and change. Paper presented at the meeting of the Association for Educational Communication and Technology, Denver, 1980.
- Simonson, M. R., Burch, G., and Thies, Pam. Media and attitudes: A bibliography part I--articles published in <u>AV Communication Review</u> (1953-1977). <u>Educational Communication and Technology Journal</u>, 1979, <u>27(3)</u>, 217-236. 451

- 10 -

Thoma

Boston: Badger Press, 1918.
Polish peasants in Europe and America.

of Dale's Cone of Experience for cognitive and affective learning. Educational Technology, July 1975, <u>15</u>, 9-13.

Witkin, H. A., Oltman, P. K., and Raskin, E. <u>Embedded figures test manual</u>. Palo Alto, California: Consulting Psychologists Press, Inc., 1971.

# TITLE: Believers, Skeptics and Dropouts AUTHOR: Constance A. Mellon

BELIEVERS, SKEPTICS AND DROPOUTS Faculty Thinking About Instructional Development

> Constance A. Mellon University of Tennessee at Chattanooga

In higher education, instructional development is most frequently defined as a service activity in which a faculty member and an instructional developer work in close cooperation to redesign an existing course or to design a new one. This activity is considered by those in the field as a method of bringing "order to chaos." In fact, the zeal which many practioners bring to development can be likened to the Biblical origins of this phrase. In the definition of these practioners, "order" (or the good) is represented by the instructional development process and chaos (or the bad) is represented by the way in which teachers approach the design of instruction. This view is clearly reflected in descriptions of instructional development which appear in the literature of the field. These descriptions fall into four categories: models, competencies, reports and heuristics.

Models and competencies represent the ideal. Models (Stamos, 1971; Iwelker, Urbach & Buck, 1972) distill from the development process the basic steps ideally followed and present them in a rational outline while competencies (Audiovisual Instruction, 1974) describe in extensive detail what an instructional developer should be able to do. Reports (Diamond, Eickmann, Kelly, Holloway, Taylor & Wilson, 1973; Educational Development Program, H.S.U., 1977) and heuristics (Haney, Lange & Barson, 1968; Holsclaw, 1974) specify the techniques which developers perceive as effective approaches to instructional development. Each of these ways of describing instructional development shares a common perspective; that of the instructional developer. Because this is so, the systematic way of designing instruction is pictured as always beneficial, always the best possible way to design a learning experience. This picture, however, is incomplete. There is a missing perspective, one which can add a dimension of reality to this prescribed Panacea for all instructional ills. The perspective needed to complete the picture is that of the client of instructional development services, the university professor.

Their objectives are really more toward making sure this thing actually happen.

-4-

Their attitudes differed sharply from those of other instructors who felt that no effort had been made to meet their need:

If you're discouraged at the implementation level, then you're discouraged period.

Perhaps the strongest contrast was presented by statements from  $t_{WO}$  instructors, both of whom were discussing their perceptions of the Center as a whole. The first was highly supportive:

I think the Center works because of the people they have in it. The ideas and the Center's task and role are sound. But there is only one thing that separates the Center from absolute tragedy --- the quality of the people they've got in it right now.

The second was intensely critical:

The whole center operation is a bust!

These contrasting statements reflect a second perspective of development, an emotional level not found in the existing literature. Published accounts of instructional development activities have focused on the business level of people doing development activities. The emotional level, however, added a new perspective. It provided a picture of how people felt about the activities in which they were engaged and this picture was, in some areas, sharply different from that presented in the literature. While all the developers writing about the development process were enthusiastic, not all instructors felt this way. Some expressed bety indifference and others were actively irritated. These reactions, which Wher occurred over and over in the data, led to the development of a typology of p of instructors, the three main categories of which were labelled Believers, defi Skeptics, and Dropouts. The names arose from actual statements of those be 1 interviewed:

They brought us through their process and now we are believers and converters.

When I look back on the process, I'm skeptical of it. I'm not sure it was that much concrete help.

This

Comp

exp(

devt

belc

a5 1

deve

but,

befc

We kept trying until we felt they had lost interest and then we just dropped out.

With the recognition of this typology of instructors as basic to data analysis in the study, two questions arose. How did those who completed the study differ from those who dropped out? How did those who believed in the value of development activities differ from those who doubted its value?

## comparison Between Dropouts and Completers

Starting with a group of university instructors, all of whom were exposed to somewhat the same initial introduction to instructional development, some completed the process while others dropped out. Dropouts appeared to be of two kinds, Early and Late. (See Figure 1 below.) Early dropouts appeared to perceive the activities of the Center as incompatible with their own values and refused to engage in any development activities. Late Dropouts engaged in development activities but, when preconceived expectations were not met, they stopped participation before their project was finished.

-5-



Figure 1

Preconceived expectations appeared to be the major difference between those who finished projects and those who did not finish them. Whereas all Late Dropouts described very specific expectations in terms of products, most Skeptics and Believers explained that they had no definite ideas of what the instructional development experience would be like. As one of the Believers explained,

> I would doubt very, very seriously if a person with strong expectations would get a great deal out of the Center --- if, for example, he went in and said, 'Well, what I need is some audio-visual assistance.'

This view was supported by the interview data of those in the Dropout category, one of whom declared,

> They gave me a little stimulation and a little support --- but not the kind of support I was expecting which was materials development. I never got that support.
## Shared Perceptions of Skeptics and Believers

Two groups completed projects: Skeptics and Believers (See Figure 2). Before examining the difference between these two groups, it might be helpful to mention four parts of the instructional development process which both Skeptics and Believers described as useful: "thinking through the course"; focusing on student needs; training for effective instruction; and facilitating implementation.

-6-



Figure 2

Both Skeptics and Believers described a process which they called "thinking through the course." This process consisted of two parts, questioning and suggesting. One respondent described it this way:

> I recall his trying to analyze what we were doing and his feeding me all kinds of questions, making a number of suggestions with no value attached to which one I might choose. And once I'd make my choice, we'd discuss what that might or might not do.

The process was described by both groups as helpful in clarifying what content was important to teach and what methods might best be used to teach it.

Skeptics and Believers both pointed out the importance of the Center's role in facilitating the implementation of the course they had designed. As one respondent termed it, "someone to support the nitty gritty logistical operation when it comes to putting these things into practice." A second respondent claimed that the instructional development process was "not just philosophical, but very tangible." He added,

> But they can deal with tangibles. They can do the printing. They can do the artwork. They can do the layout. They can do the typing. They can do

Two out were describ student focu Both groups instruction claimed, the A depai what we wan were the st described h n ŧ Both ( learning e: is educate "It w sort of on-The r a clearer being carr

al

ab ha

The designed and Belie all these things better than anybody else. It's absolutely amazing the reputation that the Center has.

Two outcomes of completing the instructional development activities were described by both Skeptics and Believers. These are an increased student focus and a greater effectiveness in the design of instruction. Both groups mentioned an increased awareness of the student for whom instruction was intended. Prior to instructional development, they claimed, they had never really focused on the needs of their students.

A department chairman told me, "Our people would way, 'This is what we want the kids to do,' rather than asking the question, 'If I were the student, how would I like to see it done'?" Another professor described his experience this way,

> In terms of articulating my content, I was now doing it in a way that I had never done it before. I was not longer doing it for the other two colleagues in my department. Instead, I was making an overt effort to address myself to my students, the profile of which I hadn't really been very self-conscious about prior to coming in contact with the Center.

Both groups described their contact with the Center as being a learning experience. "I think what they do more than anything else is educate you," said one.

"It was a very specific kind of education," said another. It was sort of on-the-job training."

The result of this experience was described primarily in terms of a clearer way of thinking about instruction. And this was described as being carried over into the design of future courses:

> I think it's just an attitude more than anything else. I have a cast of mind now, a part of my muscle fiber, to think in terms of the design of learning experiences. I'm clearer about stating the intent of each thing that I do in terms of thinking through the flow of things. And I'm constantly looking for new ways that would be better to present material. I think quite differently now. And it's a very interesting intellectual process.

The outcome of the instructional development activity, the newly designed course, was discussed with equal satisfaction by both Skeptics and Believers and the courses, when evaluated showed little difference

between the two groups on the basis of student satisfaction and state achievement. Indeed, one of the most successful courses by all evalumeasures had been designed by a Skeptic. Thus it was apparent that Skeptics and Believers shared a number of benefits as a result of the development activities. These benefits, however, appeared to be in the area discussed earlier as the "business level" of development while factors separating the two groups were clearly on the emotional level

### Differences Between Skeptics and Believers

The major theme separating Believers from Skeptics was personal involvement. This theme, while recurring throughout the interview data of all faculty in the Believer category, was noticeably absent in conversations with Skeptics. (See Figure 3.) Two other themes, need for developer and impact on content, created additional clear contrasts between these two groups.



Figure 3

Believers all expressed some kind of strong personal involvement, an experience of self-discovery, change, and growth as a result of their relationship with the instructional developer. They described development as fun and discussed a synergy, or kind of excitement, that great between themselves and their developers as the projects progressed.

One Believer expressed his feeling of growth this way:

It's a rather interesting approach that the Center uses in faculty growth. And I'm using only my own experience because I know that I have matured and grown extensively as a faculty member in terms of various areas of instructional development and of my own field and so forth. But I have never felt any push or anything of a pressure type situation. It has just happened. Yet underneath I know that the Center is there giving all kinds of support to that type of program.

A second Believer described the personal involvement she experienced in terms of counseling, the field in which she was trained:

I think the major advantage I got out of working with the Center had nothing to do with the course. It had to do with me and my potential and my capabilities and my feelings about myself. My developer, in a lot of ways, did what I do in counseling --letting me vent, letting me talk about what was going on in me, talking to some extent about what was going on in him that was similar. Just making me feel that there was a lot more available to me than in the past. I don't think that makes him any less of a developer. I think that makes him more of one. I really think that's their strength --- not developing and redesigning courses, but developing and redesigning 'people.

While all Believers who were interviewed mentioned this theme of personal involvement with their developer and the personal growth experiences that occurred as a result, none of those who expressed skepticism about development mentioned a personal relationship or personal changes.

In the area of need for a developer, the groups were clearly divided. Believers expressed their need for developers and explained that they could not have done the work on their own. "If it had been left to me," claimed one Believer, "I would never have done it --- never. That's a personality thing, no reflection on the process or the outcome. It's just what I know I cannot do."

In contrast, Skeptics said that they would have done the work anyway, that they did not really need the help of a developer. Whereas Believers discussed a continuing need for development help from the Center, Skeptics were not interested in using the services of the Center again. "Would you go back?" I asked one Skeptic.

"I don't know as I have the energy," was his response. "It took a lot out of me. And the rewards are not all that clear."

An interesting outcome of engaging in instructional development was the difference between the way Skeptics and Believers talked about content. The content of a course was, quite naturally, a major concern of faculty. An important part of academic freedom is the right to control one's own course content, to make decisions on what to include and what to omit, what to emphasize and what to change. Faculty have sued to maintain this right and have resigned when this right was denied. The preoccupation with content was reflected by Skeptics and Believers alike.

Both groups strongly expressed their feelings of ownership toward course content and explained that in their work with the Center, this content ownership was consistently respected. "My content," it was emphasized, "was not impinged upon at any point."

The contrast came in discussing the impact of instructional development activities on content. Skeptics described this impact totally in terms of form of presentation, mentioning a feeling of pressure toward how to present.

> The way the Center came on from the very first meeting was that here's the techniques we'd like you to use. I mean they said I could do it any way I wanted, but I could tell that they wanted me to do it their way.

Although Skeptics said there was pressure to present or to package their courses in some particular way, they claimed that the content did not change. In fact, one Skeptic described instructional development as a "process for structuring."

"You don't perceive that the interaction between you and the developer has made any impact on the actual thing that you teach?" one faculty member later designated as a Skeptic was asked. He replied,

> Oh no, not at all. My developer has always been ' willing for me to make the decisions about what's in the course. The Center made that very clear at the outset. We are not trying to tell you what to put in your course, but we'd like to have you package it a certain way.

Skeptics felt that change in form was unrelated to change in content, but Believers saw a definite connection between the two. As one Believer expressed it, "The form of teaching pedagogy is, in a sense, part of the subject matter. You can't separate content from form."

liter

dev

sec

dic

SUC

fac

imp

dift

impa

dep€

deve

Impl

inst

the

acce

of t

inst

leve

the |

this

insti

the e

the i

While Believers said that their participation in the instructional development process "had a definite impact on content," they did not seem to feel that this violated their right of content ownership. Nor did they mention any feelings of pressure toward specific techniques such as that described by the Skeptics. Instead, they expressed satisfaction with the relationship between form and content and with the impact of their relationship with the developer upon their content.

> This process involves a thorough study of the domain. I think when that happens, it opens your eyes to many areas you had not thought about. I know that happened in my case. I started to realize that there were some areas I just did not know about until I started looking into this and examining that and taking a survey of this topic and so on. The second part of the process allows us to work in the sky as if there were no constraints. And I think when a person does that you come up with a very creative, imaginative program. So I would say that these two aspects of process had a profound impact on content.

Personal involvement and personal growth, then were the main factors differentiating Believers from Skeptics. Need for a developer and content impact were discussed by both groups, but from varying perspectives depending on how strongly they believed in the value of the instructional development process.

## Implications of the Study

This study has proposed a typology of instructor reactions to instructional development. It has shown how faculty, confronted with the message and activities of systematic instructional development reject, accept with reservation, or come to believe wholeheartedly in the efficacy of the process. It has differentiated between the business level of instructional development reflected in the literature and the emotional level of instructional development which colors faculty perceptions of the business level. Two points arising from the information presented in this article merit discussion: the discrepancy between the picture of instructional development reported in the literature and that arising from the emotional reactions of faculty and the similarity of benefits from the instructional development process reported by Believers and Skeptics.

As has been mentioned earlier in this article, instructional development literature describes development from the perspective of the developer.

-11-

Since developers would not be involved in this activity if they were not convinced it was absolutely the best way to design instruction, the literature of the field reflects this view of the efficacy of the process. This study, on the other hand, shows that teacher thinking varied from the thinking of developers. Not all professors who engaged in instructional development activities were enthusiastic about its continued use. As one professor, a Skeptic, claimed,

Įn

80

010

edu

Thi

an o

sel

cie

,he

Se1

nor

eff

000

and

ske

Se1

35 1

Were

the

I think there's a hard sell, or a soft sell, or whatever you want to call it. Well, I'm not sure any of this is conscious. But it's the enthusiasm of the instructional technologist who obviously, professional and vocationally, is sold on what he is doing, sharing this enthusiasm --- and is it catching! But I think it is so ambiguous whether what I am doing now is any better than what I did before --- it's different, to be sure --- but whether it is, in fact, better is debatable.

While this was not a statistical study, it should be mentioned that less than half of the professors who were interviewed were Believers in the process. This indicates that, while instructional development met the needs of some professors extremely well, it was unreasonable to expect that it would meet the needs of everyone. This point needs to be clearly understood by all those involved in instructional development: developers, professors, and perhaps most importantly, administrators responsible for the funding of such programs.

A second point that needs to be considered is the similarity of benefits EXD: derived by Skeptics and Believers from their participation in the instructional Thu development process. This study showed that faculty who were Believers were and, indistinguishable from Skeptics in their descriptions of instructional developcou ment. The descriptions were similar in terms of activities and, in most instances, in terms of the effectiveness of the outcomes. While Skeptics deve expressed some feelings of doubt about the outcomes of development, they fact generally described the courses they developed as successful. However. For when they discussed how they felt about the development process, the not difference was clear. Some faculty expressed skepticism while others had deve. become intensely involved and committed. WEITE

An interesting implication of these findings is that belief is not necessary for project effectiveness. The faculty member who served as content person for one of the most visibly successful projects of the Center was a Skeptic. Belief, therefore, does not appear to be related to project effectiveness. Project effectiveness was defined by the Center in terms of faculty and student satisfaction with the course and, in comparison with the old course, increased enrollment and equal or better student achievement. All of these elements were, to some extent, observed in the projects of faculty who were Skeptics as well as faculty who were Believers.

-13-

Furthermore, the instructional development process as an inservice education activity, was equally effective for both Skeptics and Believers. This educational aspect of engaging in instructional development is another of the claims of its benefits made by proponents. Skeptics as well as Believers described an increased awareness of the student and a clearer way of thinking about instruction. These development activities, when viewed as inservice education, do not depend upon the instructor's belief in the need to work through the process with a Center developer nor in their desire to engage in further activities with the Center. Thus effectiveness of this aspect of instructional development does not depend upon generating belief in the faculty/client.

If belief is not necessarily a component of project effectiveness, and if personal involvement is the major factor separating belief from skepticism, then a difference between the needs of Skeptics and those of Believers emerges. This difference might be seen as educational <u>consulting</u> as opposed to educational <u>counseling</u>. Some faculty may need only a brief exposure to facts while others may require a more in-depth experience. Thus the project producing a Skeptic who feels that what has been produced and/or what has been learned is of value and the project producing a Believer could be viewed as equally effective.

Teacher thinking about the values of, and uses for, instructional development as depicted in this study argue strongly for the need to treat faculty as individuals in our approach to their instructional problems. For example, the Late Dropout category of this study showed that faculty who do not complete projects are not necessarily opposed to the idea of instructional development. The Late Dropout group had specific product expectations that were not met and, when interviewed, they still wanted these products and were frustrated because they could not have them. This argues strongly for the existence and support of a product-oriented division within a more

-166

process-oriented center. Had product-oriented development been a recognized and accepted part of the instructional development activities of the Center in this study, perhaps those faculty with strong product expectations would not have become Dropouts. And, as was pointed out earlier, some faculty may need long-term involvement incorporating aspects of personal counseling while others may require only a single experience in course redesign as in-service training in the systematic approach to the development of instruction.

By a study of clients' perceptions of instructional development, it becomes clear that professors are individuals, each approaching the design of instruction in the way most comfortable to him or her. Instructional developers who, in their work with university faculty, emphasize so strongly the individual learning styles of students must respect the individual teaching styles of faculty. This includes their approach to the design of instruction. Instructional development models, it must be remembered, are idealized versions of how the process should proceed. While these models usually incorporate the development philosophy of the center which uses then, they rarely consider the individual differences among the instructor/clients to whom they are applied. Examining these differences through a study of teacher thinking about instructional development may add a more realistic dimension to the development philosophy of institutions with instructional development services and a broader and more useable definition of a successidevelopment project.

#### References

Audiovisual Instruction, 1974, 19(9), whole issue.

Blumer, H. Symbolic interactionism: Perspective and method. Englewood Cliffs, N.J.: Prentice Hall, 1969.

Cooley, C.H. Human nature and the social order. New York: Scribner, 1902.

Diamond, R.M. Eickmann, P.E., Kelly, E., Holloway, R.E., Taylor, E. & Wilson, T.R. <u>Syracuse University's Center for Instructional Development:</u> <u>It's role, organization and procedures</u>. Syracuse, N.Y.: Syracuse University Printing Services, 1973.

- Educational Development Program, Michigan State University. Educational <u>development at Michigan State University</u>. East Lansing, Mich.: <u>Michigan State University</u>, 1977.
- Glaser, B. & Strauss, A. The discovery of grounded theory: Strategies for gualitative research. Chicago: Aldine, 1967.
- Haney, J.B., Lange, P.C. & Barson, J. The heuristic dimensions of instructional development. <u>A V Communications Review</u>, 1968, <u>16</u>, 358-371.
- Molsclaw, J.E. The development of procedural guidelines for the systematic design of instruction within higher education (Doctoral dissertation, University of Southern California, 1974). <u>Dissertation Abstracts</u> International, 1970, 35, 1873-A. (University Microfilms No. 74-21,479).
- KCall, G. & Simmons, J.L. (Eds.) Issues in participant observation. Reading, Pa.: Addison-Wesley, 1969.
- Kead, G.H. Mind, self and society. Chicago: University of Chicago Press, 1934.
- Aichardson, S.A. Dohrenwend, B.S. & Klein, D. Interviewing: Its forms and functions. New York: Basic Books, 1965.
- Stamos, S. <u>A descriptive study of a synthesized instructional development</u> model, reporting its instructional effectiveness, efficiency, and the cognitive and affective influence of the development process on a client. Unpublished doctoral dissertation, Michigan State University, 1971.

# TITLE: A Model for Critical Dialogue: A Study for Enhancing Student Response to Visuals

# AUTHORS: Robert Muffoletto Ann DeVaney Becker

A MODEL FOR CRITICAL DIALOGUE: A Study For Enhancing student Response to Visuals

By: Robert Muffoletto and University of Wisconsin Ann De Vaney Becker Associate Prof. Ed. Technology, Univ. Wis.

## ABSTRACT:

Twenty three high school age students were selected for a week intense photography workshop as part of the New York 51% State Summer School for the Arts. The students were studied for conceptual shifts and attitiude modification toward the medium. Students participated in Stewart's model for critical dialogue, photographic projects encouraging individualistic response and Pre and post surveys were administred to and exploration. determine changes in attitude and judgmental processes. Reaction to the photographs of Diane Arbus were noted to determine conceptual shifts. The results of the study revealed deviations in the students judgmental criteria (process for defining good and bad photographs) and in thinking about the photographic medium. The study suggests that more research in the area of critical processes and conceptual development is The study also makes suggestions for a pedagogy of needed. media.

PROBLEM

Many educational practices in instructional technology and media rely, upon conventualized standards for the judgment of Work. When this occurs the individual's freedom to explore and

4'70

to respond to internal and external stimuli, in an independ nature, is restricted. Using media to teach reading, impromath skills or provide experiences for a creative writing cla is a limited and bounded conception of media within to educational technology paradigm.

Defining how a medium is to be used within an education context creates the medium itself. This is demonstrated throug the development of educational films and television, and computers. The language used to create the technology not one defines it, but it establishes our relationship to it, and it to us. The resistance to educational television was not to to content of the programs, but to the definition of the technology as being a replacement for teachers, being more effective in selected environments than teachers, and being teacher safe.

Attitudes, beliefs and values about media are similarly defined by the language which surrounds them. What establishes "good" or a "bad" photograph is closely aligned with a belief structure about what a photograph should look like, what its function is, and what its relationship is to other photograp<sup>th</sup> and pictures. Seldom is the literature of educational technology concerned with the issues of an image's signifiance and the individual's relationship to the image created or examined. If media education is included within the educational technology paradigm then attitudes toward media within an educational context, must be reconsidered. in i

м

C (

d

Ac

Ar

Ci

11

b;

P(

34

2

# PURPOSE DE STUDY

The purpose of this study was to explore the effectiveness of a pedagogic strategy which involved the development of descriptive tactics and individual exploration into the meanings and significance of photographic images. It was hoped that the study would begin to reveal methods which enhanced student responses toward photographs, their production, function and value in educational and culutral settings.

### METHODOLOGY

Traditionally the teaching of photography at the secondary level has expressed two concerns: The first concerns is the teaching of career or professional skills, which addresses the medium of photography in terms of a product-market relationship. Most photography at this level stresses the reproduction of a The second concern is for commercialized product. the development of technical skills, that is making a good print. Again, the reproductive attitude is aspired to. Emulation of Ansel Adams, Eastmen Kodak, the regional photography club, and the community professional are part of the high school student's introduction to photography. This is an introduction that affects his/her attitudes and understanding of the medium and its Political and economic signifiance.

In an effort to form a broader concept of media, in all of its symbolic forms, this study employed the Stewart Model for

2

Critical Diaglogue and selected divergent photographic assignments. Pre and post tests were employed to notate shifts attitude and conceptual levels. The photographic work of Dise Arbus was presented to determine conceptual links to the critical model provided.

# STEWART'S MODEL FOR CRITICAL DIALOGUE

The model provided by Doug Stewart (Stewart, 1976) is nonjudgemental and categorical. His model calls for the elimination of all judgmental terms and the creation of an open and risk free environment for the discussion of images. The model provides three categories for response; judgmental, formal or visual, se poetic. In this study we added a fourth: political. After discussing each variable and its parameters with the students the judgemental category was eliminated. Discussions of all assignments were in keeping with Stewart's Model.

### ASSIGNMENTS

Assignments ambiguous in nature, were given with minimi definition of expectations. They included self-portraits, social statement, significant form, dreams and illusions, and "three feet or less". After finishing each project of approximately 8-15 prints, the students formed triads to discuss their work. After that, all work was displayed and discussed within the categories of Stewart's model. Students were

4

negatively answered by their peers when they incorporated judgmental terminology.

## Diane Arbus

The work of Diane Arbus (Arbus, 1972) was presented once each week for six weeks with no discussion allowed about the work. After the post-survey on Arbus's work a full morning discussion was held. The objective behind this method was to determine if Stewart's model for critical dialogue, the class assignments and discussions affected the student's conceptual framework and level of cognition employed to give meaning to Arbus's work.

# STUDENTS

Twenty-three students for the program were selected by the following criteria: 1) race; 2) age (giving preference to seniors); 3) gender; 4) photographic ability. Sixteen of the students ranged between 17 and 18 years of age; 6 were from urban areas, 12 from suburban, and 5 from rural areas. Eleven students had one year of photographic instruction, with one having more than five years. Seventeen students said they only received instruction in a school setting, five were self-taught, and one attended classes at a community center. Fifteen students saw their involvement with photography as both artistic and career centered. Seven considered it only as an art form, and one to the program with a wide range of interest and abilities. Each

5

brought an understanding and expectation of the workshop the medium.

#### INSTRUMENTS

A survey was designed to gather background information to assess current practices and attitudes toward the medium. surveying attitudes an open format was followed. Data obtained through the selection of language to answer quest. Categories were then created from the student responses, comparisions made.

# DATE ANALYSIS

In the analysis of the data, movements and shifts a attitudes and rational were looked-for. Comparisions were an between pre and post-survey data. We observed the follo-us through the collected data, that:

o akin

- There was a movement toward a concern for meaningful photographs.
- Student rationale for making photographs evinced a shift toward communications and away from creativity.
- 3. Student discussion of the meaning of photographs demonstrated movement away from reflection and creativity as a major focus to more defused responses which included careers and individual perception.

6

- When students addressed the importance of the medium they evinced a movement toward photography as a form of expression.
- 5. In defining what is a good photograph the pre and post-survey showed no differences. The primary reason given was for its message/meaning capablities.
- 6. Students definition of a bad photograph shifted from reasons of commonality/non-creativity to a rationale of no definition.

## ABBUS SURVEY RESULTS

2

52

12

10

ada

104

175

5

The Diane Arbus photographs were shown once each week for six weeks, with no discussion before or after each showing. The presurvey was administered immediately after the first showing. The survey was administered immediately after the sixth and final showing. Categories were formed from the student's replies to the survey. Again a number of interesting perceptual shifts occured. The students, in discussing their responses to Arbus's work demonstrated a movement away from emotional and contextual referents. In the pre-survey there was a marked tendency to discuss individual photographs. The post-survey disclosed a move toward the relationship between images. In discussing the major Idea of the work students responded to pre-survey questions by demonstrating an avoidance of the question, whereas on the post-Survey they offered a range of responses. The reference to the Prganizational structure was of critical nature. The responses to this last question on the meaning of Arbus's work, the

7

4'76

student's responses suggested a conceptual shift in rationalizing of Arbus's work.

## DISCUSSION

The results of the study revealed a number of interestic considerations for teachers of media. The study suggested the by structuring the psychological learning environment conceptual shifts can occur. It also suggested that conceptualization one activity could be crossed over to another activity while becomes an important consideration for educators when using media in their curriculum. The study also suggested that the development of a critical dialogue model for students may enhance verbal responses to photographs. The study also suggests the more study in this area is needed.

# REFERENCE

Arbus, Diane Diane Arbus, Milerton: Aperture, 1972

Stewert, D. This material was presented at workshops given at the northeast regional conference for the Society for Photographic Education, 1976.

8

TITLE: Eye Movement As An Index of Learning

AUTHOR: Larry L. Nesbit

#### Eye Movement As An Index Of Learning

Within the past few years eye movement indicies, i.e., the number of fixations and their average duration, have been used as a measure of cognitive processing. Loftus (1972) found that the number of fixations made by a subject while initially viewing a picture was the best indicator of subsequent picture recognition. Gould's (1973) research indicates that the fixation duration is reflective of cognitive processes while viewing stimuli of varying complexity. Perhaps Wolf (1970) most succinctly states the case of using eye movements as an index of learning:

Eye movements present an unusual opportunity for finding out the reactions of viewers to a visual stimulus. They give information on where the subject is looking, how long he looks at particular objects and the type of movements he makes...This reaction is different from giving the subject a printed test or asking him in an interview what he has learned from the stimulus. (p. 13)

According to earlier research, there are two factors that may influence the looking behavior of subjects: the stimulus materials themselves and the intelligence level of the viewer. The areas that have received the most attention from researchers are those of complexity and novelty. Faw and Nunnally (1967, 1968), Mackworth and Morandi (1967), Hochberg and Brooks (1978), and Zusne and Michels (1964) found that the more complex stimulus drew more eye fixations than the simpler stimulus materials. However, Wolf (1970) qualified the complexity issue because he found that the more sophisticated stimulus materials attract more eye fixations, but only up to a point. When the stimulus becomes extremely complex, the subject may tend to avoid the stimuli or to fixate centrally.

Just as the complexity issue is clouded with contradictory findings, so are the results of picture recall tests. It was mentioned earlier that Loftus (1972) found that recall is positively related to the number of times a subject fixated a picture. Tversky (1974), however, found different results. In her study, subjects who fixated the stimulus material fewer times had the highest recall on later memory tasks. The two studies did differ in the type of stimulus materials employed: Loftus used photographs and Tversky used simple line drawings.

According to some previous research, it is the viewers' intelligence levels -- not the stimulus materials -- which influence how viewers look at the stimulus material. Anderson (1937), Guba, Wolf, deGroot, Knemeyer, Van Atta, and Light (1964), and Wolf (1970) have all completed research in which a correlation between eye fixations and intelligence was evidenced. It should be emphasized, however, that some of these studies had confounding problems.

The following hypotheses were explored in this study:

\* Subjects who have a greater number of eye fixations will have higher scores on the posttest than students who have fewer fixations. Subjec drawin either repres

Subjec

The e: treatment ; of the gro subjects ( Harford, M Aberdeen P is located were all e is where t

The t and the me of the tre or realis slides, t posttest. the same

As a ing Labor an advanc novements of the oc by Mont:

Four the data of the t on the posttest between was used posttest r's were slides t and they respect:

To of visu of vari not sig of the

signifi

Fi Was use Subjects who view the stimulus materials composed of shaded line drawings will have more eye fixations than subjects who view either the simple line drawings or the realistic photographic representations.

Subjects who are in varying categories of intelligence will have different numbers of eye fixations.

The experimental design of the study was the posttest only controltreatment groups but the subjects were not randomly assigned to either of the groups because of geographical limitations. The treatment subjects (N = 46) were students enrolled at Harford Community College, Harford, MD which is in close proximity to the Human Engineering Laboratory, Aberdeen Proving Ground, MD where the advanced, unobtrusive oculometer is located which was utilized in the study. The control subjects were all enrolled at Mansfield State College, Mansfield, PA and this is where the investigator is employed.

The treatment subjects were administered the physiology pretest and the mental ability test before they were individually shown one of the treatment conditions, i.e., simple line drawings, shaded drawings, or realistic photographs. Immediately after viewing the treatment slides, the subject was taken to another room and administered the posttest. All tests were administered to the control subjects in the same sequence as the treatment subjects.

As alluded to earlier, the study was conducted at the Human Engineering Laboratory, Aberdeen Proving Ground, Maryland because they maintain an advanced oculometer which has the capability of tracking the eye movements of a subject unobtrusively. For a more complete description of the oculometer, the reader is referred to an article published by Monty (1975).

Four statistical tests were utilized in the study to analyze the data. A t test was used to compare the pretest and posttest scores of the treatment and control subjects and there was no difference on the pretest, i.e., t (89) = 1.64, p = .104, but there was on the posttest, i.e., t (68) = -12.7, p = .001. To test for any relationship between eye fixations and posttest scores, the Product Moment Coefficient was used. The overall relationship between eye fixations and the posttest score was r = .2467, p = .049. Three additional Pearson r's were computed for each sequence of 13 slides of the total of 39 slides to determine if the relationship varied during the treatment and they are .1834, p = .111; .1948, p = .097; and .3040, p = .020respectively.

To determine if eye fixations are influenced by either the type of visuals viewed or the intelligence of the viewer, two-way analysis of variance was employed. The effect of the type of treatment was not significant, F (2,57) = 1.73, p = .192, but the intelligence level of the subject did influence the average number of fixations and was significant, F (2,37) = 3.89, p = .029.

Finally, two-way analysis of variance with repeated measures Was used to determine if fluctuations in the eye fixation data could

skew the data. Again, it was found that the treatment was not significant F (2,37) = 1.73, p = .191, but intelligence level was significant F (2,37) = 3.88, p = .030. In addition, the mean number of fixations did vary throughout the treatment, F (2,74) = 58.74, p = .001, but neither the interaction of treatment type and slide group, F (4,74) = .68, p = .610, or intelligence level and slide group, F (4,74) = .41, p = .799, were significant using the repeated measures test.

#### Conclusion

The present study supports previous findings that: (1) there is a relationship between the number of eye fixations and internal cognitive activity, (2) novelty is an important factor in viewing visuals, and (3) the intelligence level of the subject influences the number of eye fixations. The study did not give evidence that the level of picture complexity will influence the number of eye fixations.

#### Discussion

The present study was designed to determine if a relationship exists between cognitive activity, i.e., posttest scores and the number of fixations. Past research has indicted that there is a positive correlation between learning and the number of eye fixations. The present study confirmed this relationship using an unobtrusive eye movement measuring system.

The second objective of the study was to determine if eye movement is a stimulus or a personalogical variable. The present study did provide evidence that it is personalogical: Subjects in the highest category of intelligence had a significantly higher number of fixations than did subjects in the lowest category of intelligence. This finding supports previous research.

The investigator did not find a relationship between the type of visuals viewed and eye movements. This result is similar to Barron's (1980) work because neither study found any evidence that the stimulus materials influenced eye movements. It should be noted, however, that the findings of the present study were both internally consistent and supportive of the research of Loftus (1972, 1976), i.e., no difference in eye movements should be expected because there was no significant difference in learning. Thus, additional research needs to be completed in order to learn whether, and how, different types of visuals influence eye movement. For instance, Fleming (1978) has listed many perception principles which were based on previous research, but not on eye movement studies. It would be interesting to construct visuals which incorporate the principles outlined by Fleming to determine if eye movement research will support the previously reported findings. Since eye movement indices are more item specific than other summary measures such as posttests, the results of the proposed research may enable researchers to refine the principles presented by Fleming through the use of current technology such as the HEL Oculometer. This latter type of information, if available, would be instrumental in providing guidance in the design, development, and use of visual materials in the learning process because researchers (Baron, 1980; Rayner, 1978; Wolf, 1970; Yarbus, 1967) have concluded eye movements are an objective measure of cognitive activity

#### References

- Anderson, I. Studies in the eye movements of good and poor readers. Psychological Monographs, 1937, 48, 1-35.
- Baron, L. Interaction between television and child-related characteristics as demonstrated by eye movement research. <u>Educational</u> <u>Communication</u> and <u>Technology Journal</u>, 1980, <u>28</u>, 267-281.
- Faw, T. & Nunnally, J. The effects on eye movements of complexity, novelty, and affective tone. <u>Perception and Psychophysics</u>, 1967, 2, 263-267.
- Faw, T. & Nunnally, J. The influence of stimulus complexity, novelty, and affective value on children's visual fixation. <u>Journal of Experi-</u> mental <u>Child Psychology</u>, 1968, <u>6</u>, 141-153.
- Fleming, M., & Levi, W. Instructional messages design: principles from the behavioral sciences. Englewood Cliffs, N.J.: Educational Technology Publications, 1978.
- Gould, J. Eye movement during visual search and memory search. Journal of Experimental Psychology, 1973, 98, 184-195.
- Guba, E., Wolf, W., deGroot, S., Knemeyer, M., Van Atta, R., Light, L. Eye movements and TV viewing in children. <u>Audiovisual Communication</u> Review, 1964, 12, 386-401.
- Hochberg, J., & Brooks, V. Film cutting and visual momentum. In J. Senders, D. Fisher, & R. Monty (Eds.), Eye movements and the higher psychological functions. New York: Erlbaum, 1978.
- Loftus, G. Eye fixations and recognition memory for pictures. <u>Cognitive</u> Psychology, 1972, 3, 525-555.
- Loftus, G. A framework for a theory of picture recognition. In R. Monty & J. Senders (Eds.), Eye movements and psychological processes. New York: Erlbaum, 1976.
- Mackworth, N., & Morandi, A. The gaze selects information details within pictures. Perception and Psychophysics, 1967, 2, 547-551.
- Monty, R. Advanced eye movement measuring and recording systems. American Psychologist, 1975, 30, 331-335.
- Rayner, K. Eye movements in reading and information processing. <u>Psycho-</u> logical Bulletin, 1978, 85, 618-660.
- Tversky, B. Eye fixations in prediction of recognition and recall. Memory & Cognition, 1974, 2, 275-278.
- Wolf, W. <u>A study of eye movement in televison viewing</u>, <u>Final report</u>. Columbus: Ohio State University, 1970. (ERIC Reproduction Service No. ED 046 254)

Yarbus, A. Eye movements and vision. New York: Plenum Press, 1967.

Zusne, L., & Michels, K. Nonrepresentational shapes and eye movements. Perceptual and Motor Skills, 1964, 18, 11-20. TITLE: The State of the Art in Rate-Modified Speech A Review of Contemporary Research

AUTHORS: Janet S. Olson Louis H. Berry

#### THE STATE OF THE ART IN RATE-MODIFIED SPEECH:

A REVIEW OF CONTEMPORARY RESEARCH

Janet S. Olson Speech and Language Clinician Allegheny Intermediate Unit Pittsburgh, Pennsylvania 15212

Louis H. Berry Assistant Professor of Education Program in Educational Communications and Technology University of Pittsburgh Pittsburgh, Pennsylvania 15260

A paper presented at the national convention Association for Educational Communications and Technology Research and Theory Division Dallas, Texas May 1982

#### INTRODUCTION

In an everchanging society with an increasing rapid pace, it becomes more important for an individual to acquire knowledge and information in the most efficient and expedient manner. This imperative is compounded by the fact that individuals learn at different rates. Since time spent in instruction is an important factor in maximizing instructional efficiency, technology has provided a means of altering recorded speech so that instructor or student may adjust the rate of spoken presentation to suit his needs. This technique has been generally referred to as rate controlled speech or "Compressed Speech," Silverstone (1974) described this method of rate control as the "...reproduction of an original recording in which the word-per-minute ratio is changed to a slower or faster rate of speech without eliminating the pitch or natural quality of the voice." In an earlier publication, Silverstone (1972) describes this technique as the process by which consonant sounds are maintained as the original production, vowel sounds are reduced and pauses are eliminated as often as possible.

#### HISTORICAL DEVELOPMENT

The historical development of rate-modified or compressed speech goes back over 40 years. Early research attempted to isolate a means of increasing the amount of information that could be communicated over a limited period of time. The advent of modern electronic recording technoley made a means of effectively compressing speech a reality. The earliest interest and research in speech compression began, however, linguistically father than technologically.

#### Change in Speaking Rate

Initially, the most efficient and feasible method of changing the rate of speech was to have the speaker produce the words more rapidly so that the faster speech could be recorded. This method had the advantage of being very simple and required no special equipment or conditions. The increase in speaking rate, however, was limited because the voice inflection, intensity and articulation were affected when the speech rate became too fast. (Foulke and Sticht, 1969)

2

Studies were conducted that examined the effectiveness of speaking rate. One study done by Goldstein (1940) summarized many findings which included:

- Listening comprehension was found to be superior to reading comprehension.
- b. The easier the material becomes, the greater the listening comprehension.
- c. Listening comprehension is less variable than reading comprehension.
- d. Comprehension in reading and listening both decline when the rate is increased.
- e. The decline of comprehension continues as the rate increases.

A study by Nelson .(1948) estimated a speaking range of 125 to 250 words per minute and found no significant difference between the two rates. It was found though, that the subjects preferred a rate of 175 words per minute to be the most acceptable rate.

# Simplification of Text

Alterations in the text offered an easy and accessible way to change the rate of spoken material. By making minor changes in the text, one was able to read them faster and with greater enunciation. The use of shorter words and a vocabulary that was simplified, enabled the reader to proceed to greater speed. Grammatical structure in a less complex form was also

found to be of importance when considering speed (Duker, 1974). In presentations varying from 175 to 375 words per minute, passages containing a simplified version of grammatical structure were found to be understood more easily than more difficult versions (Reid, 1968).

this

lanj

Gar

reci

tog

dis

Jae

cut

sel

8.80

pre

was

was

3

# Speed Changing Method

Changes in word rate were also achieved by simply changing the speed at which the recorded material was played back. By using a slower playback speed, the word rate is slowed down. Similarly, by using a faster playback speed, the word rate is speeded up. Thus, the recorded speech can be expanded or compressed respectively. A change in pitch of one octave occurs, however, when the speed of the playback is double that of the recorded speed (Foulke and Sticht, 1969).

The use of this method dates back to 1919 when phonograph records were speeded up for listening experiments. Since then, it has been found that speeded up material could be dealt with in this manner as long as the material was simple enough in context (Klumpp and Webster, 1961).

These early attempts to alter speech rate enabled rudimentary research (Mi to be carried out, but also presented basic problems in that the degree of the distortion interfered with messages. With more complex technological advances in the ensuing years, more complete and reliable experiments were cor conducted on compressed speech.

#### Sampling Method

A method of sampling speech by a switcher that intermittently sampled pr segments of a recorded tape was demonstrated by Miller and Licklider (1950). In With this technique, it was found that up to 50% of speech could be eliminated before intelligibility dropped below 90%. These findings held true as long so as the sampling was done at a frequency of at least 10 times per second. The By demonstrating that a considerable amount of speech can be eliminated, re

this study confirmed the contention of Shannon and Weaver (1949) that language is highly redundant.

Building upon the concept of discarding a portion of the speech signal, Garvey (1953) described a method of "cut and splice." Periodic portions of recorded tape were manually cut out and the remaining portions were spliced together. This technique allowed speech to be compressed without voice distortion but was too time consuming to be practical.

The electromechanical method presented by Fairbanks, Everitt and Jaeger (1954) sampled speech mechanically without the need for manually cutting and splicing tape. This sampling technique was periodic and unselective. Expanded speech could also be achieved by repeating speech samples. A study by Foulke (1966 a) comparing the sampling method and the previously used speeded method, found that intelligibility of the message was superior when the sampling method was used. Comprehension, however, was not significantly increased.

Two widely cited research efforts, (Diehl, White and Burk, 1959) and (Miron and Brown, 1968) examined the compression of speech by altering only the pauses that occur between words. These pauses were shortened or eliminated altogether by either manual adjustment or by use of a computer. In comparing rates of 126 to 175 wpm, no significant differences in comprehension were reported.

Speech compression achieved by a computer allowed more analytical and precise sampling to be done. However, the cost of this kind of sampling limited its use at the time of its introduction (Scott, 1967).

More recently, two techniques have been developed that provide a more sophisticated and technical means of speech compression. The speech synthesizer can produce speech at any given rate and according to the signal redundancy (Campanella, 1967). The Harmonic Compressor shortens the speech

488

signal in half by dividing the signal into frequency bands and then reduces them (Foulke, 1968a). This level of technology has provided a means of more analytical and complex research into compressed speech as well as a finished product that is more effective in terms of intelligibility.

#### REVIEW OF THE RESEARCH

The research conducted on compressed speech in the late 1950's and the 1960's was considerable. A complete review of the literature would go far beyond the length of this paper and has been previously compiled by Duker (1974). The following is an overview which highlights the major contributors and the important issues and findings.

Research studies have examined a wide variety of treatments and variables the findings of which basically fall into four main categories: (1) comprehension and intelligibility, (2) trainability, (3) retention and (4) applications of compressed speech to various instructional situations.

# Comprehension and Intelligibility

Foulke (1968<sup>a</sup>), in a paper presented at the Perception of Language Conference at the University of Pittsburgh, identified two indices for the evaluation of compressed speech: comprehension and intelligibility. These two variables have been investigated extensively in the study of the effectiveness of compressed speech. Comprehension of compressed speech is the ability to extract knowledge and information from a given text that has been accelerated. Objective tests have usually been given to measure the amount of information which has been attained.

Intelligibility refers to the extent that one is able to repeat inform ation which was presented or to discriminate what one has heard. Tests of intelligibility usually require the subject to repeat given words or to choose a word from a selection based on their perception of the speeded text.

489

Tests of comprehension involve two or more groups that listen to a test

which has been compressed to various degrees and then complete a multiple choice test on the material presented. Comprehension studies have investigated variables related to speeded playback, various sampling methods and word rates ranging from 250 to 325 words per minute. Generally, studies have found no significant difference as far as comprehension of material is concerned (Foulke, 1966a; 1967b).

Foulke (1968a) indicates that in measuring comprehension, there are two groups of factors which must be taken into consideration: (a) organismic features and (2) characteristics of the signal. Organismic factors include age, sex, intelligence and previous experience with the subject. Characteristics of the signal are concerned with word rate, method of compression and rate of occurrence of the speech sounds.

ts

Que.

3-

al-

0

ity

-29

-

10-

ext.

ext

In reviewing compressed tapes, the influence of the reader's voice and style does make a difference in the comprehension of material. However, there is no information available on what determines a better reader voice quality or how to choose an effective reader. It has been suggested that the same qualities necessary for comprehensible speech at compressed rates also apply to normal speech. These qualities must be identified so that the findings may be applied to both kinds of recordings (Foulke, 1967a).

Intelligence or mental aptitude of subjects using compressed speech has been investigated and it has been shown that there is no significant difference between high and low aptitude subject's comprehension of material at one third the compression of normal rate (Parker, 1971). This finding is supported by research that shows that not only is there no difference between high and low aptitude subject's comprehension at one third compression of normal speech, but also the subjects learned more efficiently at the faster speed (Sticht, 1971).

In comparing high and low aptitude subjects, the influence of speech rate on comprehension is greater than the signal degradation which might

occur. This indicates that regardless of the listener's mental ability, other human factors have a greater effect on comprehension than factors that are of a technical nature (Sticht, 1970).

7

Characteristics of the signal that may influence comprehension of the compressed speech have also been extensively examined. Research conducted by Sticht (1969) reveals that speech rate and signal distortion may affect listening comprehension. Material that has a low redundancy content is particularly affected by signal distortion because missed portions cannot be obtained in another form. Linguistic cues that are included in the text are considered to be aids to listening comprehension. Inflection, use of syntax and sequencing of words can provide cues which the listener can use to comprehend material that might not otherwise be understood.

The use of a summary or precis and introduction of key words preceding the listening exercise has also shown to have no significant effect on the level of comprehension (Orr and Freidman, 1967).

Results of research in comprehension of compressed speech may be influenced by inadequacies of the measurement techniques used. Orr (1971) indicates that there is a need for reliable and valid tests of comprehension which will measure these factors more accurately for research purposes.

Nolan and Morris (1971) found that comprehension and word rate are negatively related since comprehension decreases as the word rate is increased. Motivation, however, was found to have no relation to comprehension of material at different word rates, a fact which seems to indicate that even though a person's motivation may be high, his comprehension at faster word rates may nonetheless be lower. Foulke (1968b) reported that, with word rates ranging from 125 to 400 words per minute, comprehension was found to be adequate until the word rate exceeded 250 words per minute. As the word rate rose higher, the level of comprehension decreases in an

inverse proportion. Foulke hypothesized that adequate processing time is needed for perception of words in order for comprehension to occur. If processing time is reduced, a decrease in comprehension results. Lost processing time was indicated to be a contributing factor in the level of comprehension.

Studies have shown that compressed speech is intelligible at rates compressed up to 50% of the original rate (Fairbanks, Guttman and Miron, 1957) while others report intelligibility at even higher rates of compression. The use of longer words in the text have also shown to be an aid in the intelligibility of the compressed passages (Heise, 1971).

Factors such as age and hearing loss also have a direct effect on intelligibility. Older subjects (over sixty years old) were found to score lower on tests of intelligibility than younger subjects. Even in cases of normal hearing, older subjects suffered a loss of intelligibility which Sticht and Gray(1969), suggest may be due to loss in the speech spectrum brought about by old age or a slower processing time.

#### Trainability

The variables of listener trainability in compressed speech and retention were investigated as additional factors which related to the effectiveness of compressed speech as an instructional tool. Blind students receiving only two hours of instruction on compressed speech demonstrated a superiority in performance over those who received no training (Resta, 1971). Although as previously cited, the use of precis and key words did not affect comprehension, training sessions of only five hours resulted in better performance (Orr and Friedman, 1967).

Training of eight to ten hours that involved compression rates as high as 325 to 475 wpm revealed no significant decline in comprehension. These findings led to the conclusion by Orr, Friedman and Williams (1965) that

8

training in compressed speech will yield better results and in a shorter period of time.

Along with improved comprehension of material, training may provide the necessary listening skill to improve processing of connected discourse. The time needed to process information may be a function of training and may be reduced with practice (Orr, 1964).

Experiments conducted by Friedman and Orr (1967) which used speeded rates up to 475 words per minute further supported the effect of training on increasing comprehension of compressed material.

#### Retention

The process of perception, storage and retrieval of the compressed information, generally referred to as retention, is undoubtedly of utmost concern for educators.

Studies using rates ranging from 175 to 325 words per minute and different methods of compressing tested subjects after 0 days, 7 days and one month. No significant difference was found between the groups using compressed speech and those using normal rates of speech (Foulke, 1966b). Their results are further supported by Friedman, Orr, Freedle, and Norris (1966) in their finding that retention of speeded information is as good as retention of information presented at normal speed.

Lecture presentations reduced as much as one-third the original length resulted in no significant difference in the retention of material in a study reported by Barabasz (1968). Studies involving sighted and blind subjects revealed that although there was no significant difference in retention of material at speeded rates up to 280 words per minute, blind subjects retained even more information than sighted subjects over a longer period of time (deHoop, 1967).

A study using rates of speech from 238 to 328 words per minute,

9

described by Woodcock (1968), showed that the efficiency for learning was superior and more information was retained at these rates than at a rate of only 178 words per minute.

10

Research involving retention of material presented in a simplified form suggests that more information is preserved when material is used that contains less complexity. George (1970), in a paper, suggests the need for increased research attention toward the retention variable. Application

The use of compressed speech has been applied to many areas of education for dissemination of knowledge and training. Compressed speech has been used with the Audio-Tutorial method of instruction in an effort to contrast learning with this method as opposed to traditional approaches. No difference was found using compressed speech for information contained on audio tapes (Smith, 1979). In addition, compressed speech was found to make no difference in the comprehension of material presented in a selfpaced format. Not only did students achieve as well with the use of compressed speech, but they also preferred this method of presentation over a presentation of normal speech (Orr, Friedman and Graae, 1969).

An Air Force study used compressed speech to train officers with positive results. Consideration, it was suggested, should be given to the difficulty level of material included in such a format and the intended audience. Material of moderate difficulty should be used rather than very complex material when speech is to be compressed (Watts, 1970).

Research conducted by Thames and Rossiter (1972) investigated the case of compressed speech as a pacing device to aid in reading instruction. Findings of the study showed that compressed speech pacing resulted in a significantly greater increase in reading rates without any significant loss in reading comprehension. After nine months, the increased effects were still found to be present.
In the 1960's, the Perceptual Alternatives Laboratory at the University of Louisville was established under the directorship of Dr. Emerson Foulke. This facility experimented with compressed speech and its uses with the visually impaired (Foulke and Robinson, 1970).

Other early applications of compressed speech were made in the fields of instructional broadcasting (Jamison, 1971), medical education (Boyle, 1971) and foreign language instruction (Friedman and Johnson, 1971).

#### CURRENT RESEARCH: BASIC AND APPLIED

The preceeding summary reviewed the relevant research literature on compressed speech published during the period 1919 to 1974. During the mid part of the 1970's, research interest in compressed speech lagged. In part this hiatus was due to the thorough and comprehensive nature of the early research, however, another major inhibiting factor was the high relative cost of speech compression technology and the subsequent limited availability of such hardware and software.

During the late 1970's interest in speech compression was renewed as a result of new innovations in electronics and an increased need for the transmission of large amounts of instructional material in short periods of time (George, 1976).

Until recently, compressed speech was achieved by sampling methods which selected portions of the original tape recording. Developments in new technology have made other methods possible by which material recorded at normal speed can be played back at a faster speed with pitch control devices that reduce distortion and allow the faster speed to be intelligible. This new technology is available at a fraction of the cost of former speech compression methods and provides the opportunity to make this technique available to users for a variety of applications that

495

until recently would have been impractical. This new technology has also provided a means to individualize instruction that would match the individual's rate of learning with the rate of presentation of material (Hartjen, 1977).

12

The Variable Speech Control Co. of San Francisco currently holds the patent rights on one "new generation" speech compressor. This device. using both analog and digital electronics, when joined with a variable speed tape recorder/player can take normal speech of approximately 150 words per minute and either speed it up to 2.5 times its rate (375 wpm) or slow it down to .6 time its rate (105 wpm) (Dickstein, 1977). This unit, known as the Variable Speech Control Module provides a number of advantages over earlier speech compressors in that (1) through the use of micro-processor technology, the degree of pitch distortion has been reduced below levels previously achieved. (2) The VSC unit is a playback, rather than recording device, a fact which has further reduced the cost. (3) The playback rather than record nature of the device permits the use of any previously recorded, normal rate material. (4) The playback speed of the unit is continuously variable from .7 to 2.5 times normal rate, making adjustment to individual listener needs possible. A number of other, similar variable speed playback modules and players have been recently made available to the public as well as a unit similar to the VSC module which is available to the blind through the American Printing House for the Blind (Dickstein, 1977; Mowinski and Lauer, 1980).

The majority of basic research that has been conducted in recent years in the area of compressed speech has continued to examine many of the same issues that were of interest in past studies. The focus in contemporary work has, however, expanded on previous studies in order to gain more insight into the effectiveness of this method as it relates to

-196

individual aptitudes. Researchers have begun to measure the effects of variables that had not been previously examined. One such study by Grosjean and Lane (1976), examined the independent variables of articulation rate, number of pauses and duration of pauses to determine how the listener can integrate them into an overall impression of the rate of speech. The researchers found that, although it was possible to develop a predictive model, articulation rate contributed most to the listener's concept of speaking rate.

In a comprehensive study conducted by Adelson (1975), the researcher utilized hour long lectures rather than short passages, presented at rates of 175 and 275 wpm. The researcher suggested that shorter passages such as those used by earlier researchers do not adequately assess a listener's overall comprehension. Findings of the study indicate that the length of stimulus materials is a critical factor. Significantly larger comprehension losses were apparent when materials reflected the more realistic length of most instructional presentations. Also of importance was the conclusion of the researcher that the efficiency index of Fairbanks et al., [195]] should be questioned because it fails to take into consideration the factors of: density of ideas, number of items not learned, importance of items learned and not learned, the relative difficulty of items learned and not learned, and a criterion of acceptable comprehension which is stated in advance. The efficiency index was further questioned on the grounds that it justifies a method which appears to only encourage skimming of material at the expense of analytic thinking. More research was suggested to establish the optimal length of a presentation for realistic situations at different educational levels and the establishment of criteria to measure idea density.

The traditional measures of intelligibility and comprehension were

13

investigated by deHaan (1977) in an attempt to determine if an individual's self-selected rate threshold could be used as a measure of either variable. Results indicated that an individual's threshold is an extremely reliable indicator of compressed speech intelligibility but not of comprehension.

Other research related to the comprehensibility of compressed speech found that comprehension is closely related to subject's habitual reading speed (Hausfeld, 1981). Strong evidence was presented for a workingmemory processing limit of approximately 275 wpm. Speaker familiarity was also investigated as a factor influencing comprehension of compressed material, but was rejected as a significant variable in a study by Thompson and Silverman (1977).

A study of the effects of sex, age, passage structure and speech rate on listening comprehension of children and young adults conducted by Riding and Vincent (1980) yielded the following results: 1. Both sexes performed best with passages that contained related sentences that were positioned together and were presented at a slow rate of speed. 2. Girls were better than boys when the rate was slow and content details separate but were inferior to boys when the rate was increased. 3. Girls at age 15 showed the greatest drop in recall of compressed material, a finding which the authors suggest may be due to more complex processing strategies employed by women. The authors further suggest that if such a trend continues into adulthood, women may learn best in situations which involve no time pressure.

The comprehension measure itself has been put in question in a study by Behnke and Beatty (1977). The researchers contend that comprehension cannot be accurately measured by the standard multiple-choice question technique. They suggest that it is not clear, how sure the respondee is to the accuracy of the response. This study used a confidence-weighting technique to measure comprehension and found a significant drop in weighted

198

comprehension when speech rate was doubled (275 wpm). The researchers speculate that for longer passages such as occur in classroom instruction, the drop in comprehension could be of major proportion.

15

A series of studies (Beasley, Maki and Orchik, 1976; Riensche, Konkle and Beasley, 1976; Beasley, Bratt and Rintelmann, 1980) investigated the variable of intelligibility using clinical measures of speech discrimination. Findings generally supported early research to the effect that children have more difficulty discriminating compressed material than adults and that sentences are more intelligible than monosyllables, an effect the authors attribute to redundancy within the sentence.

Training in rapid reading was shown to improve comprehension of compressed material by Boatson (1978). Other findings, while non-significant, indicated that such training may be more effective with highly compressed speech.

Compressed speech has continued to be used with the blind and visually handicapped as a valuable listening tool. Different rates used for compression are still of interest to researchers who wish to determine if rates affect learning efficiency. Findings obtained by Myers (1978), indicate that learning is more efficient at the faster rates of compression and that factors of intelligence, grade level, sex and comprehension level were insignificant in determining learning efficiency. It is implied that compressed speech may provide an alternative to blind students to keep up with their sighted peers who can read much faster in a shorter period of time. Results of this study conducted in a residential school should be confirmed with research done in an integrated setting so that the findings can be applied to other situations and learners.

Affective dimensions of the use of compressed speech have been explored with respect to learner anxiety and its relationship to the technique, in a study by Beatty and Behnke (1978). Results support the notion that as

the rate of presentation increases so does learner anxiety. The use of this technique may indeed be counter-productive to the learning task unless sufficient measures can be taken to lessen anxiety. The researchers suggest that a reduction in anxiety may result in greater information processing efficiency. The authors further suggest, however, that the decreased efficiency may be due to a combination of both anxiety and perceptual limitations.

16

Moderate compression of up to 30%, has been found to have no effect on comprehension or evaluation of emotional variables in reviewing tapes of dialogue for counseling sessions. Empathy, warmth, genuineness and depth of self-exploration were all comprehended without any significant variation in a study conducted by Schwab and Travers (1975).

A number of studies have examined the rates at which subjects prefer to listen to compressed material. One study (Leeper and Thomas, 1978), has reported that generally children preferred a rate of 200 wpm the most and least preferred a rate of 100 wpm. Although younger children tend to prefer faster rates than older children and adults, this may be due to the fact that children need to process information as a whole instead of piece by piece as older subjects do. Consequently, it is more helpful for them to receive the information faster so that they can process it as units in short-term memory. The researchers make a strong case for the existence of a "chunking process" in this type of processing. Findings of Short (1978) further support learner's preference for faster rates.

Age in adults has also been found to have a significant effect on preference for listening rate (Riensche, Lawson, Beasley and Smith, 1979). Older listeners tend to need more time to process information, a fact which may be due to increased auditory perception problems that occur with older age. Although it has been found that older people prefer the slower rates of speech, there has been no significant difference found between males and females.

College students were found to prefer compression up to 300 wpm with no difference in performance. It was suggested that more students over time would begin to prefer compressed speech to normal speed tapes as their use became more common (Primrose, 1975). Rippy (1975), in an earlier study also found strong preferences for compressed speech among college students. It was also reported that students do not always use a constant rate of speed but rather vary the speed according to their needs in the listening task. He further found that students may prefer speech compression if they were permitted to control and vary the rate.

Beatty, Behnke and Froelich (1980) investigated the effect of achievement incentives on compression of rate-controlled speech and found that although comprehension was less, incentives significantly reduced the magnitude.

In research performed by Lase and Leeper (1977), listening preferences were compared using two different compression techniques: Vocom-1 selective vowel compression/pause deletion vs. the VARISPEECH 1 systematic expand/deletion process. There was an overall similarity found between the two groups for listening preferences. The researchers conclude, however, that differences in preferred rates in past studies may be due to the earlier methods that were used to compress the speech rather than the rates themselves.

# Research Related to the Use of Compressed Speech with the Blind, Visually Impaired and Handicapped

Extensive research has been and continues to be conducted in the area of rate controlled speech and the blind, visually impaired and handicapped. It is possible that in this area the most benefits have been derived from compressed speech.

Bishoff (1979) presents an excellent review of the literature relative to the teaching of listening skills to the blind and visually impaired and makes a number of recommendations for the improvement of

17

these skills based upon the research, many of which incorporate speech compression techniques and applications.

18

The average reading speed of braille is 90 wpm and the speed of a professional recording is around 175 wpm. Visually impaired and blind students have had difficulty in keeping pace with their sighted peers who read about 250 to 300 wpm. College students facing this problem have used compressed speech to record class lectures and then played them back at a higher rate or have occassionally slowed the tapes down when the tape quality or extraneous noises interferred with comprehension. Speeding up commercially prepared tapes has also enabled these students to keep up with their reading assignments (VSC means top grades, 1979).

A study involving blinded veterans revealed that 86% of them were able to comprehend material that was compressed to almost 475 wpm (De L'Aune, Lewis, Needham and Nelson, 1977). It was also found that the younger subjects performed better than the older ones and that WAIS, IQ and educational level did not have any significant relationship to performance. It was found, however, that scores on the MMPI (Minnesota Multiphasic Personality Inventory) and the CPI (California Personality Inventory), which reflect positive mental health factors and psychological adjustment, were significant predictors of comprehension of compressed speech.

Although the use of compressed speech by the blind and visually impaired probably represents the most extensive as well as intensive application of the technology, other uses have been identified to aid other individuals with handicaps or as diagnostic tools.

Children with auditory processing problems may benefit from the use of time-compressed speech. Compression of 30% not only did not interfere with performance, but also appeared to be an aid in that it exercised a neutralizing effect on the decay of stimuli from short-term memory (Manning, Johnston and Beasley, 1977). Compression may also be credited with motivating the student. Woodcock and Clark (1968) suggested

that information that is presented at a rate which is slower than the students optimum processing rate may be blocked by extraneous information. Manning, Johnston and Beasley (1977) feel that this phenomena may be particularly acute with children who experience auditory processing problems and consequently, may be able to use compressed material to minimize this effect. Results of this study indicated that 30% timecompression for children with auditory perceptual problems helped them to perform approximately as well as normals.

19

In addition to general auditory processing problems, compressedspeech may prove useful in the diagnosis of central auditory lesions in children. There appears to be poorer speech discrimination in the ear contralateral to the site of lesion at 60% time-compression. The use of this method has been put forth by Oelschlaeger and Orchik (1977) to help to determine the site of lesion. The authors suggest the incorporation of compressed speech techniques into an auditory test battery for children.

The use of time-compressed speech has also been suggested for inclusion in a test battery for the diagnosis of peripheral and central auditory processing problems as a function of aging. Increasing age and time-compression rates showed a decrease in intelligibility and with an accompanying decrease in sensation level (Konkle, Beasley and Bess, 1977).

Aphasics demonstrated a need for more processing time in order to produce more complex and developed language. Manipulation of processing time may be indicated for use in the beginning stages of therapy or for introducing new concepts to the patient, although the optimum processing time has not been established (Goldfarb and Halpern, 1981).

#### Reading and Language Instruction

Success with the use of compressed speech tapes has been achieved for teaching reading skills. High school students with Learning Disabilities have been able to increase their reading speed and comprehension by reading

the printed text while listening to the compressed version (Variable Speech Control Co., 1979). Other findings have reported that reading speed achieved by this method can approach a 50% increase in speed and that this increase can be maintained over a period of time (Reading speed up 50%, 1978). Higher Education not only used the compressed tapes along with the written text but also used it for building vocabulary. Such application has been important for remedial purposes to aid the student who cannot keep pace with his peers. Advanced students also benefit from such materials as they prepare for GRE's, skim through reading material or simply use it for a motivation and challenge (University students increase reading, 1982).

Children with reading impairment differ from normal readers on scores used to measure compressed speech. It has been suggested by Freeman and Beasley (1978), that compressed speech could be used as a diagnostic tool in identifying these children with reading problems by their scores and the types of errors they make on these measures.

The use of compressed and expanded speech in foreign language instruction may appear to work against the attainment of correct pronunciation, however, it was found by Wingfield (1975) that normal intonation of language minimizes loss of intelligibility. These findings were further supported using both French and English materials by Wingfield, Buttet and Sandoval (1979). The implication of these findings is that even with the partial pitch distortion common to compressed speech, a sentence spoken with normal intonation will still retain a high degree of intelligibility in several languages.

Flaherty (1979) reviewed much of the literature related to compressed speech and foreign language instruction and concluded that (1) speech compression and expansion techniques appear to have considerable influence in the learning of a foreign language and (2) that much of the basic research previously conducted on speech compression should be replicated in the area of foreign language applications.

20

50.1

Students of foreign languages in the past have experienced a lack of control over commercially prepared tapes. With the use of compressed tapes the advanced student may be challenged or the tapes can be used as aural pacers while the student reads along silently. Foreign language that has been prerecorded also has the problem of eliminating the redundancies and pauses that are present in regular conversation. As a result, the listener is expected to comprehend the foreign speech at a rate that is faster than conversation. With the aid of a speech expander, the student is able to slow down the rate of speech in order to allow for more processing time and thus prevent cognitive overload. This expansion replaces the juncture pauses that are lost in prerecorded text which are essential to comprehending spoken speech (Speed control provides effective foreign language, 1980).

The teaching of English as a second language has also been an area where the use of speech compression has been researched with important findings. It was found by Neville and Pugh (1975) that foreign speakers who are learning to read English have more difficulty with pacers than silent reading because they cannot go back and reread a passage that was not clearly understood. Nonetheless, rate-altered speech is useful in helping foreign students to read and comprehend written English. Expanded speech that slows the rate down can make the task easier while speeding the text up can provide more advanced practice. The difficulty of the task can also be increased by simply speeding up the rate without having to change the existing text. Vocalisation of the text while reading was also found to decrease as students became more proficient in their reading due to the use of compressed tapes. Bruns (1978), in a study, found that daily English language training via compressed speech tapes facilitated achievement on an English criterion measure and improved learning efficiency.

21

## Other Applications of Compressed Speech to Learning and Instruction

22

Speech Compression has been utilized for general instructional purposes in an increasingly frequent manner. A variety of specific instructional areas have made use of compressed speech and it has become an important study device in college and university instruction and learning skills centers. These centers generally offer services to an entire institution and consequently aid a variety of subject areas. Bimodal programs that combine listening and reading serve to increase reading speed without decreasing comprehension. Second language learners can review tapes that are slowed down to make the foreign language more comprehensible (Olsen, 1978). Media services have recorded lectures so that students can benefit from listening to rate-altered versions without having to rely on their own poorer quality recordings that may prove to be more distracting (Special media services help students, 1979). A course in Listening Dynamics has also been offered to students so that they might profit from developing listening skills that otherwise would not have been refined. Listening centers can service students by providing an opportunity to review material, preview large quantities of information, slow material down that is difficult, unusual or complex (Listening programs at Mesa College, 1981).

Controlling the rate of speech has also been applied to paramedic nursing. Emergency calls that are received in a hospital can become both legal and medical records. Hospitals can also use these tapes as training materials to review the procedures and methods used with each call. In one hospital, reported in <u>Biomedical Communications</u> (The Reviews are In, 1979), weekly review sessions are held to evaluate performance and procedures on half a dozen tapes. These tapes are played at the highest speed unless otherwise requested, thus saving time. The tapes are also played at this high speed when they are reviewed for selection for these weekly sessions. In situations where background noises may interfere with

intelligibility during a critical situation, the tapes can be played at a slower speed in order to extract the important information.

23

Time spent commuting to work is usually considered wasted time. With the use of time-compressed speech, this wasted time can be transformed into a profitable experience. In a study by Singer, Dilloway and Ganjamie (1976), subjects, while driving to work, listened to material presented at three different compressed speeds: 200, 230, 260 wpm. No significant differences were found between the varying rates and the control group who simply read the material. This implies that compressed speech can be used while driving in order to study for examinations, review material, preview material or simply use the time to listen to any chosen material the user may want. The authors further suggest the feasibility of using compressed material for study in environmental conditions that impair reading such as poor lighting or during times of restricted activity, possibly during hospital stays.

Time-compressed speech has also been used for in-house employee training. (Variable speech control saves, 1981).

### Other Contemporary Uses of Rate-Modified Materials

Increasingly, rate controlled speech is being used to maximize the input of information to the public as well as for other, persuasive and economic applications.

In the legal and law enforcement area, the use of compressed speech has been investigated. Time-compressed speech in moderate rates was found to have no negative effects on juror's ability to comprehend legal discourse or to make legal decisions. In a study conducted by Levison (1978), jurors tested were able to listen to information of "relative difficulty" and recall more "factual information" than those who listened to natural speech. Included in the compressed material was the attorney's summation, cross-examination of a witness and the judge's charge to the jury. Law enforcement has applied speech expanders/compressors in cases

50.7

of hysterical phone calls to a dispatcher or instances where a foreign speaker may be difficult to understand. By slowing the tape speed down, an official is better able to decipher what was said, especially if requesting the caller to repeat the message may not be a convenient or possible alternative. Slowing down recorded speech has also been used for surveillance to understand "street talk" that at normal speeds of delivery is almost unintelligible. The law official can slow the speech down to a point where he can transcribe the words as he listens to them. Speeded speech, however, also serves to be a useful tool when used to review testimony that is lengthy and has previously been examined (The talk of the town, 1978).

In a series of studies by MacLachlan and others, time-compression techniques were applied to advertising messages presented via radio and television. Not only did the use of moderate compression rates (maximum 40%) permit more information to be encapsulated in a thirty second commercial, but its use had significant cognitive and affective effects on listeners. It was found that listeners recall of the products described was not significantly lessened, however, levels of interest in the message was increased in some cases by the use of compression techniques (MacLachlan and LaBarbera, 1978). It was also suggested that listeners prefer messages presented at a faster rate. MacLachlan (1979) also describes an experiment which indicated that viewer's attentional effort level was increased significantly by speeded messages. These findings were confirmed in a study by MacLachlan and Sigel (1980) where viewers watched time-compressed television commercials embedded in a news presentation. Viewers who watched the compressed messages recalled products more frequently and could describe the content of the message more frequently than normal speed, control groups. These studies confirmed an earlier study by Wheeless (1971) which indicated that the sales effect of a message was not reduced when rate of presentation was increased.

508

MacLachlan, (in press) found also that viewers perceptions of television spokespeople was altered when the messages were rate-increased. These speakers were seen to be more energetic and to a degree, more knowledgeable.

Other research in mass media has described the use of time compression technology to compress television or film presentations into shorter periods of time. Using relatively small rates of compression (8-10%) it is possible to encapsule a 130 minute film or video program into the standard 120 minute video cassette, thereby achieving an economic advantage (Angus, 1981).

#### New Research Directions

With the advent of the newer, variable speed compression technology, has come an increased interest in the application of time-compressed speech. A corresponding renewal of research in the area has emerged. It would appear useful, at this time, to put forward a number of recommendations for the directions this research should follow.

Replication of some of the past research in new areas of application would provide some insight into those specific instances where this technology can be of use. We also should bear in mind, however, that speech compression, like many other instructional technologies, is not a panacea for all instructional ills. Research should attempt to carefully delineate those areas or applications where the learning advantages of timecompressed material can be of most benefit, while at the same time identifying those areas of minimal benefit. It may also be possible that the relatively small decrease in comprehension at moderate rates can be accepted when the nature of the learning task is such that high information redundancy is present or the task is not critical in nature.

The variable speed advantage of the new technology probably is one of the most significant factors operating on the renewal of 'research. This advance can now make individualization of time-compressed material

25

possible. Until now, the range of compression rates was limited and listeners were generally forced to accept only one, experimenter controlled rate. Much like self-paced instruction, the variable speed feature will allow the listener to adjust the rate to his or her optimal listening or processing rate, with the added advantage of permitting a self-selected slow down or speed up based upon the specific material.

Research should focus on a number of interacting variables, primarily those of individual listening and processing aptitudes and how they interact with presentation rate, type of information, the specific learning objective/task and the purpose to which the information will finally be put. Current interest in the Aptitude Treatment Interaction (ATI) research paradigm has reflected our need to individualize instruction. This research orientation has enabled us to examine how individual characteristics of the learner interact with various types of instructional materials to meet the needs of specific types of learners.

Only limited research in the past has focused on an ATI approach to investigating the interaction between speech compression rates and individual learner characteristics. Current and future research should, however, proceed in this direction. Numerous variables such as comprehension, intelligibility, attention, processing rate, message complexity, etc., have, fortunately, been identified in previous research; a fact which should aid researchers in the formulation of new studies. Many other, as yet unexplored, variables are apparent however. Primary among which are those relating to the individual such as cognitive and perceptual styles.

Time-compressed speech can be seen as an auditory analog to visual complexity, a variable given extensive research attention in the past. Through the study of the interaction of both types of stimulus complexity, a clearer understanding of human information processing may be achieved. Speech compression would appear to present a useful tool for the continued

26

investigation of auditory information processing, especially relative to channel capacity, verbal complexity and both visual and auditory processing rates. Research currently underway at the University of Pittsburgh is directed toward the interaction of this auditory complexity variable and individual perceptual and cognitive styles.

A

А

в

E

I

1

27

Other directions for research are suggested by the past research on mass media effects of time-compressed speech. Marketing and advertising research is not too distant from learning research and indeed many of the same variables are concurrently being investigated. Contemporary research in television and radio messages presented at higher rates seems to have strong implications for instructional materials design in terms of the variables of recall, attention and motivation. Further research in this area would appear extremely worthwhile.

Recent, increased concern for the educational and training needs of the handicapped make research thrusts in this area obvious. Although much primary research was aimed at blind and visually impaired individuals, compressed speech can now be seen as a technique for the rapid transmission of information to a wide variety of individuals who have physical handicaps which impede or impair their ability to gain information in traditional manners.

Finally, the need of the general public, in times of what has been described as the "Knowledge or information explosion", to gain rapid access to useful information, makes time-compressed speech a significant compliment to "speed reading".

- Adelson, L. Comprehension by college students of time-compressed lectures. Journal of Experimental Education, 1975, 44, 53-60.
- Angus, R. VSC...Money saver or video vandalism?. <u>Video Review</u>, June 1981, pp. 51-52.
- Barabasz, A.F. A study of recall and retention of accelerated lecture presentation. <u>The Journal of Communication</u>, 1968, <u>18</u>, 283-287.
- Beasley, D.S., Maki, J.E. & Orchik, D.J. Children's perception of time-compressed speech on two measures of speech discrimination. Journal of Speech and Hearing Disorders, 1976, 41, 216-225.
- Beasley, D.S., Bratt, G.W. & Rintelmann, W.F. Intelligibility of time-compressed sentential stimuli. Journal of Speech and Hearing Research, 1980, 23, 722-731.
- Beatty, M.J. & Behnke, R.R. Effects of compressed speech on learner anxiety. Southern Speech Communication Journal, 1978, 43, 296-301.
- Beatty, M.J., Behnke, R.R. & Froelich, D.L. Effects of achievement incentive and presentation rate on listening comprehension. Quarterly Journal of Speech, 1980, 66, 193-200.
- Behnke, R.R. & Beatty, M.J. Effects of time-compressed speech on confidence-weighted comprehension scores. <u>The Southern Speech</u> Communication Journal, 1977, 42, 309-317.
- Bischoff, R.W. Listening: A teachable skill for visually impaired persons. <u>Journal of Visual Impairment and Blindness</u>, 1979, <u>73</u>, 59-67.
- Boatson, G.C. The effects of training in rapid reading on the comprehension of time-compressed speech. (Doctoral dissertation, Indiana University, 1978). <u>Dissertation Abstracts International</u>, 1978, 39, 5425A. (University Microfilms No. 7906007).
- Boyle, G.J. Compressed speech in medical education. <u>Proceedings of</u> the Second Louisville Conference on Rate and/or Frequency-Controlled Speech. University of Louisville, 1971.
- Bruns, R.W. A study of the effects of practice in time-compressed speech listening upon aural comprehension levels of second language learners. (Doctoral dissertation, University of Colorado at Boulder, 1978). <u>Dissertation Abstracts International</u>, 1978, 39, 2697A-2698. (University Microfilms No. 7820491).
- Campanella, S.J. Signal analysis of speech time-compression techniques. Proceedings of the Louisville Conference on Time Compressed Speech, University of Louisville, 1967, 108-114.
- deHaan, H. A speech-rate intelligibility threshold for speeded and time compressed connected speech. <u>Perception and Psychophysics</u>, 1977, 22, 366-372.

- deHoop, W. Effects and interaction effects of speaking role, visual limitation and intelligence level on aural acquisition and retention of sentences. <u>Proceedings of the Louisville Conference on</u> Time Compressed Speech, University of Louisville, 1967, 115-125.
- DeL'Aune, W., Lewis, C., Needham, W. & Nelson, J. Speech compression: Personality correlates of successful use. <u>Journal of Visual Impair-</u> ment and Blindness, 1977, <u>71</u>, 66-70.
- Dickstein, M. Looking at variable speech control <u>db</u>, <u>The Sound Engin</u>ering Magazine. October, 1977, pp. 44-47.
- Diehl, C.F., White, R.C. & Burk, K.W. Rate and communication. <u>Speech</u> Monographs, 1959, 26, 229-232.
- Duker, S. Summary of research on time-compressed speech. In S. Duker (Ed.) <u>Time-Compressed Speech: An Anthology and Bibliography (Vol. 1)</u>. New Jersey: Scarecrow Press, Inc., 1974.
- Fairbanks, G., Everett, W.L. & Jaeger, R.P. Method for time or frequency compression-expansion of speech. <u>Transactions of the Institute of Radio Engineers</u>, Professional Group on Audio AU2 (1): 7-12, 1954.
- Fairbanks, G., Guttman, N. & Miron, M.S. Effects of time-compression upon the comprehension of connected speech. <u>Journal of Speech and</u> Hearing Disorders, 1957, 22, 10-19.
- Flaherty, E. Sr. Rate-controlled speech in foreign language education. Foreign Language Annals, 1979, 12, 275-280.
- Foulke, E. Comparison of comprehension of two forms of compressed speech. Exceptional Children, 1966, 33, 169-173. (a)
- Foulke, E. The retention of information presented at an accelerated word rate. <u>International Journal for the Education of the Blind</u>, 1966, <u>16</u>, 11-15. (b)
- Foulke, E. The influence of a reader's voice and style of reading on comprehension of time-compressed speech. <u>The New Outlook for the</u> <u>Blind</u>, 1967, <u>61</u>, 65-68. (a)
- Foulke, E. Summary and conclusions. <u>Proceedings of the Louisville</u> <u>Conference on Time-Compressed Speech</u>, University of Louisville, 1967, 149-154. (b)
- Foulke, E. <u>The Perception of Time Compressed Speech</u>. Manuscript prepared for The Perception of Language Conference, University of Pittsburgh, January, 1968. (a)
- Foulke, E. Listening comprehension as a function of word rate. <u>The</u> Journal of Communication, 1968, 18, 198-206. (b)

Foulke, E. & Robinson, J. <u>The Development of Accelerated Speech as a</u> <u>Useful Communication Tool in the Education of Blind and Other Handi-</u> <u>capped Children</u>. Progress Report. Project no. 7-1254 covering the period from May, 1969 to Jan. 31, 1970. Washington, D.C.: U.S. Deptof HEW, Office of Education, 1970.

- Foulke, E. & Sticht, T.G. Review of research on the intelligibility and comprehension of accelerated speech. <u>Psychological Bulletin</u>, 1969, <u>72</u>, 50-62.
- Freeman, B. & Beasley, D. Discrimination of time-altered sentential approximations and monosýllables by children with reading problems. Journal of Speech and Hearing Research, 1978, 21, 497-506.
- Friedman, H.L. & Johnson, R.L. Rate-controlled speech and second language learning. <u>Proceedings of the Second Louisville Conference</u> on <u>Rate and/or Frequency Controlled Speech</u>. University of Louisville, 1971. 143-152.
- Freidman, H. & Orr, D.B. Recent research in the training of compressed speech comprehension. <u>Proceedings of the Louisville Conference on</u> <u>Time Compressed Speech</u>, University of Louisville, 1967. 69-76.
- Freidman, H., Orr, D.B., Freedle, R.O. & Norris, C.M. <u>Further Research</u> on Speeded Speech'as an Educational Medium. Washington, D.C.: American Institutes for Research, 1966.
- Garvey, W.D. The intelligibility of abbreviated speech patterns. Quarterly Journal of Speech. 1953, 39, 296-306.
- George, R.G. Retention of prose material as a function of rate of presentation and difficulty of material. <u>Audio Visual Communication</u> Review. 1970, 18, 291-299.
- George, R.G. <u>A review of research on rate-controlled speech and its</u> <u>implications for education</u>. Paper presented at the annual convention of the Association for Educational Communications and Technology, Anaheim, CA, March 1976.
- Goldfarb, R. & Halpern, H. Word association of time-altered auditory and visual stimuli in aphasia. <u>Journal of Speech and Hearing Research</u>, 1981, 24, 233-246.
- Goldstein, H. Reading and Listening Comprehension at Various Controlled Rates. Doctoral Dissertation, New York: Columbia, University, 1940. Excerpt in S. Duker (Ed.) <u>Time-Compressed Speech: An Anthology and</u> <u>Bibliography</u>. Vol. No. 1, New Jersey, Scarecrow Press Inc., 1974.
- Grosjean, F. & Lane, H. How the listener integrates the components of speaking rate. <u>Journal of Experimental Psychology: Human Perception</u> and Performance, 1976, 2, 538-543.
- Hartjen, R.H. <u>Compressed media: A new dimension of compressed speech</u>. Paper presented at the annual convention of the Association for Educational Communications and Technology, Miami Beach, April 1977.
- Hausfeld, S. Speeded reading and listening comprehension for easy and difficult materials. <u>Journal of Educational Psychology</u>, 1981, <u>73</u>, 312-319.
- Heise, R. The intelligibility of compressed words. <u>Proceedings of the</u> <u>Second Louisville Conference on Rate and/or Frequency-Controlled Speech</u>. University of Louisville, 1971, 70-79.

- Jamison, D.T. Economic analysis of time-compressed speech for instructional broadcast satellites: A proposal for Brazil. <u>Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Recordings</u>, University of Louisville, 1971, 271-281.
- Klumpp, R.G. & Webster, J.C. Intelligibility of time-compressed speech. <u>Journal of the Acoustical Society of America</u>, 1961, <u>33</u>, 265-267.
- Konkle, D.F., Beasley, D.S. & Bess, F.H. Intelligibility of timealtered speech in relation to chronological aging. <u>Journal of</u> Speech and Hearing Research, 1977, <u>20</u>, 108-145.
- Lass, N.J. & Leeper, H.A. Jr. Listening rate preference: Comparison of two time altered techniques. <u>Perceptual and Motor Skills</u>, 1977, 44, 1163-1168.
- Leeper, H.A. Jr. & Thomas, C.L. Young children's preferences for listening rates. Perceptual and Motor Skills, 1978, 47, 891-898.
- Levison, G.K.L. The effects of natural audio and compressed audio speech presentation on four factors of simulated-jury-decisionmaking. (Doctoral dissertation, Columbia University, 1978). <u>Dissertation Abstracts International</u>, 1978, <u>39</u>, 5996A-5997A. (University Microfilm No. 7909003)
- Listening programs at Mesa College. T.H.E. Journal, 1981, 8(5), 42.
- MacLachlan, J. What people really think of fast talkers. <u>Psychology</u> Today, November 1979, pp. 113-114; 116-117.
- MacLachlan, J. Listener perceptions of time-compressed television spokespeople, Journal of Advertising Research, in press.
- MacLachlan, J. & LaBarbera, P. Time-compressed tv commercials. Journal of Advertising Research, 1978, 18(4), 11-15.
- MacLachlan, J. & Siegel, M.H. Reducing the costs of tv commercials by use of time-compression. <u>Journal of Marketing Research</u>, 1980, <u>17</u>, 52-57.
- Manning, W.H., Johnston, K.L. & Beasley, D.S. The performance of children with auditory perceptual disorders on a time-compressed speech discrimination measure. <u>Journal of Speech and Hearing Disorders</u>, 1977, 42, 77-84.
- Miller, G.A. & Licklider, J.C. The intelligibility of interrupted speech. <u>Journal of the Acoustical Society of America</u>, 1950, <u>22</u>, 167-173.
- Miron, M.S. & Brown, E. Stimulus parameters in speech compression. Journal of Communication, 1968, <u>18</u>, 219-235.
- Mowinski, L. & Lauer, H. Personal type speech compression; information for teachers and consumers. <u>Aids and Appliances Review, The Carroll</u> Center for the Blind, Newton, Mass., No. 4, 1980.

- Myers, J.A. Compressed speech increases learning efficiency. Education of the Visually Handicapped, 1978, 10(2), 56-64.
- Nelson, H.E. The effect of variations of rate on the recall by radio listeners of 'straight' newscasts. <u>Speech Monographs</u>, 1948, 15, 173-180.
- Neville, M.H. & Pugh, A.K. An exploratory study of the application of time-compressed and time-expanded speech in the development of the English reading proficiency of foreign students. <u>English</u> Language Teaching Journal, 1975, 29, 320-329.
- Nolan, C.Y. & Morris, J.E. Effects of motivation and word rate on aural compression. <u>Proceedings of the Second Lousiville Conference</u> on Rate and/or Frequency-Controlled Recordings, University of Louisville, 1971, 224-230.
- Oelschlaeger, M.L. & Orchik, D. Time-compressed speech discrimination in central auditory disorder: A pediatric case study. <u>Journal of</u> Speech and Hearing Disorders, 1977, <u>42</u>, 483-486.
- Olsen, L.D. Variable speech control aids gifted and impaired students. AV Guide, 1978, 57(7).
- Orr, D.B. Note on thought rate as a function of reading and listening rates. Perceptual and Motor Skills, 1964, 19, 874.
- Orr, D.B. The measurement of listening comprehension. Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Recordings, University of Louisville, 1971, 219-223.
- Orr, D.B. & Freidman, H. The effect of listening aids on the comprehension of time-compressed speech. <u>Journal of Communication</u>, 1967, 27, 223-227.
- Orr, D.B., Freidman, H.L. & Graae, C.N. Self-pacing behavior in the use of time-compressed speech. <u>Journal of Educational Psychology</u>, 1969, 60, 28-31.
- Orr, D.B., Friedman, H.L. & Williams, J.C.C. <u>Trainability of Listening</u> <u>Comprehension of Speeded Discourse</u>. Maryland: American Institutes for Research, 1965.
- Parker, C.C. Effect of rate of compression and mode of presentation on the comprehension of a recorded communication to junior college students of varying aptitudes. <u>Proceedings of the Second Louisville</u> <u>Conference on Rate and/or Frequency-Controlled Recordings</u>, University of Louisville, 1971, 21-28.
- Primrose, R.A. <u>College students' preference for compressed speech</u> lectures. 1975. (ERIC Document Reproduction Service No. ED104360).
- Reading speed up 50% at Eau Claire junior and senior high schools. T.H.E. Journal, 1978, 5(2), 27.
- Reid, R.H. Grammatical complexity and comprehension of compressed speech. Journal of Communication, 1968, 18, 236-242.

Resta, P.E. The effects of training on the intelligibility and comprehension of frequency-shifted time-compressed speech by the blind. Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Recordings, University of Louisville, 1971, 347-362.

- Riding, R.J. & Vincent, D.J.T. Listening comprehension: The effects of sex, age, passage structure and speech rate. <u>Educational Re-</u> <u>view</u>, 1980, <u>32</u>, 259-266.
- Riensche, L.L., Konkle, D.F. & Beasley, D.S. Discrimination of timecompressed CNC monosyllables by normal listeners. <u>The Journal of</u> Auditory Research, 1976, 16, 98-101.
- Riensche, L.L., Lawson, G., Beasley, D.S. & Smith, L. Age and sex differences on preferred listening rates for speech. <u>The Journal</u> of Auditory Research, 1979, <u>19</u>, 91-94.
- Rippey, R.F. Speech compressors for lecture review. <u>Educational</u> <u>Technology</u>, 1975, 15(2), 58-59.
- Schwab, R. & Travers, R.M.W. Effects of speech compression on affective dimensions of dialogue. <u>Journal of Auditory Research</u>, 1975, 15, 172-176.
- Scott, R.J. Computers for speech time compression. <u>Proceedings of</u> the Louisville Conference on Time-Compressed Speech., University of Louisville, 1967, 29-35.
- Shannon, C.E. & Weaver, W. <u>The Mathematical Theory of Communication</u>. Urbana: University of Illinois Press, 1949.
- Short, S.H. The use of rate-controlled speech to save time and increase learning in self-paced instruction. <u>NSPI Journal</u>, 1978, 17(4), 13-14.
- Silverstone, D.M. Listening, speech compression and continuing education. <u>Journal of Continuing Education and Training</u>, 1972, <u>2</u>(2), 115-121.
- Silverstone, D.M. Compressed speech. <u>Audiovisual Instruction</u>, 1974, 19(1), 42-43.
- Singer, D.G., Dilloway, P. & Ganjamie, C. Learning while commuting to school: New uses for compressed speech tapes. <u>Educational Tech-</u> nology, 1976, 16(4), 54-56.
- Smith, H.G. Investigation of several techniques for reviewing audiotutorial instruction. <u>Educational Communication and Technology</u> <u>Journal</u>. 1979, <u>27</u>, 195-204.
- Special media services help students with limited time. <u>T.H.E. Journal</u>, 1979, <u>6</u>(6), 33.
- Speed control provides effective foreign language training. <u>T.H.E. Jour-</u> nal, 1980, 7(6), 34.
- Sticht, T.G. Some interactions of speech rate, signal distortion, and certain linguistic factors in listening comprehension. <u>Audio-Visual</u> <u>Communication Review</u>, 1969, 17, 1959-171.

- Sticht, T.G. Mental aptitude and comprehension of time-compressed and compressed-expanded listening selections. <u>Journal of Audi-</u> tory Research, 1970, <u>10</u>, 103-109.
- Sticht, T.G. Learning by listening in relation to aptitude, reading, and rate-controlled speech. (HumRRO Tech. Rep. 69-23). Alexandria, VA: Human Resources Research Organization, 1971.
- Sticht, T.G. & Gray, B.B. The intelligibility of time compressed words as a function of age and hearing loss. <u>Journal of Speech</u> and Hearing Research, 1969, 12, 443-448.
- Thames, K.H. & Rossiter, C.M. Jr. The effects of reading practice with compressed speech on reading rate and listening comprehension. Audio Visual Communication Review, 1972, 20, 35-42.
- The reviews are in--how a paramedic nurse coordinator expedites education and review. Biomedical Communications, May 1979, pp. 37-38;42.

The talk of the town. Law Enforcement Communications, October 1978.

- Thompson, A.J. & Silverman, E. Children's comprehension of time-compressed speech: Effect of speaker's familiarity. <u>Perceptual and</u> <u>Motor Skills</u>, 1977, 45, 1253-1254.
- University students increase reading skills. T.H.E. Journal, 1982, 9(2), 40.
- Variable Speech Control Co. Special education students become 'real readers' using speech compression/expander. <u>Curriculum Product</u> Review, April 1979.
- Variable speech control saves time, money and employee energy. T.H.E. Journal, 1981, 8(4), 34.
- VSC means top grades for visually impaired freshmen. <u>T.H.E. Journal</u>, 1979, 6(1).
- Watts, M.W. Jr. Using compressed speech to teach instructional techniques to Air Force Officers. <u>Air University Studies in Teacher</u> <u>Education</u>. Alabama: Maxwell A.F.B., March 1970.
- Wheeless, L.R. Some effects of time-compressed speech on persuasion. Journal of Broadcasting, 1971, 15, 415-420.
- Wingfield, A. Acoustic redundancy and the perception of time-compressed speech. <u>Journal of Speech and Hearing Research</u>, 1975, 18, 96-104.
- Wingfield, A., Buttet, J. & Sandoval, A.W. Intonation and intelligibility of time-compressed speech. Supplementary Report: English vs French. Journal of Speech and Hearing Research, 1979, 22, 708-716.
- Woodcock, R.W. & Clark, C.R. Comprehension of a narrative passage by elementary school children as a function of listening rate, retention period and I.Q. Journal of Communication, 1968, 18, 250-271.

TITLE: Test Score Results by Sex and Perceptual Ty, When Background Music Accompanies Film, Filmstrip, and Lecture Presentations

AUTHORS: Josephine Raburn LaWanda Tyson TEST SCORE RESULTS BY SEX AND PERCEPTUAL TYPE WHEN BACKGROUND MUSIC ACCOMPANIES FILM, FILMSTRIP, AND LECTURE PRESENTATIONS

By

Josephine Raburn

and

LaWanda Tyson

# TEST SCORE RESULTS BY SEX AND PERCEPTUAL TYPE WHEN BACKGROUND MUSIC ACCOMPANIES FILM, FILMSTRIP, AND LECTURE PRESENTATIONS

Research on the value of music as an aid to learning has not fully answered the questions of when and how to use it. This study will investigate the feasibility of using it as a soft background to lecture, filmstrip and film when teaching certain concepts in freshman psychology. Music's only value may be to pace the action, accompany titles, heighten dramatic effects, change moods and predict things to come in instructional films and filmstrips, but, it is possible that it may actually help to organize information more efficiently in the brains of certain people.

Paivio has proposed dual processing in the brain. Visual, auditory, and affective components are analog; while verbal components are sequential in nature. The parallel processing of holistically perceived stimuli is usually pefformed in the right hemisphere while sequential processing is in the left hemisphere (Paivio, 1971; 1972). Regelski (1977) believed that music played while verbal material was being presented would cause the two hemispheres to interfere with each other. Later research by Raburn (1981) seemed to substantiate that finding when visual people, as determined by Viktor Lowenfeld's Successive Perception Test-1 (Lowenfeld, 1945) were distracted by background music when they were trying to recognize the exact wording of sentences they had heard before. Nonvisual people, called haptics by Lowenfeld, were not affected by music in that experiment, but they scored lower than visuals on the test.

Perception was thought by Lowenfeld to be an innate quality which varied between individuals. He saw a continuum, the ends of which were extremes. At one end were people who were visual and at the other end were people who were non-visual or haptic. In the middle were the indefinites. Visuals use their eyes and learn through visual imagery. Haptics learn by means of touch, feelings, and kinesthetic functions (Lowenfeld & Brittain, 1970). Since haptics respond to sound, and visuals prefer to use their eyes, it seemed appropriate to use them in a study of the effects of music on learning.

An earlier experiment by Raburn (1981) showed that background music was helpful to American Indian teenagers in their understanding of an art film.

Older studies using music as a background while subjects attempted to learn verbal material had proven inconclusive. Fendrick (1937) found that music distracted people who were reading difficult material. Whitely (1934) found that music bothered memorization of verbal material. Others (Henderson, Crews, & Barlow, 1945; Carlson & Hergenhahn, 1967) found that music had no particular effect on learning. Background music helped 8th and 9th grade students make higher scores on a silent reading test in one study (Hall, 1952), but seriously distracted students who were taking a test in another study (Fogelson, 1973). A couple of experiments looked at the effects of music

2

on arithmetic or mathematics. When background music was used in a fifth grade class where students were performing addition, subtraction, multiplication, and division, it had no effect (Engel & Engel, 1962). Madsen and Forsythe (1973) found that music improved the incidence of correct response to mathematics problems. Mann (1979) found that fourth grade students remembered stories better when they were accompanied by music and sound effects.

Great claims were made for a pedagogical technique called suggestopedia which used music as a background when students were attempting to learn facts. This method originated in Bulgaria and was first introduced to America by Ostrander and Shroeder in 1970, but its ability to increase learning was never documented empirically. It seems to depend more on hypnosis than on music for its effect, if any.

Music as a background to other media might qualify as multimedia, but if that medium also contained music to heighten the effects of a verbal presentation, an added background of music might act as noise. Noise is thought to be a form of psychological stress, and Jerison (1959) found it bad for sustained performance, but of no particular effect in short performances.

It was hypothesized that background music when added to a commercial film or filmstrip composed of visual and verbal

523

whe

tha

on

in

ta

bo

ví

bu

elem

elements and paced by occasional music will:

- lower the scores of a greater number of males than it will females.
- (2) lower the scores of visual individuals significantly.
- (3) raise the scores of non-visual (haptic) individuals significantly.

It is also hypothesized that the same background music when added to a lecture presentation will:

- lower the scores of more males than females.
- (2) lower the scores of visual individuals significantly.
- (3) not affect the scores of non-visual (haptic) individuals in a significant way.

These hypotheses are based on the widely held assumption that males are more visual than females. They are also based on previous research (Raburn, 1981) which showed that visual individuals were distracted by music in a sentence recognition task.

It is further hypothesized that when music is present at both presentation time and at testing time, scores of both visual persons and haptic persons will be lowered slightly, but not significantly so.

524

METHOD

At a university where General Psychology is one of the options to meet part of the general education requirements, three freshman psychology classes were chosen. They all met in the morning, in the same room, and were taught by the same teacher, a Ph.D. with 10 years of experience. Since it was impossible to randomly assign students to the treatment groups, a pretest was given on the information to be taught to them by one of three methods: film, filmstrip, or lecture tape. This pretest was given on a Wednesday before the instruction was subj€

out (

twent

cond:

the :

SCOT

non-"

those

on v

each

whic

clas

some

Some

chos

and

sent

of t

the

Your

filr

hus:

alit

given on the following Friday. It was the same test that would be given to them after presentation of the material to be learned. Each of the classes was given information through the same film, filmstrip, and lecture tape. One class had music at presentation time, one had music at both presentation and testing time, and one was a control group which had no music at all except what was present on the commercial products. The classes were rotated on each change of media so that each class was subjected to each type of treatment, and each class was a control group at one time during the experiment. It was felt that rotation of the treatments and the giving of pretests would offset to some degree the lack of random assignment of

5

ut of the classes for the statistical tests, and the same wenty people were used as subjects for all of the treatment onditions. That is, ten males and ten females were chosen and he scores of those people from each class were used as the cores to compare all of the media. Another ten visuals and ten on-visuals or haptics were randomly chosen from each class, and hose people were used to compare all of the media and its effect n visuals and haptics. Each experiment used 60 people, and ach person had 3 scores, one from each treatment condition hich ranged over the three media of instruction. Since the lasses varied in size from thirty to forty people, there was ome overlap in the two groups, male/female and visual/haptic. ome subjects chosen for the male/female experiment were also hosen for the visual/haptic experiment.

All media were approximately the same length (25 minutes) and the multiple-choice test was given immediately after preentation of the information by each medium. The first week if the experiment all classes had a filmstrip which dealt with the stages of human life: Adolescence to Old Age. Part six, oung Adulthood, and part 7, The Mature Adult were shown. These ilmstrips were accompanied by audiotapes which were paced by music. One month later all classes had a lecture tape on personlity which had been done by the psychology professor, and which

6

had no music as background or pacing. At the end of another four weeks, all of the classes were shown a film on mental illness which included music as part of its sound track. The name of the film was, "Abnormal Behavior in a Mental Hospital." No one was permitted to take notes. Studies on the effectiveness of note taking do not agree. For example, Weiland and Kingsbury (1979) showed that the act of taking notes improves both immediate and delayed recall. Ash and Carlton (1953) found that note taking interferred with learning when film was the medium of instruction.

Fem- Male

Male

Female.

Male

Female

T

S

Pretest scores were subtracted from posttest scores and the difference scores were used in a multivariate analysis. (See Table 1 for design.) Since these difference scores can sometimes be unreliable, an analysis of covariance was also done on each medium so that the pretest scores were the covariates and could be used to adjust for possible initial differences in knowledge among the treatment groups. T-tests were done on pretest and posttest scores in each medium to see if they were significantly different from each other, and a one-way analysis of variance was done between all three of the classes to see if they showed

7

## DESIGN

# Multivariate Analysis

	Lecture Class 1	Lecture Class 2	Lecture Class 3
	Treatment 2 *	Treatment 3 *	Treatment 1 *
Male	10	10	10
rem-	10	10	10
	Film Class 1	Film Class 2	Film Class 3
	Treatment 3 *	,Treatment 1 *	Treatment 2 *
Male	10	10	10
Female	` 10	10	10 .
	Filmstrip Class 1	Filmstrip Class 2	Filmstrip Class 3
	Treatment 1 *	Treatment 2 *	Treatment 3 *
Male	10	10	10
remale	10	10	10

Table 1

The same design was used for the visual/haptic analysis.

.

Substitute visual for male and haptic for female in this design.

\*Treatment l = Music at Presentation Time \*Treatment 2 = Music at Presentation Time and at Testing Time \*Treatment 3 = No Music

8

differences. To make the classes equal for these one-way analyses, students were drawn randomly from the larger classes until equality was achieved. Twenty-seven people was the smallest number used when testing the three classes for differences. onto ;

all b.

this 1

RESUL!

show ;

analy:

nedia

eithe:

score:

CL

CL

CL

Random selection of 10 males and 10 females were taken from each class to serve as subjects when testing the hypothesis of no difference in the effect of music by sex. Random selection of 10 visuals and 10 haptics as determined by Lowenfeld's SPT-1 test were chosen to serve as subjects when testing the hypothesis of no difference in the effect of music by perceptual type. Those who scored in the upper 5% and the lower 5% of the scores made were considered to be visuals and non-visuals (haptics) respectively. Missing data caused a reduction in the number of subjects used to fall from 60 to 54. Equal cells were needed for the multivariate analysis, so one person was removed randomly from each cell. This was not considered to be a serious reduction since 9 per cell gives a minimum power of .96 to detect differences of two or more standard deviations.

Music was chosen by a music professor and was recorded on tape. It was a string quartet; 2 violins, a viola, and a violoncello; chosen for its calm, unobtrusive, and major key qualities. It was a selection that is not widely known, "The Middle Quartets" by Beethovan, and it was recorded carefully

529

onto a tape so that loud portions could be softened to an overall blandness. Only one movement, Molto Adagio, was used, and this was repeated over and over for thirty minutes.

## RESUL'TS

Means and standard deviations of pretest scores did not show any differences between the three classes. A one-way analysis of variance of the classes using each of the three media of instruction showed no significant difference in either the raw posttest scores or in improvement (difference) scores. See Tables 1 and 2.

	PRE	TEST SCORES	
		Filmstrip	
CLASS	MEAN	S.D.	CORRELATION
1	14.57	3.48	.495
2	14.16	3.38	.735
3	14.46	3.06	.61
	,I	ecture Tape	
CLASS	MEAN	S.D.	CORRELATION
1	10.54	3.50	.71
2	11.37	3.92	.52
3	10.58	3.84	.492
		Film	
CLASS	MEAN	S.D.	CORRELATION
l	9.41	2.42	.573
2	9.97	2.93	.420
3	10.13	2.70	.484

Table 1
COMPARI	SON OF TH	HE SCORES OF	THE TH	REE PSYCHOLA	OGY CLASSES
	1	Filmstrip	1		1
	SS	*	df	MS	F
Raw Scores	32.16		2	16.03	.59
Difference scores	11.553		2	5.776	.820
		Lecture tape			- Car
	SS		df	MS	F
Raw Scores	19.00		2	9.5	.337
Difference scores	58.789		2	29.394	1.75
	4	Film			100
Raw Scores	8.98		2	4.49	.398
Difference scores	10.64	2011	2	5.32	.528

## Table 2

Results of these tests indicate that the assignment of students to the three classes is <u>as if</u> it were random, since the classes seem to be similar with respect to pretest scores, posttest scores, and improvement scores. Also, since correlations between pretest and posttest scores were not particularly high, difference scores can be considered reliable.

Results of the multivariate analysis using difference scores by sex showed no melody effects on film, filmstrip or lecture tape. There was no interaction, and no sex effect except when film was the medium of instruction. The F-test for sex in the film analysis was  $F_{1.48} = 4.03$ , p<.0505. Pairwise comparisons thai for exac by c

CO

di

wa:

pl

COL

11

controlled for error by Tukey's HSD method showed no significant difference in any one melody condition, but the overall difference was highly significant,  $\underline{t}$  (52) = 4.19,  $\underline{p}$ <.002. (See Figure 1 plot of means of males and females in the three treatment conditions for film.)



## Figure 1

Since the improvement of females was so much higher than that of males in the control group, pretest scores were compared for the two groups. Means of the pretest scores were almost exactly the same for males and females, varying from each other by only 0.8.

12

An analysis of covariance was performed on raw scores of the posttest, using pretest scores as the covariate. Results showed stronger evidence of a difference between males and females when the medium of instruction is film,  $F_{1,48} = 7.75$ , P < .01. (See Table 3.)

adj

sig:

fic

p<

Soi

Pere dif: Post pre

Melc

pre

Perc

Erre

Cori

Adjı

## FILM SUMMARY TABLE

(Comparing difference scores and posttest scores with pretest scores covaried out.)

SOURCE	SS	df	MS	F
Sex difference scores	37.50	1	37.50	4.03
Posttest adjusted by pretest scores (sex)	61.20	1 .	61.20	7.75
Melody difference score	s 5.77	2	2.88	.31
Posttest adjusted by pretest scores (melo)	22.47	2	11.235	1.42
Sex * Melody	12.44	2	6.22	.67
Error	447.111	48	9.3148	
Corrected total	502.83	53		
Adjusted error	379.41	48	7.90	1

## Table 3

The overall Wilkes Lambda Criterion was not significant, yielding  $F_{6,92}$ = .35, p<.90 for the interaction;  $F_{3,46}$  = 1.76, p< .167 for sex effect; and  $F_{6,92}$  = .75, p<.61.

Results of the multivariate analysis using difference scores by perceptual type showed no melody effects using the film and filmstrip, but did show melody effects when a lecture tape was the medium of instruction,  $F_{2, 48} = 4.54$ , p<.01.

13

There were no significant differences between visuals and haptics, but when the lecture tape was the medium of instruction the difference scores of haptics and visuals approached a significant difference,  $F_{1,48} = 3.51$ , p < .06. There was no interaction.

An analysis of covariance performed on posttest scores, adjusting for the pretest results gave a weaker, but still significant melody effect,  $F_{2,48} = 3.20$ , p<.05, and a significant difference between visual and haptic subjects,  $F_{1,48} = 7.55$ , p<.01. See Table 4.

# LECTURE TAPE SUMMARY TABLE

(Comparing difference scores and posttest scores with pretest scores covaried out.)

Source	SS	df	MS	F
Perceptual Type difference scores	71.185	l	71.185	3.51
Posttest adjusted by pretest scores (Perc)	192	1	192	7.55
Melody difference score	s 184.037	2	92.01	4.54
Posttest adjusted by pretest scores (Melo)	162.703	2	81.35	3.20
Perceptual Type * Melo	42.70	2	21.35	1.05
Error	973.777	48	20.287	
Corrected Total	1271.7037	53		
Adjusted error	1221.533	48	25.44	

Table 4

## 14

Pairwise comparisons showed visuals did significantly better than haptics in the melody at presentation time condition,  $\pm$  (51) = 2.74, p<.01. Music caused haptics to do worse and visuals to do better. Visuals improved when music was present and haptics did not. See Figure 2 for Plot of the Means.



DIFFERENCE MEANS FOR LECTURE TAPE

## Figure 2

The Wilkes Lambda Criterion showed an overall melody effect,  $F_{6,92} = 2.30$ , p < .04. The Hotelling-Lawley Trace was also significant for melody effect,  $F_{6,90} = 2.42$ , p < .03.

Posttest scores were much improved over pretest scores in all media. Correlated t-tests between pretest and posttest scores of the film, filmstrip, and lecture tape sessions showed a significant rise in posttest scores with each medium of instruction. The differences observed between the two sets of scores in each medium could not have occurred by chance but once in a thousand times. Although every correlated t-test was significant to .001, that does not necessarily mean that learning took place. Stake (1971) has pointed out that gain scores can appear to reflect learning that does not occur. In this case, however, correlations between pretest and posttest scores were only moderate so that more confidence can be placed in the reliability of the difference scores.

Because of the sex effect which showed film to be better for females than for males, additional tests were done on the media of instruction. All filmstrip scores, film scores, and lecture tape scores made by females, and those made by males, were put gether regardless of treatment condition. Results of the analysis of variance showed sex to be a significant factor,  $F_{1,180} - 4.61$ , p < .03. Media was also significant,  $F_{2,180} =$ 19.171, p < .001. Pairwise comparisons between means showed the lecture tape much better than the filmstrip for men, <u>t</u> (60)

16

= 4.65,  $\underline{p}$ <.001. The lecture tape was also better than the filmstrip for females,  $\underline{t}$  (60) = 2.02,  $\underline{p}$ <.05, and the film was also better than the filmstrip for females,  $\underline{t}$  (60) = 2.80,  $\underline{p}$ <.05. Although the improvement means for men and women were not significantly different in any one medium, the difference in the effectiveness of that media by sex was different. Film and lecture tape were better than the filmstrip for both men and women, but film was best for women and the lecture tape for men.

Another two by three ANOVA was done using visuals and haptics to compare film to lecture tape to filmstrip. Again, the lecture tape and film proved superior to the filmstrip. Media was significant,  $F_{2,66} = 9.15$ , <u>p</u><.001. Perceptual type was not significant.

## DISCUSSION

The hypotheses were not supported. Background music when added to a film and filmstrip did not lower the scores of males or of visuals significantly. There was no effect when bland background music was played along with a film or a filmstrip. There was no effect when the same music was played while the subjects took a test on the content of the film or filmstrip.

The same background music when added to a lecture presentation on tape, lowered scores of females more than it did males, but this drop was less than a two point difference in the mean

treatr

a sma.

of

fer

rai

WOI

sen

vis

wer

Bot]

cont

stuc

dist

are

The

in s

diff.

some

this

a tes

for v

a lec

CONCL

of the females who had music and the mean of the control group females. It was not significant.

Music did not lower the scores of visual individuals. It raised them. Apparently the task of recognizing the exact wording of a sentence is guite different from getting the sense out of an auditory verbal presentation. Music may distract visuals in an exacting task such as word recognition, but they were helped by the addition of music to the lecture tape. Both visuals and non-visuals improved more when music was continued throughout the whole presentation and the test. This study did not agree with the Fogelson study which found music distracting to students who were taking a test. Many variables are at work when music is added to a medium of instruction. The type of music is a factor, and so are individual differences in students. The same music may affect different people in different ways. It is possible that some people would find some music distracting on a test. The string guartet used in this study was not distracting to any group which was taking a test. It seemed to facilitate the making of high scores for visuals and haptics on a test given after instruction by a lecture tape accompanied by background music. CONCLUSIONS

It would be unwise to draw definite conclusions from such a small sample of people who were not randomly assigned to the treatment groups. Since they did seem to be evenly matched

18

according to comparisons of gain scores and pretest scores, it is appropriate to tentatively say that music can be a good addition to visual and/or verbal presentations. Background music in addition to music already present on a film or a filmstrip is superfluous. When no music accompanied the auditory verbal presentation on tape, males and females did just as well or slightly better than they did when music was added, but the addition of background music seemed to help visual students learn the information. It caused haptic scores to drop unless music continued through the testing time. This is somewhat puzzling. It may mean that haptics adjust to the music and begin to ignore it, but their scores surpass those of haptics in the control group, suggesting that music may help them to remember information that had accompanied the music earlier. Haptics and visuals are different from each other in their response to music as background to a lecture tape. Visuals outperform haptics except in the control group. Music may serve to mask other noises, and to focus attention on the medium of instruction. It may serve as an auditory image which provides additional information to the brain just as Paivio's visual images seemed to do (Paivio, 1972).

ef:

fi.

haj

as

tic

of

in

tic

sti

mu]

The sex effect showing film to be a better medium of instruction for women than it was for men, was a surprise. This experiment was not set up to compare the media of instruction to each other, but the tests that were done to check this

19

effect suggest that film and lecture tape are superior to filmstrip for both men and women and for both visuals and haptics. It is possible that this filmstrip was not as good as the film and the lecture tape in quality, or in the presentation of content. Research that matches quality and content of these three media should be done to see if this difference in effectiveness is a true one. All of the media of instruction were efficient in their ability to teach facts to these students so that they could make acceptable scores on a multiple choice test after exposure to the media.

20

5.10

## REFERENCES

	pai
Ash, P. and Carlton, B. J. The value of note taking during film learning. <u>British Journal of Educational Psychology</u> , 1953, <u>23</u> , 121-125.	Pai
Carlson, J. A., and Hergenhahn, B. R. Effects of rock-n-roll and classical music on the learning of nonsense syllables. <u>Psychological Reports</u> , 1967, <u>20</u> (3, pt. 1), 1021-1022.	Rab
Engel, A., and Engel, C. The effect of musical distraction upon performance efficiency of children. Journal of Educational Research, 1962, <u>56</u> , 45-47.	
Fendrick, P. The influence of music distraction upon reading efficiency. <u>Journal of Educational Research</u> , 1937, <u>31</u> , 264-271.	Rat
Fogelson, S. Music as a distractor on reading-test performance of eighth grade students. <u>Perceptual and Motor Skills</u> , 1973, <u>36</u> , 1265-1266.	Reç
Hall, J. C. The Effect of background music on the reading comprehension of 278 8th and 9th grade students. <u>Journal</u> <u>of Educational Research</u> , 1952, <u>45</u> , 451-458.	Sta
Henderson, M. T., Crews, A., and Barlow, J. A study of the effect of music distraction on reading efficiency. <u>Journal</u> <u>of Applied Psychology</u> , 1945, <u>29</u> , 313-317.	
Jerison, H. J. Effects of noise on human performance. <u>Journal</u> of Applied Psychology, 1959, <u>43</u> , 96-101.	
Lowenfeld, V. Tests for visual and haptical aptitudes. American Journal of Psychology, 1945, <u>58</u> , 100-112.	
Lowenfeld, V., and Brittain, W. L. <u>Creative and mental growth</u> . (5th ed.) New York: Macmillan, 1970.	
Madsen, C. K., and Forsythe, J. L. Effect of contingent music listening on increases of mathematical responses. <u>Journal</u> <u>of Research in Music Education</u> , 1973, <u>21</u> , 176-182.	
Mann, R. E. <u>The effect of music and sound effects on the</u> <u>listening comprehension of fourth grade students</u> . Un- published dissertation, North Texas State University, Denton, Texas, May, 1979.	
Ostrander, S., and Schroeder, L. <u>Psychic discoveries behind the</u> <u>iron curtain</u> . New York: Bantam, 1970.	
21	

- Paivio, A. Imagery and verbal processes. New York: Holt, Rinehart and Winston, 1971.
- Paivio, A. Symbolic and sensory modalities of memory. In M. E. Meyer (Ed.) <u>Third Western symposium on learning: Cognitive</u> <u>learning</u>. Bellingham, Wash.: Western Washington State College, 1972.
- Raburn, J. <u>Relationship of Melody and Perceptual Type To</u> <u>Performance on Recognition and Recall Tasks</u>. Unpublished dissertation, The University of Oklahoma, Norman, Oklahoma, May, 1981.
- Raburn, J. Field independence and the effect of background music on film understanding and emotional responses of American Indians. Lawton, Okla.: Cameron University, 1981. (ERIC Document Reproduction Service No. ED 196 412)

Regelski, T. A. Who knows where music lurks in the mind of man? New brain research has the answer. <u>Music Educator's Journal</u>, 1977, <u>63</u>(9), 31-38.

Stake, R. E. Testing hazards in performance contracting. <u>Phi</u> Delta Kappan, 1971, <u>52</u>, 583-589.

5.12

TITLE: The Computer Threat to Educational Technolog

ź

t T a a

т

N

a a to - d

u c r II in d d e

CI

DI DI CE

AUTHOR: Ronald G. Ragsdale

## THE COMPUTER THREAT TO EDUCATIONAL TECHNOLOGY

## Ronald G. Ragsdale The Ontario Institute for Studies in Education

Our educational practices are strongly shaped by our assumptions, usually implicit, including both our group assumptions and individual ones. They include our expectations about what students will have learned before reaching a certain level, what they can learn in a fixed period of time, and what factors external to the student will influence learning, such as materials, mode of presentation, classroom structure, etc.

The topic of discussion at this point, however, is not the general role of assumptions, but the specific role that assumptions play in the application of computers to education. The following discussion is not intended to be an exhaustive analysis of all possible assumptions, but rather a relatively quick consideration of some of the more important assumptions, to increase the sensitivity of the reader.

#### THE LAW OF THE HAMMER

00

Many of our assumptions regarding the use of computers are not explicit. One of these assumptions operates in a manner similar to the "Law of the hammer" which has been around for many years. The statement of the law is (roughly) "if you give a hammer to a two-year old, suddenly a lot of things will need hammering." If you change "hammer" to "computer", "two-year old" to "educator", and "hammering" to "computing", you have a description of the effect.

Many people like working with computers and, myself included, they try to find different uses for computers. This attitude has some positive aspects, in that new applications of computers (or hammers) are more likely to be discovered when they are applied in a great many contexts. Yet the damage that may occur, in both cases, hammer or computer, is likely to put an expensive price on the new information which is obtained. The assumption, in education, sometimes seems to be that an educational practice will be improved if it is done by a computer, or that something which is not worth doing will become valuable if done by computer. A chronic example of this assumption is seen in the overproduction of extensive statistical summaries which are rarely used.

#### CONSEQUENCES OF THE HAMMER

One of the consequences of searching for ways to use computers has been a tendency to build from computer strengths rather than to build toward student weaknesses. A special case of this is our tendency to use computers for instruction of skills which have become

TITLE: The Computer Threat to Educational Technolog

AUTHOR: Ronald G. Ragsdale

#### THE COMPUTER THREAT TO EDUCATIONAL TECHNOLOGY

## Ronald G. Ragsdale The Ontario Institute for Studies in Education

Our educational practices are strongly shaped by our assumptions, usually implicit, including both our group assumptions and individual ones. They include our expectations about what students will have learned before reaching a certain level, what they can learn in a fixed period of time, and what factors external to the student will influence learning, such as materials, mode of presentation, classroom structure, etc.

The topic of discussion at this point, however, is not the general role of assumptions, but the specific role that assumptions play in the application of computers to education. The following discussion is not intended to be an exhaustive analysis of all possible assumptions, but rather a relatively quick consideration of some of the more important assumptions, to increase the sensitivity of the reader.

## THE LAW OF THE HAMMER

0100

Many of our assumptions regarding the use of computers are not explicit. One of these assumptions operates in a manner similar to the "Law of the hammer" which has been around for many years. The statement of the law is (roughly) "If you give a hammer to a two-year old, suddenly a lot of things will need hammering." If you change "hammer" to "computer", "two-year old" to "educator", and "hammering" to "computing", you have a description of the effect.

Many people like working with computers and, myself included, they try to find different uses for computers. This attitude has some positive aspects, in that new applications of computers (or hammers) are more likely to be discovered when they are applied in a great many contexts. Yet the damage that may occur, in both cases, hammer or computer, is likely to put an expensive price on the new information which is obtained. The assumption, in education, sometimes seems to be that an educational practice will be improved if it is done by a computer, or that something which is not worth doing will become valuable if done by computer. A chronic example of this assumption is seen in the overproduction of extensive statistical summaries which are rarely used.

## CONSEQUENCES OF THE HAMMER

One of the consequences of searching for ways to use computers has been a tendency to build from computer strengths rather than to build toward student weaknesses. A special case of this is our tendency to use computers for instruction of skills which have become

#### THE MICROCOMPUTER THREAT

less important because of computers and other electronic technology, such as calculators. This is, no doubt, because it is easier to construct CAI lessons for tasks which computers can do very well.

Page 2

LF

all

re

15

in

al

al

(F

w

w

pi

e

ol re al P

tř

0

h

g

ir.

\$

15

fe C

łł.

\$

n

r

ő

r c

The discipline in which the greatest number of CAI programs exists is mathematics, particularly arithmetic skills, with one estimate being that "95% of the large, computer-managed packages are arithmetic programs." (EPIE Reports, 1981, p. 8)

In addition to the assumptions made about the use of computers in general, there are assumptions specific to particular kinds of applications. Assumptions play a particularly important role in simulation or simulation/game applications. Weizenbaum (1980) relates that an MIT graduate student, while deeply engaged in a game, was heard to say, "We ought to get more points for killing than for merely surviving." (p. 442)

This latter relationship is an example of an assumption about human behavior, made by the designer, the effects of which, although likely to be subtle, might be completely in opposition to what the designer desired. The most important assumption for the role of educational technology, however, is the research assumption.

#### THE RESEARCH ASSUMPTION

Underlying a general interest in the application of computers to education, there is often an assumption that educational research can have a positive influence on the ways in which computers are used in education. Is this assumption warranted? There are at least two lines of reasoning that suggest that it is not.

In 1965, the Learning Research and Development Center (LRDC) at the University of Pittsburgh had a computer system that would provide spelling drills as one of their many investigations into the uses of computers in education (for a more complete description, see Ragsdale, 1969). At that time, and over the following years, a number of other educational research institutions had similar systems. The major deterrent to the transfer of new techniques (about the computerized improvement of spelling) to the classroom was the cost of the equipment required.

The LRDC equipment included a Digital Equipment Corporation PDP-7 computer with a base price (not including options) in excess of \$40,000, plus a random-access audio unit that added at least another \$10,000. Prices of computers and other electronic equipment declined over the years, but a random-access audio unit was still a four-figure item in the late 1970's. Recently, the picture changed completely when Texas Instruments offered a spelling drill device that incorporated microprocessor, keyboard, and random-access audio for approximately \$50 (U.S.).

When a large corporation, like Texas Instruments, makes a decision to mass-produce an educational device at a low price, the technological impact is much greater than that of the accumulation of instructional knowledge by educational researchers. In fairness, it must be pointed out that research related to spelling drills was not a major priority at

#### THE MICROCOMPUTER THREAT

LRDC, or with other similar institutions, but the point is still valid. Similarly, it is not being alleged that the Texas Instruments device is devoid of any influence from educational research, but that the point is irrelevant. The careful accumulation of educational wisdom intended for institutional use can become irrelevant to educational practice when industry is able to (almost instantaneously) provide the necessary electronic technology, in an inexpensive form, directly to the student.

Another area of concern was outlined by Scriven (1981), when he asserted that although the widespread use of computers appeared to be inevitable, it did not follow that all applications of computers were similarly inevitable. He cited programmed instruction (PI) and performance contracting as examples of applications of instructional technology which had been rejected by the educational community, although it appears that they work when applied in a careful manner.

Programmed instruction is a particularly interesting case, since it has had a long and productive history in military and industrial applications, but was very short-lived within the educational establishment. A plausible explanation for this result is that the initial success of PI was based on carefully developed sequences prepared by experts, whereas the later rejection was based on a flood of material which was hastily prepared by untrained authors. One could also say that the schools saw the initial success of relatively expensive PI and then acquired the cheapest material that was available for their needs, or created their own, with the unsurprising result that the materials were not satisfactory.

If we look at the history of CAI, we may conclude that it is following the same path as PI. Over the past 20+ years. CAI systems and materials have been developed at a number of research sites. The production of materials has been expensive, requiring as many as 300 hours of effort to produce one hour of CAI instruction. There have been, however, generally good results from those large-scale efforts, such as CAN in Ontario and PLATO in the U.S., which have invested large amounts of skilled-labor time in their materials.

Up to this point, due to the expensive costs associated with CAI on large computer systems, there has been little personal experience with CAI in most schools. This situation is now changing very rapidly, as in the case with the spelling drills, and it is now possible for most schools and/or teachers to use or create CAI on microcomputers located in the classroom. Just as with PI, the CAI material which is now flooding the educational market is cheaper, but less carefully developed than the prototypes which have been shown to be successful in earlier research.

It should be pointed out, that a major share of the blame for poorly developed microcomputer CAI materials rests with the schools themselves. Because there is widespread copying of CAI program cassettes and disks, the authors can't anticipate revenue commensurate with the number of users of their programs and can't afford to invest much development time in the programs, unless they are major vendors who can afford to take the necessary steps to protect their work.

Even more discouraging, in my eyes, is the plan of some school boards to make CAI the major application for microcomputers, even though there is little material available and only a small portion of that is properly developed. The existence of CAI as a useful

#### THE MICROCOMPUTER THREAT

Therefore, not only is it questionable to assume that educational research can have a positive impact on the kinds of technology made available to the schools, as with spelling drills, but in some cases it seems that those effective methods which are discovered, such as PI and CAI, can be almost completely negated by premature and inadequate implementations within the educational system. Computers may be robust, in that people will need to use and understand computers in order to work and live, but some of their applications are fragile. As a result, although computers are not like teaching machines and language labs, in that they are a growing part of the everyday world, we must question the assumption that computers will be used in schools to do all the tasks which are best suited for computers. Those who hold a more optimistic view of the inevitability of CAI, such as Evans (1980), also tend to view PI as fatally flawed and Ignore the continuing success of carefully prepared programmed instruction.

There are some steps being taken to maintain centralized control over the uses of computers in education. One is the use of media such as videodiscs, which prevent copying and thereby allow expensive development costs to be recouped. Another is increased emphasis on expensive and complex packages such as word processing, which are unlikely to be developed locally and can be used as tools to assist students. At this point it is difficult to predict the eventual role(s) for computers in education. We must be as influential as possible in promoting effective roles.

## REFERENCES

- EPIE Report, Microcomputer courseware/Microprocessor games. Reports 98/99m, Stony Brook, NY: EPIE Institute, 1981.
- Evans, C. The micro millenium. New York: Viking Press, 1980.
- Ragsdale, R. G. The learning research and development center's computer assisted laboratory. In Computers in the psychology laboratory. Maynard, MA: Digital Equipment Corporation, 1969, 61-65.
- Scriven, M. Current developments in evaluation theory. Invited address presented to the American Educational Research Association, Los Angeles, April 13–17, 1981.
- Weizenbaum, J. Once more the computer revolution. In M. L. Dertouzos & J. Moses The computer age: A twenty year view. Cambridge, MA: MIT Press, 1980.

TITLE: Why Use Media Materials in University Instrucion? - Personal Beliefs of Selected Professors

AUTHOR: Anne L. Russell

Why use Media Materials in University Instruction? -Fersonal Beliefs of Selected Professors. prof

in ı

why

medi

all

prov

info

The

star

has

cent

and

pers

by Anne L. Russell Kelvin Grove College of Advanced Education, Brisbane, Australia.

Paper for presentation to the Research and Theory Division of A.E.C.T., Dallas, Texas, May 6, 1982.

## ABSTRACT

This descriptive, interview-based study of twenty selected university professors portrays personal beliefs concerning the use of media materials in university instruction.

Hour-long interview tapes were content analysed to discover reasons why these university professors choose to support their verbal lectures with media materials.

Though 70% of the respondents are untrained in instructional media use, all feel media materials are essential for effective teaching. Media materials provide variety, change of pace, and focus for transferring conceptual information in a manner that caters to individual student learning styles. The common experiences shared by the entire class provide valuable discussion starters.

Respondents' preference for using personally developed media materials has important implications for financial administrators, instructional media center directors, media librarians and educational technologists. Funds and facilities should be allocated to enable teaching faculty members to produce personally relevant media materials to integrate within their instruction. Why do individuals use media materials in their university instruction? My descriptive study reports an examination of the perspectives of twenty selected university media users. The complete study (Russell, 1981) involved an analysis of personal perceptions as to why, what, when, and how media materials are used in university instruction.

This paper will report findings related to the first of these four questions; namely 'why use media materials in university instruction?'.

The media materials identified for the study are limited to electronically augmented materials such as overhead transparencies, slides, 16mm films, 8mm films, filmstrips, videotapes, audiotapes, computers, and combinations of these formats.

## Rationale for the study

Research concerning the use of media materials to enhance learning has provided contradictory evidence as to their effectiveness in the learning process (Campeau, 1974; Jamison, Suppes, and Wells, 1974; Parkhurst, 1975; and, Schramm, 1977). While researchers look for evidence of media effectiveness an important variable seems to have been overlooked -- the teacher.

I believe the ways a teacher presents information to learners can influence the use and effectiveness of media materials in an instructional situation.

Some researchers (Tobias, 1966, 1969; Armsey and Dahl, 1973; Purdy, 1973, 1975; Dodge,1974; and Schramm, 1977) have studied teachers involved in mediated or programmed instruction; my interests concern those teachers who integrate media materials within their personal lecture presentations. Why do these teachers believe media materials need to be integrated into their personal verbal presentation?

## Methodology

Only faculty members at the University of Oregon who were known to use media materials frequently in their instruction were selected to participate in this study. In consultation with the staff of the Instructional Media Center and students from many subject areas in the University, I formulated a list of faculty members who use media materials in their instruction. Individuals who taught less than three courses during the academic year and who were not full time faculty members were eliminated from the list; graduate teaching fellows and tutors were also eliminated.

2/

I selected twenty professors, one from each of the following subject departments of the University of Oregon: Anthropology, Architecture, Art Education, Art History, Biology, Dance, Education, Education Policy and Management, Film and Television Studies, Geography, German, Health Education, History, Journalism, Marketing, Music, Psychology, Recreation and Park Management, Sociology, and Spanish.

## Profile of the study group

Teaching status: The respondents comprised: one senior instructor, seven assistant professors, six associate professors, and six full professors.

Sex: The study group approximated the ratio of male and female faculty members at the University of Oregon -- sixteen males (80%) and four females (20%) took part in the study.

Age: The ages of the respondents ranged from early thirties to early sixties.

Academic qualifications: Fourteen (70%) of the respondents have Ph.D. or Ed.D. degrees.

Number of years teaching in higher education: The average number

of years respondents have taught at college or university level is 15 years. Every respondent had taught at this level for at least four years.

Academic preparation in media production or use: Six (30%) of the respondents have formal training in media production, or the use of media materials for education.

Location: The University of Oregon is a research oriented university where faculty members are required to publish books and articles in quality research journals, in addition to normal university teaching, advising, and committee responsibilities. At the time of the study the University was suffering large financial cuts and this factor was frequently mentioned by the study group when discussing costs and quality of university facilities affecting their use of media materials in instruction.

#### Development of the data gathering instruments

A combination of questionnaire and personal interview was used to collect data for this descriptive study. The questionnaire and interview schedule were each developed specifically for this study.

The self-administered questionniare was presented to each respondent at an initial twenty minute interview. The responses provided basic information related to the background experiences of the respondents concerning their training in, and use of media.

The main (hour long) interview was recorded on audiotape. This interview was designed to encourage respondents to explore and report their reasons for developing instructional strategies that require the use of media materials.

In relation to the general question 'why use media materials?' I asked

3/

specific questions pertaining to (1) early media related influences, (2) non-teaching media experiences, (3) preferred instructional strategies, (4) beliefs about student learning, and (5) media as a communication tool.

The question sequence of the main interview was flexible in order to accomodate the natural direction of conversation. All questions were covered in each interview.

Both the questionnaire and main interview schedule were pilot tested and revised.

## Analysis of the data

The data collected from the questionnaires were translated into frequencies and averages. The tape-recorded interviews were systematically analysed and interpreted through content analysis. The content analysis was carried out by:

- Listening to each of the tapes and transcribing significant information to provide part-transcripts approximately sixteen pages in length.
- The part-transcripts were analysed for content pertaining to the questions posed to the respondents.
- This content was further categorized into sub-headings pertaining to each interview question.

#### The findings

The findings are best reported in the words of the respondents. Words of wisdom and enthusiasm came in all directions in the twenty interviews. Though 70% of the respondents were untrained in media use, their gut level response to my questions produced some textbook statements regarding the theory of media materials use in instruction.

The selected professors reported a personal need to integrate media materials into their instruction. The content analysis of the

main interviews revealed the following typical comments and specific insights concerning why these professors elect to use media materials within their personal lecture presentation.

1. Early media-related influences:

I guess I would have benefitted with some formal training in (use of media). Maybe I would have run on to these things a long time ago. I assume that there are some things that I am doing now that I can improve on if I had some assistance.

Present use of media materials does not necessarily stem from

training in production and/or use of media materials.

I can't remember being influenced by a professor. But I can see where instruction I had along the way would have been enhanced by media. I am quite visual.

Present use of media materials does not necessarily stem from influences of a powerful role model.

Non-teaching media experiences:

My use of radio and television (for pleasure) has a lot to do with two things. The content of what I am presenting, because I am kind of like a sponge . . . I am absorbing things and wondering how I can use them. From the content standpoint the media provides me with a lot of information. Secondly, the manner of presentation. If I see something in a film that I really like in the terms of technique I wonder how I could ever use that. Is there some way that I could copy that or adapt it, or adjust it? . . . I am constantly looking for examples.

Mass media can be a source for instructional and informational ideas, and present awareness of current public interest in related subject areas.

Slide taking I think for me and a lot of architects has gotten to be like note taking or sketching used to be. Its quicker and less edited, actually that's also its weakness. . . I take slides according to whim and feeling. . . I take slides of anything that occurs to me to be a good slide to have. I sometimes do that methodologically but not usually. Usually I take them and then make sense out of them later.

Slides taken for recreational purposes are likely to be incorporated in class instruction.

3. Preferred instructional strategies:

Media gives variety and excitement to a class that books and lectures alone don't give.

Media materials can provide variety or change of pace.

My class happens to be one hour and twenty minutes long which is a long haul for anybody to talk. I have discovered that if I use a film in that class period it gives focus to discussion. I can use that as one of a variety of things I want to do during a given class session.

Media materials can provide a focus for concepts being taught. Media materials can be used as building blocks to build on basic information provided by the teacher.

> I have become more and more aware -- the longer I teach, the more material is sent to me. The more things are not so awesome. If I have taught a class one or two times I have a certain foundation to it and I am always looking for new things. As you teach longer you start to become aware of more resources.

Media-related instructional strategies are continually explored, developed and refined by each teacher to develop a personal repetoire of successful media-related instructional strategies.

> Teaching is like a performance, and that is why media has to be used, you are a performer every time you get up to teach. I am a perfectionist so I want those performances to be not just good but excellent, and unless you come across with some stimulating information it is not going to be that. It is a performance and media is one of the supporting characters. It helps you a lot -- it levels -there are some days when you don't really have the energy for teaching in the late afternoon -- media can pick you up and the class up.

Media-related instructional strategies are accommodated to parallel personal beliefs about teaching.

4. Beliefs about student learning:

The more variety you can get in the materials that you use, the more opportunities that something will really click with the students. . . Visual and audio combinations of materials are processed differently. Some people relate very strongly to visual imagery.

The use of media materials can enhance instructional strategies in order to cater to the individual learning styles of students.

Whenever I think about media and teaching . . . I think about the little exposure or opportunity for most students to see dances of other cultures. . . To be able to go into a culture and see a dance from the way the people who created that form see it. At least as close as we can when you think you see it through the eye of the camera and not as a person sitting next to and feeling the body heat of somebody else.

0/

The use of media materials can provide the opportunity to simulate reality for students.

5. Media as a communication tool:

I use media to present a large amount of information that then becomes common to the group . . . I can assume a certain common experience from which to launch.

Media materials can provide common experiences to be shared by the entire class.

Media tends to become very passive if you let it. . . (In a class) I ensure that there is time for the expressive part that follows the receptive part. Just the passive receptiveness (of media) is very limiting. Films, like television, are experienced by receptors on the brain . . . I think that they are received differently if there is an expectation that there is going to be a response to (the media presentation). I try to take care of the other side of communication by expecting the student to follow up and to evaluate or respond in some way. Films then do not become entertainment -- but become part of a communication process which is going to require something (of the students) by way of language expression.

Media materials can provide passive stimuli to be followed by active student expression.

Media materials give a tremendous amount of control. You control the information that is there, you control the emotional tone, you capture the students' sensory systems. . When you darken the room and you present two sensory modes at the same time, you have captured the person and you essentially control (the information flow). It also moves fast enough so that continuous attention is necessary.

Media materials can regulate the flow of information within the classroom.

> Use of media demonstrates I am thinking ahead and trying to figure out ways of making subject matter interesting.

The presence of media materials in instruction can indicate teacher preparation and concern for the student learning situation.

#### Discussion

Though the results of this research study cannot be generalised beyond the selected professors at the University of Oregon, certain factors pertaining to why media materials are used in instruction can

7/

be discussed. What should be done about those teachers who do not use media materials in instruction?

Professors who use media materials to supplement their verbal instruction tend to use personally developed materials inspired by their non-teaching media-related experiences. They feel comfortable using these materials as extensions of themselves. Should all teachers be encouraged to use media materials, even if they do not feel comfortable doing so?

In spite of a lack of formal educational technology courses these professors intuitively believe each learner processes information differently, and therefore the use of media materials will provide the best instructional situation for a variety of learners. Should teachers who do not use media materials be encouraged to take educational technology courses?

The respondents of this study have developed their skills over many years of teaching and seem to be aware of the need to use each media format for a specific instructional purpose. Is it possible to identify specific media formats appropriate to specific instructional instances?

#### Implications

Interviews with professors, from a variety of subject areas, who frequently use media materials, have provided insights into why media materials are used in their university instruction. Implications from this study are relevant for teachers, university and college administrators, media center directors, media librarians, educational technologists, and media researchers.

- Teachers from a variety of subject areas should consider the use of media materials for improving their instruction and subsequent student learning.
- University and college administrators should consider funding projects related to media production where the teachers are to

be involved in the production process.

- Media center directors should consider offering extensive production services, support staff, and workshops to help teachers produce personally relevant media materials.
- 4. Media librarians should consider purchasing fewer commercial media kits for the use of facultv and, instead, provide financial support for the purchase of raw materials such as film, acetate sheets, videotapes, etc. (This does not negate the need for commercially produced media kits suitable for individual student study and enrichment.)
- Educational technologists should be directed by insights from this and similar studies as they consult with, or teach, higher education faculty.
- 6. Media researchers should replicate this study in other university and college situations in order to support the conclusions presented in this study. (The study has been replicated at a community college in Oregon (Garrison, 1981). The results support the findings reported here.)

In conclusion, attention should be given to provide opportunities for teaching faculty to produce personally relevant media materials to integrate within their instruction.

9/

## REFERENCES

- Armsey, J.W. and Dahl, N.C. An inquiry into the uses of instructional technology. N.Y., Ford Foundation Report, 1973.
- Campeau, R.L. Selective review of the results of research on the use of audiovisual media to teach adults. <u>AV Communications</u> Review, 1974, 22(1):5-30.
- Dodge, M, et al. How teachers perceive media. <u>Educational Technology</u>, 1974, 14:21-24.
- Garrison, J. (personal communication, masters thesis in progress) University of Oregon, College of Education, 1981.
- Jamison, D., Suppes, P., and Wells, S. The effectiveness of alternative instructional media: A survey. <u>Review</u> of Educational Research, 1974, 44:1-69.
- Parkhurst, P.E. Generating meaningful hypotheses with aptitudetreatment interactions. <u>AV Communications Review</u>, 1975, 23(2):171-183.
- Purdy, N.L. <u>A case study of acceptance and rejection of innovation</u> by faculty in a community college. Ed.D. dissertation, University of California, 1973.
- Purdy, N.L. Community college instructors and the use of new media: Why some do and others don't. <u>Educational technology</u>, 1975, 15(3):9-12.
- Russell, A.L. The use of media materials in instruction as reported by selected faculty of the University of Oregon. Ph.D. dissertation, University of Oregon, 1981.
- Schramm, W. The researcher and the producer in ETV. <u>Public</u> Telecommunications Review, 1977, 5(4):11-21.
- Tobias, S. Lack of knowledge and fear of automation as factors in teachers' attitudes toward programmed instruction and other media. AV Communications Review, 1956, 14:99-109.
- Tobias, S. Effects of attitudes to programmed instruction and other media on achievement from programmed materials. AV Communications Review, 1969, 17:199-206.

# TITLE: The Impact of Mediated Instruction on the Formation and Change of Attitudes

AUTHOR: Michael R. Simonson

561

Titl

Auti

Title: The Impact of Mediated Instruction on the Formation and Change of Attitudes

Author: Michael R. Simonson Associate Professor of Secondary Education NO31 Quadrangle Building Iowa State University Ames, Iowa 50011 (515) 294-6840

## The Impact of Mediated Instruction on the Formation and Change of Attitudes

In 1931, Thurstone was able to demonstrate that attitudes can be changed with media. Two films depicting Chinese favorably or unfavorably were shown to groups of students. While this type of research would not be socially acceptable today, it was found that attitudes towards Chinese were changed in either a positive or negative direction, depending on the intent of the motion picture. Thurstone's initial efforts provided a foundation for a large number of research studies on the relationship between attitude formation and change and persuasive messages delivered by media. A review of over 200 of these studies by Simonson (1979c; 1980) are the basis for the discussion below.

This paper will discuss why attitude media research is important, will review the current state of the art of research in this area, will present the problems researchers in this area have encountered, and will make recommendations for future research needs.

## Why Study Attitudes?

A critic of attitude research might ask several questions about the importance of this area of research.

Question #1 - What is an attitude?

- #2 Why should research on the relationship between attitude and media be conducted?
- #3 How are attitudes measured?
- #4 How are messages constructed so attitudes are influenced?

## #1 - What is an attitude?

Attitude has been a difficult concept to adequately define, primarily because it has been defined by so many, but also because of its many lay uses and connotations. One of the earliest, and most widely accepted, definitions of attitude was proposed by Thomas and Znaniecki (1918). They defined attitude as:

A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related (Thomas and Znaniecki, 1918).

In other words, while attitudes are latent and not directly observable in themselves, they do act to organize, or to provide direction to, actions and behaviors that are observable. Also, attitudes vary in direction, either positive or negative; in degree, the amount of positiveness or negativeness; and in intensity, the amount of commitment with which a position is held (Fleming and Levie, 1978).

Additionally, attitudes have three components: affective, cognitive, and behavioral (Zimbardo and Ebbeson, 1970). The affective component is said to consist of a person's evaluation of, liking of, or emotional response to some object or person. The cognitive component is conceptualized as a person's beliefs about, or factual knowledge of, the object or person. The behavioral component involves the person's overt behavior directed toward the object or person.

By applying these definitions and explanations researchers have attempted to evaluate the impact various instructional procedures have had on attitude formation and change.
## #2 - Why media-attitude research?

Most educational endeavors, including research, are concerned with producing or evaluating human behavior. The improvement of achievement and the modification of unacceptable or discordant actions are examples of the type of behavioral outcomes that often concern educators. Research dealing with the media-attitude (M-A) relationship has often attempted to determine if there is an identifiable relationship between what a student likes or dislikes about the form in which a concept is presented and how much is learned. The media-attitude-achievement link appears to be present because:

- A positive link between learner attitude toward content information and achievement has been identified by numerous researchers (Fenneman, 1973; Greenwald, 1965, 1966; Levy, 1973; Perry and Kopperman, 1973; Simonson, 1977; Simonson & Bullard, 1975)
- A preference (affect) for mediated instruction by learners has been found in experiments conducted by several media researchers (for example, Dambrot, 1972; Redemsky, 1959).

While this positive link between attitude and achievement has been identified by some, most researchers have been reluctant to propose any cause and effect relationship between these two learner variables. The reason for the researcher to be concerned with attitude positions resulting from instruction should not be based primarily on the impact of attitude on achievement. Rather, the development of a more favorable attitude toward instruction or subject area is a desirable end in itself. Fleming and Levie (1978) have proposed several reasons why the instructional developer should be interested in the attitudes of students. First, most teachers would agree that there are cases when it is legitimate, and important, to urge learners to accept the truth of certain ideas. In

- 3 -

other words, to promote an attitudinal position. Second, as stated above, while the relationship between attitudes and learning is unclear it seems to be common sense that students are more likely to remember information, seek new ideas, and continue studying when they react favorably to an instructional method and certain content areas. Third, the educator should be made aware of procedures that are likely to influence attitudes in one direction or another so that bias can be reduced when inappropriate. Last, attitudes toward instruction felt by learners can tell the teacher a great deal about the impact of that instruction on the learning process. In other words, we need to assess the opinions of our students toward the learning activities we are subjecting them to, if for no other reason than to improve the quality of our procedures.

# #3 - How attitudes are measured.

Since attitudes are defined as latent, and not observable in themselves, the researcher must identify some behavior that would seem to be representative of the attitude in question so that this behavior might be measured as an index of the attitude construct. This characteristic of attitude measurement is justifiably the most criticized limitation of this area of educational evaluation. However, without going into the question of the overall validity of attitude measurement, there are several generally recognized procedures used to determine an individual's, or group's attitude toward some object or person. It is those procedures that are described below.

## Characteristics of Measurement

Before procedures for measuring attitudes are discussed, there are several characteristics of measurement, in general, that should be

- 4 -

considered in order to determine if an evaluation technique is an effective one. Good tests have these characteristics. They should:

- be valid -- the instrument must be appropriate for what needs to be measured;
- be reliable -- the measure should yield consistent results;
- be fairly simple to administer, explain, and understand -- generally, the measures that yield a single "score" of an attitude position epitomize the intent of this characteristic, although the single "score" may be deficient in meeting the intent of other characteristics of good measurement; and
- be replicable -- someone else should be able to use a measure on a different population, or in a different situation, to measure the same attitude.

## Categories of Attitude Measurement

There are four categories, or approaches, for collecting attitude information. These approaches are:

- self-reports -- where the members of a group report directly about their own attitudes;
- reports of others -- where others report about the attitudes of a person or group;
- sociometric procedures -- where members of a group report about their attitudes toward one another; and
- records -- which are systematic accounts of regular occurrences, such as attendance reports, sign-in sheets, library check-out records, and inventories.

Within each of these categories there are strategies for measuring attitude-related behaviors. Most commonly, attitude measurement is

- 5 -

accomplished by one of the following techniques:

- 6 -

- questionnaires;
- o rating scales;
- interviews;
- written reports;
- observations; or
- sociometrics

A specific strategy for attitude measurement should be chosen that is appropriate for the type of attitude construct of interest, the type of learners, and the situation being examined. (See Henerson, 1978, for specific details.)

## Process for Attitude Measurement

Any attempt at measurement, including the evaluation of attitude, requires that a systematic process be followed. Such structured procedures do not guarantee an effective measurement, but they will increase the likelihood of this occurring. Generally, there are six steps to be followed during the attitude measurement process.

- Identify the attitude construct to be measured.
- 2. Find an existing measure of the attitude construct.
- Construct an attitude measure, if an existing measure is not available.
- Pilot test the measure on a group similar to the one to be evaluated.
- 5. Obtain and approve reliability and validity data.
- Revise the measure and use it. (See Simonson, 1979a, for a complete discussion of attitude measurement.)

## #4 - How are attitudes changed by media?

Psychological researchers have proposed a number of theories of attitude change (Insko, 1967). While these theories provide general information about the attitude change process, they are not especially useful to the instructional developer who wants to design instruction that is intended to change attitudes, or to the researcher who wants to evaluate the impact of some media treatment on an attitude variable.

- 7 -

Based on a review of over 200 research studies dealing with attitude formation and change and instructional media, Simonson (1979b) was able to propose six guidelines that if included in the planning, production or use of instructional media would hypothetically contribute to the development of desired attitude outcomes in learners. These guidelines were an attempt to translate general theoretical information and specific research results into a series of procedures that could be reliably applied in the message design process.

These six guidelines, and a sample of the research studies that support them are: (Note: Refer to Simonson, 1979, for a more complete discussion).

Guideline #1: Learners react favorably to mediated instruction that is realistic, relevant to them, and technically stimulating. (Levonian, 1960; 1962; 1963; Seiler, 1971; Klapper, 1958; Croft, et al., 1969; Donaldson, 1976; Booth and Miller, 1974; Winn and Evertt, 1978; Ganschow, 1970)

wi

st

ev

(K

Guideline #2: Learners are persuaded, and react favorably, when mediated instruction includes the presentation of new information about the topic. (Jouko, 1972; Knowlton

and Hawes, 1962; Peterson and Thurstone, 1933; Levonian, 1960, 1962, T963)

- Guideline #3: Learners are positively affected when persuasive messages are presented in as credible a manner as possible. (Kishler, 1950; Seiler, 1971; O'Brien, 1973)
- Guideline #4: Learners who are involved in the planning, production, or delivery of mediated instruction are likely to react favorably to the instructional activity and to the message delivered. (Erickson, 1956; Coldevin, 1975; Simonson, 1977; Goldman, 1969)
- Guideline #5: Learners who participate in guided post-instruction discussions and critiques are likely to develop favorable attitudes toward delivery method and content. (Allison, 1966; Fay, 1974; Domyahn, 1972)
- Guideline #6: Learners who experience a purposeful emotional involvement or arousal during instruction are likely to change their attitudes in the direction advocated in the mediated message. (Janis and Feshbach, 1953; Rogers, 1973; Miller, 1969)

While these guidelines are derived from research studies that dealt with attitude formation and change, it is important to remember that the studies were conducted prior to the development of the guidelines. Post-hoc evaluation of each guideline and of groupings of guidelines has just begun (Kloock, Simonson and Cook, 1982; and Simonson, 1982; for example).

- 8 -

## Problems in Media-Attitude Research

Although this discussion does not attempt an in-depth analysis of research and research design, there are four prevalent characteristics that often have marred M-A research.

## Definitions

"Attitude," a difficult concept to define, has been used in such a broad, all-inclusive way that a single definition used by all attitude researchers is not possible. However, it is imperative for future research that whenever "attitude" is measured the experimenter define what is meant by that term in that research situation. This definition should be based on attitude literature and should be stated clearly for the research consumer. A common fault of the research was the failure to define "attitude".

## Measurement

It has been said that an experimental treatment is only as good as the measure used to determine its success. The measures used in studies reported in much of the media-attitude literature often have been faulty. In more than 50% of the 200 studies reviewed by Simonson (1979c, 1980) no validation of the attitude measurement tool appeared to have been attempted. Fewer than 20% reported any descriptive information about their attitude tests. Most measures seemed to have been prepared locally and intended for use only once--in the specific study reported.

## Design

Studies that were conducted prior to Campbell and Stanley's (1963) publication on research design can possibly be forgiven for not using generally accepted experimental procedures to test attitude hypotheses.

- 571

- 9 -

ob 11

re:

fe

ba

0f

re

me

wa

th

sh

qu

Fo

in

tr

in

10

CO

In:

foi Re Of greater concern was the poor design and control procedures used in more recent studies. This problem was compounded by the fact that attitude measurement often was not of primary concern to many researchers, but rather was a post-hoc analysis that had peripheral importance and connection to the main purposes and design of the study. Attitude hypothesis testing should demand the same design rigor as the testing of any experimental question.

#### Follow-Up

Long-term follow-up of the results of treatments is almost nonexistent in M-A research. Many critics of attitude research consider attitudes transitory and attitude changes short-lived. While there is some evidence in the psychological literature on attitudes to refute that criticism, the long-term consequences of mediated instruction on learner attitude needs considerably more evaluation.

## Future Research Needs

222 3

the state of the sector of

It often seems much easier to criticize the literature of our profession than to create or recommend. The observations listed above were based on an in-depth review of the M-A research. These trends seemed obvious and would have been obvious to any serious student of the M-A literature. It follows that these trends suggest needs for future research.

## Instrumentation

Attitude measurement is difficult, but difficulty is a poor excuse for the use of haphazardly constructed and unvalidated measurement tools. Reliability of attitude scales can and should be determined before use.

- 10 -

Measures should be pilot tested, and this information, as well as all descriptive information concerning measurement instruments used to test M-A hypotheses, should be reported.

While attitude scales (Likert and Guttman, for example) probably will continue to be the most widely used measures of attitude, other methods of measuring attitude, such as galvanic skin response and heart and breathing rates, should continue to be explored.

Above all, the reader of M-A research results should be informed of the process used to obtain the data.

## Experimentation

The carefully constructed and controlled experiment is certainly not the only method for M-A hypothesis testing, nor should it be. However, in the initial stages of exploration into the interaction between media and attitude this type of controlled study seems to provide the greatest generalizability and strongest foundation for future research and theory building.

## Media-Attitude-Aptitude Interaction

The interaction between the variables that characterize a certain type of medium and the variables of learning in the affective domain seems to provide the most fertile ground for future research efforts. For example, one could attempt to determine whether the number and type of visual cues of a medium have any relationship to attitude change and formation for different age groups. Another effort might be directed toward developing a media hierarchy based on some variable of media, such as degree of abstraction of message, that could be used to predict attitude formation related to controversial topics.

This type of research would be in contrast to the more generally found,

- 11 -

ship are

bu1

tov

eva

anc

of

att

num

The

see

in .

resi

atui

DOS1

the

drav

tior

area

rela

have

but less generalizable, studies in which the attitude of a group of learners toward a specific lesson, as influenced by a category of media types, was evaluated.

- 12 -

Obviously, the analysis of the relationship between media characteristics and student learning styles when attitude change is the dependent variable of the research study is an important area for future research. ATIattitude studies have not been reported in the literature in any great number and would seem to be worthy of future research effort.

### Theory-Based Research

Much M-A research has been conducted in a theoretical vacuum. There seems to have been little or no attempt to relate attitude results obtained in experimental situations to any theoretical framework. In fact, many researchers failed to include any review of attitude research in the literature section of their studies. Much of the evaluation of attitude was post hoc and was of only tangential importance to the main objectives of the published study. It seems imperative that future M-A research efforts draw more carefully upon the literature on attitude change and on perception research for a theory base, until the body of credible data in the M-A area is large enough to begin formulating a theory base more directly related to the use of media in instruction.

#### Summary

Attitudes can be defined and measured. There seems to be a relationship between attitudes and some behaviors, and the attitudes of learners are definitely influenced by mediated instruction. In the literature there have been a sufficient number of studies reported that examined the

relationship between attitude positions and message design so that a tentative set of guidelines for the relationship between these two variables could be proposed. In the future, these guidelines require validation and revision so that a more definitive set of recommendations can be proposed. It may be that attitude formation and change is a unique consequence of mediated instruction. Only careful research by dedicated

researchers can say for sure.

## References

- Allison, R. W. The effect of three methods of treating motivational films upon attitudes of fourth, fifth, and sixth grade students toward science, scientists, and scientific careers (Doctoral dissertation, Pennsylvania State University, 1966). <u>Dissertation Abstracts</u>, 1966, <u>28</u>, 994.
- Booth, G. D. and Miller, H. R. Effectiveness of monochrome and color presentations in facilitating affective learning. <u>AV Communication</u> <u>Review</u>, 1974, <u>22</u>, 409-422.
- Campbell, D. T. and Stanley, J. C. Experimental and quasi-experimental designs for research on teaching. In N. L. Gage (ed.), <u>Handbook of</u> <u>Research on Teaching</u>. Chicago: Rand-McNally, 1963.
- Coldevin, G. O. Spaced, massed, and summary as review strategies for ITV production. <u>AV Communication Review</u>, 1975, <u>23</u>, 289-303.
- Croft, R. G.; Stimpson, D. V.; Ross, W. L.; Bray, R. M.; and Breglio, V. J. Comparison of attitude changes elicited by live and videotape classroom presentations. <u>AV Communication Review</u>, 1969, <u>17</u>, 315-321.
- Dambrot, F. General psychology over closed-circuit television. <u>AV Communi-</u> cation Review, 1972, 20, 181-193.

5:75

- 13 -

Fer

Doi

Doi

Er

Fa

Fle

Gar

Go1

Domyahn, R. A. The effects of a nonpersuasive film, a specially designed persuasive critique, and a nonpersuasive group discussion on attitude and retention of information (Doctoral dissertation, University of Iowa, 1972). <u>Dissertation Abstracts International</u>, 1973, <u>33</u>, 6586A. Donaldson, J. Channel variations and effects on attitudes toward physically

disabled individuals. <u>AV Communication Review</u>, 1976, <u>24</u>, 135-144. Erickson, C. W. H. Teaching general science through film production.

AV Communication Review, 1956, 4, 268-278.

- Fay, F. A. Effects of a film, a discussion group, and a role playing experience on architecture student's attitudes, behavioral intentions, and actual behavior toward barrier free design (Doctoral. dissertation, University of Illinois, 1974). <u>Dissertation Abstracts</u> <u>International</u>, 1974, <u>34</u>, 6445A.
- Fenneman, G. C. <u>The validity of previous experience, attitude, and</u> <u>attitude toward mathematics as predictors of achievement in freshman</u> <u>mathematics at Wartburg College</u>. Unpublished doctoral dissertation, University of Northern Colorado, 1973.

Fleming, M. and Levie, W. H. <u>Instructional message design</u>. Englewood Cliffs, New Jersey: Educational Technology Publications, 1978.

- Ganschow, L. H. et al. <u>Stimulating educational information seeking and</u> <u>changes in student attitude toward vocational education by videotape</u> <u>and film presentations</u>. Palo Alto, California: American Institute for Research in the Behavioral Sciences, 1970. (ERIC Document Reproduction Service No. ED 043 778).
- Goldman, B. A. Effect of classroom experience and video tape self-observation upon undergraduate attitudes toward self and toward teaching. Washington, D.C.: American Psychological Association, 1969.

- Knowlton, J. and Hawes, E. Attitude: Helpful predictor of audiovisual usage? AV Communication Review, 1962, 10, 147-157.
- Kloock, T.; Simonson, M.; and Cook, S. Field dependence, attitude change and instructional media. Paper presented at the 1982 Convention of the Association for Educational Communication and Technology, Dallas, Texas, 1982.
- Klapper, H. L. Closed-circuit television as a medium of instruction at New York University, 1956-1957. (A Report on New York University's Second Year of Experimentation with Television in College Classrooms). New York University, 1958.
- Kishler, J. P. The effects of prestige and identification factors on attitude restructuring and learning from sound films. University Park, Pennsylvania: The Pennsylvania State University, 1950. (ERIC Document Reproduction Service No. ED 053 568)
- Jouko, C. The effect of directive teaching materials on the affective learning of pupils. Jyvaskyla, Finland: Institute for Educational Research, Report Number 139, 1972.
- Janis, I. L. and Feshbach, S. Effects of fear-arousing communications. Journal of Abnormal and Social Psychology, 1953, 48, 78-92.
- Henerson, M. E.; Morris, L. L.; and Fitz-Gibbon, C. T. How to Measure Attitudes. Beverly Hills, California: Sage, 1978. Insko, C. H. Theories of attitude change. New York: Appleton, 1967.
- Greenwald, A. G. Effects of prior commitment on behavior change after a persuasive communication. Public Opinion Quarterly, 1966, 29, 595-601.
- Journal of Personality, 1965, 33, 370-391.
- Greenwald, A. G. Behavior change following a persuasive communication.

- 15 -

0'B1

Lei

Lei

Lev

Lev

Mi1

Perr

Pete

Reder

Roger

- Levonian, E. Development of an audience-tailored film. <u>AV Communication</u> <u>Review</u>, 1960, 8, 62-68.
- Levonian, E. The use of film in opinion measurement. <u>AV Communication</u> <u>Review</u>, 1962, <u>10</u>, 250-254.
- Levonian, E. Opinion change as mediated by an audience-tailored film. AV Communication Review, 1963, 11, 104-113.
- Levy, J. Factors related to attitudes and student achievement under a high school foreign language contingency contract. Unpublished doctoral dissertation, University of Southern California, 1973.
- Miller, W. C. Film movement and affective response and the effect on learning and attitude formation, <u>AV Communication Review</u>, 1969, <u>17</u>, 172-181.
- O'Brien, S. J. The effect of television instruction on problem solving attitudes of fifth and sixth grade students (Doctoral dissertation, Oregon State University, 1973). <u>Dissertation Abstracts International</u>, 1973, <u>34</u>, 2277A.
- Perry, G. A. and Kopperman, N. <u>A better chance-evaluation of student</u> <u>attitudes and academic performance, 1964-1972</u>. Boston: A Better Chance, Inc. 1973.
- Peterson, R. C. and Thurstone, L. L. Motion pictures and the social attitudes of children. New York: McMillan, 1933.
- Redemsky, L. W. Student evaluation of films used in college social studies. AV Communication Review, 1959, 7, 3-13.
- Rogers, R. W. <u>An analysis of fear appeals and attitude change</u>. Final report, 1973, University of South Carolina, Grant No. 1803 MH22157-01 MSM, National Institute of Mental Health.

- 16 -

- Seiler, William. The effects of visual materials on attitudes, credibility and retention. Speech Monographs, 1971, 38, 331-334.
- Simonson, M. R. Attitude change and achievement: Dissonance theory in education. Journal of Educational Research, 1977, 70(3), 163-169.
- Simonson, M. R. Attitude measurement: Why and how. <u>Educational Technology</u>, 1979a, September, 34-38.
- Simonson, M. R. Designing instruction for attitudinal outcomes. <u>Journal of</u> Instructional Development, 1979b, 2(3), 15-19.
- Simonson, M. R. Media and attitudes: An annotated bibliography of selected research--Part II. <u>Educational Communication and Technology Journal</u>, 1980, 28(1), 47-61.
- Simonson, M. R. <u>Persuasive films: Techniques used to change attitudes</u>. Paper presented at the 1981 Convention of the Association for Educational Communication and Technology, Philadelphia.
- Simonson, M. R. and Bullard, J. Influence of student expectations and student sex on predicting academic success. Paper presented at the meeting of the Midwest Area Educational Research Association, Chicago, 1978. <u>Resources in Education</u>, ED 114049.
- Simonson, M. R.; Thies, P.; and Burch, G. Media and attitudes: Pertinent research published in AV Communication Review. <u>Educational Communica-</u> <u>tion and Technology Journal</u>, 1979c, <u>27</u>(3), 217-236.
- Thomas, W. I. and Znaniecki, F. <u>The Polish peasant in Europe and America</u>. Boston: Badfer, 1918.
- Thurstone, L. L. Influence of motion pictures on children's attitudes. Journal of Social Psychology, 1931, 2, 232-234.
- Winn, W. and Everett, R. <u>Differences in the affective meaning of color and</u> <u>black and white pictures</u>. Paper presented at the Annual Convention of the Association for Educational Communication and Technology, 1978.

579

- 17 -

Zimbardo, P. and Ebbesen, E. <u>Influencing attitudes and changing behavior</u>. Reading, Massachusetts: Addison-Wesley, 1970.

1. 1. 1. 1.

A 92 T

. . .

÷ .,

. .

# TITLE: Cueing and Anxiety in a Visual Concept Learning Task

AUTHOR: Philip M. Turner

# Cueing and Anxiety in A Visual Concept

Learning Task

Philip M. Turner Associate Professor Graduate School of Library Service The University of Alabama P. O. Box 6242 University, Alabama 35486

## CUEING AND ANXIETY IN A VISUAL CONCEPT LEARNING TASK

#### ABSTRACT

Cueing to increase the probability that the learner will receive the criterial information is an established procedure in the production of instructional visuals. Research suggests, however, that indiscriminate use of cues may actually be counterproductive.

Anxiety has been shown to affect the entire range of learning with a general cumulative negative effect. This is true particularly with difficult tasks and high states of anxiety. Of particular interest to this study was the position that anxiety can cause difficulty at the input stage of learning from a visual cue in two ways. These are (1) a narrowing of perception to include only the salient features and (2) a heightened distractibility.

#### Purpose

by philip M. Turner

The first purpose of this study was to determine the relationship of two measures of anxiety, the <u>State-Trait Anxiety Inventory-Trait Form</u> and the <u>S-R Inventory of Anxiousness-Exam Form</u>, with performance on a visual concept learning task where the criterial information was embedded. The second purpose was to determine if cueing the criterial information reduces any negative effect found.

#### Design

Two treatment groups were utilized consisting each of 24 randomly selected senior-level and graduate students. Treatment Group I located embedded figures, identified the concept criteria, and identified nonexample concept set members. Treatment Group II performed the same task with the examples and non-examples cued by outlining in red. Degree of embedding was investigated by the use of two levels of embedment.

#### Results and Analyses

Significant main effects were found for trait anxiety with the lightly and heavily embedded figure scores and for cueing with the heavily embedded figure scores. A significant interaction was indicated between the trait anxiety variable and cueing for the heavily embedded figures. This interaction was caused by the low scores for high anxious subjects utilizing the non-cued treatment. A non-significant interaction was found for the test anxiety measure with cueing. The high anxious cued subjects scored the highest and the high anxious non-cued subjects scored the lowest.

Utilizing a stepwise multiple regression, it was found that the combined variance accounted for by the two anxiety variables dropped from 34% for the lightly embedded non-cued figures to 4% for the lightly embedded cued figures. For the corresponding heavily embedded figure scores, this variance was reduced from 54% to 7%.

#### Discussion

The presence of a high degree of both anxiety types seemed to have a severe debilitating effect on performance of the task without the aid

3

of cues. Cueing drastically reduced the influence of both measures and actually was associated with superior performance by the high test anxious cued subgroup.

Further study is recommended including manipulation of time variables and cueing types; a testing of actual instructional materials; and a further refinement of techniques to isolate the effects of anxiety on the input stage of learning. The addition of cues, especially where embedded criterial information is presented to highly anxious learners is recommended.

# Cueing and Anxiety in a Visual Concept Learning Task

Many instructional materials utilize complex visuals in which the criterial information is not salient. In order to assist the learner, the addition of cues is an accepted practice of the instructional visual designer who decides which attributes are criterial and makes them salient. This is done in a number of ways including underlining, outlining, and the addition of superscripts or pointers. A rationale for this practice is that if the learner is directed to the important parts of a visual, there will be a greater chance that the "correct" information will be received and processed and that learning will be enhanced (Bruner, Goodnow, and Austin, 1956).

While the addition of various types of cues has been shown to be effective (Levin, J. R., Bender, B. G., and Lesgold, A. M., 1976; Smith, Farquhar and Thomas, 1965; Weiss and Margolius, 1954) caveats have emerged as to their usage. There is evidence that the addition of cues is task and learner specific, i.e. certain cues are effective for some instructional situations and learners and not for others (Jones, 1962; Dwyer, 1978; Smith and Farquhar, 1965; Bovey, 1981). Also, the additional cost usually involved in the insertion of cues must be considered. This study investigates the use of cues in a visual learning task utilizing embedded information and the interaction of this practice with anxiety, a learner personality characteristic.

#### Color Cues

While the random use of color cues has been found to decrease performance due to increased "signal-to-noise ratio" (Green and Anderson, 1956), color has been shown to be an ideal cueing technique in aiding the learner in locating embedded information (Jones, 1962; Smith, Farquhar, and Thomas, 1965). In a study done in 1963, Smith found that the addition of redundant color cues resulted in an average time to criterion reduction of 65% in a visual search task and 69% in a counting task with a 76% reduction in counting errors. By cueing certain items, search time is virtually directly related to the proportion of criterial items within cued items (Green and Anderson, 1956).

#### Anxiety

<u>General effects of anxiety on learning</u>. Anxiety, as used in this study, consists of the two conceptually distinct components of worry and arousal (Liepert and Morris, 1967; Eysenck, 1979). The worry component consists of the tendency for negative self-evaluation, a great deal of concern for level of performance, and negative task expectations. On the other hand, the arousal component involves changes in physiological functioning with resultant feelings of tension and nervousness.

Tobias (1979) advances a model for studying the general effects of anxiety on learning from instruction. In effect, he utilizes a classical information processing model including input, processing, and output and calls for the researcher to delineate which steps are to be investigated in a study in terms of the effects of anxiety.

While high levels of the worry component of anxiety would most likely have a negative effect on all the stages of learning by diverting attention

from the task at hand, such is not the case for the arousal component. Among the effects of higher arousal, according to Hockey (1979), is an increased rate of work or "throughput." For simple tasks, this can offset the reduction in primary memory capacity, increased selectivity of attention, and increased selectivity of response which are also the results of higher levels of arousal, as well as offset the negative effects of the worry component (see Figure 1). For more complex tasks, this throughput advantage is overcome by the negative aspects of higher arousal in conjunction with the worry components. The interactions tend to produce an inverted "U" shaped graph when performance is compared with anxiety.

Effect of anxiety on the input process. Beyond Hockey's prediction that higher arousal will affect the input process through the increased selectivity of attention, there is additional supporting evidence. Easterbrook (1959) posits that, whatever the task, arousal has the effect of reducing the use of cue information. Broadbent (1978), in research on arousal due to noise, has found that as a person becomes more aroused, there is a tendency to select information from a smaller area. Other studies where stressful situations have been linked to a narrowing of attention to include only salient cues include those of Agnew and Agnew (1963), Tecce and Happ (1964), Wachtell (1966, 1968), West, Lee, and Anderson (1969), Wine (1971), and Zaffy and Bruning (1966).

The effect of the worry component on the input mode would also be in the direction of narrowing the amount of information input. The greater the amount of task irrelevant activities, which might include concentration on failure consequences (Deffenbacher, 1978), the less

opportunity for peripheral cue utilization. This is due to the repeated necessity of "re-focusing" on the criterial information.

In terms of the input of information in a learning task, the consensus of the literature is that the anxious learner will tend to be limited to, and dominated by, the salient cues in an instructional visual. This study investigates the extent to which color cues, utilized in the input mode of a visual concept acquisition task, will ameliorate the negative effect of anxiety in a task where the criterial information is not salient. The effect of the degree of embedding is also investigated.

#### METHOD

#### Subjects

Subjects in the study were 48 senior-level and above students (four males and 44 females) enrolled in graduate courses. The proportion of males and females is standard for students in this division of the University and should allow for generalizability to the larger population of which these students were a sample. The subjects were drawn from introductory courses and participation was voluntary, with all but two students from those courses participating. The procedures used were approved by the Institutional Review Board for the Protection of Human Subjects. Subjects were assigned randomly to one of two treatment groups.

#### Experimental Task

The experimental task for Treatment Group I (Non-Cued) consisted of a visual concept acquisition task in which the criterial information was not the salient portion of the visual. Each subject was required to

(a) locate five geometrical figures in the top half of a form which were embedded in a ground of overlapping larger figures, (b) to identify the criterial attributes that made each a member of the concept set, and (c) to delineate three examples from three non-examples on an answer sheet. On the bottom half of the form embedded in a similar background were five non-examples to assist in criteria identification. Twenty sets of figures were used. One half of the sets had backgrounds consisting of one-third fewer figures, along with bolder member set figure outlines, in order to investigate for degree of embedding (see Figure 2).

Treatment Group II (Cued) performed the same task varying only in that the examples and non-examples were outlined in red to make them the salient portion of the visual. Red was chosen since it tends to produce the quickest response time in location tasks (Reynolds, White, and Hilgendorf, 1972).

#### Procedure

The subjects were provided packets containing instruments and figure sets. At the outset they completed two anxiety inventories. The first, the A-Trait Scale of the <u>State-Trait Anxiety Inventory (STAI)</u>, consisted of twenty statements which asked the subjects to describe how they generally felt. The <u>STAI</u> has been used in other learning task studies and has extensive reliability and validity data (Spielberger, Gorsuch, and Lushene, 1970). The second inventory used, the <u>S-R Inventory of Anxiousness, Exam Form</u>, is a test anxiety measure and has also been used in learning task studies (Ender, Hunt, and Rosenstein, 1962). The rational for utilizing these specific anxiety measures, aside from representing

#### Cueing and Anxiety in

T:

t

n

C

Т

τ

general and exam specific measures, was that an examination of the test revealed that the majority of the items on the <u>STAI</u> seem to reflect the worry component, and the majority of the items on the exam scale seemed to reflect physiological symptoms of arousal. (See Appendix **A** for tests.)

Subjects were given fifteen seconds to locate each set of example and non-example figures, decide on the concept set criteria, and then given five seconds to circle the three examples on the answer sheet. Subjects were told to circle three and only three figures each time, even if this involved guessing. In explaining the task, ego-involving instructions were utilized in an attempt to provide an environment that was as close as possible to an actual classroom situation. The subjects were instructed to imagine that they were participating in an assignment that accounted for a major portion of a course grade. Time limits were indicated through the use of a buzzer.

Two practice problems were worked initially to insure that the subjects understood the directions. Following the instructions and practice, subjects completed the 20 problem sets and returned the material to their folder.

Two scores were generated for each subject. One score for the heavily and one score for the lightly embedded figures identified correctly with a possible range for each score of from zero to 30. Anxiety scores in both treatment groups were dichotomized about the median for each anxiety measure. A series of two-way analyses of variance were performed with treatment type paired with anxiety level as independent variables and subtest scores as dependent variables.

#### RESULTS AND ANALYSES

#### Trait Anxiety/Lightly Embedded Figures

The trait anxiety variable engendered significant main effects on the lightly embedded figure scores (see Table 1). While the mean score for the high anxious non-cued treatment subgroup ( $\underline{X} = 22.17$ ) was the lowest of the four subgroups (see Table 2), this interaction was not significant. Evidently, for this shallow level of embedding, the negative effects of trait anxiety were evenly dispersed across the stages of learning.

#### Trait Anxiety/Heavily Embedded Figures

Both the trait anxiety variable and cueing treatment generated significant main effects for the heavily embedded figure score. A significant interaction was found between these variables as well (see Table 3). The significant main effects for both variables were generated almost entirely by the lower performance ( $\underline{X} = 18.83$ ) of the high trait anxiety, non-cued treatment subgroup. The other subgroup scores were similar to those obtained on the lightly embedded figures (see Table 4).

#### Test Anxiety

The analyses of variance utilizing test anxiety and cueing as independent variables and lightly and deeply embedded figure scores as dependent variables yielded a main effect only for cueing in the heavily embedded figures (see Tables 5-6). While no significant interactive effects were found, a study of the results shows that for both the lightly and heavily embedded figure scores, the high anxious cued subjects scored the highest ( $\underline{x}_1 = 26.46$ ,  $\underline{x}_h = 26.15$ ) and the high anxious non-cued subjects scored the lowest ( $\underline{x}_1 = 24.1$ ,  $\underline{x}_h = 20.9$ , see Tables 7-8).

Multiple Regression

Several factors evident at this stage of the study suggested the employment of a stepwise multiple regression procedure to investigate the cumulative effect of the anxiety variables on both lightly and heavily embedded figure scores. These factors were:

- The direction of influence for both anxiety variables was as expected, i.e. the high anxiety non-cued treatment groups did less well.
- This direction was also reflected in the significant correlation coefficients for non-cued figure scores and both measures of anxiety (see Table 9).
- There was a non-significant correlation between the anxiety variables (r = -.06).

<u>Non-cued treatment group scores</u>. The trait and test anxiety variables were entered into the equation as independent variables with lightly and heavily embedded figure scores as dependent variables for each of the two treatment groups. As can be seen in Table 10, for the lightly embedded figure scores in the non-cued group, the trait anxiety measure entered first and accounted for 22% of the variance. The test anxiety measure accounted for an additional 11.2% of the variance for a total explanation of 34%.

For the heavily embedded figure score, the variables entered in the same order with increased variance accounted for (see Table 11). The trait anxiety score accounted for 35% of the variance with the test anxiety measure increasing the total variance accounted for to 54%.

<u>Cued treatment group scores</u>. If anxiety was acting as an agent in interfering at the input stage by preventing the quick location of embedded information, a marked decrease in the influence of anxiety when the information was no longer embedded would be expected. As can be seen in Tables 12 and 13, this was the result.

For the lightly embedded figures, the total variance accounted for dropped from 34% (non-cued) to 4.5% when cues were added. For heavily embedded figures, the substantial influence of the anxiety variables in the non-cued treatment group declined from 54% to 7.4% in the cued treatment group.

#### DISCUSSION AND CONCLUSIONS

This study was designed to investigate the effect of trait and test anxiety on the input process of a visual concept acquisition task where the criterial information was embedded. Furthermore, if such a negative relationship were found, could cueing to make the criterial information salient reduce the effect of these types of anxiety?

The construct measured by the trait anxiety instrument clearly had an influence on the performance of the task without the assistance of cues exhibiting a general debilitating influence. The test anxiety measure failed significantly to affect performance when forced into a dichotomization around the median. Perhaps this dichotomization resulted in an inordinate amount of variance lost, however, as significant negative correlation was obtained with performance on the non-cued figures. Furthermore, for this instructional task and population, the addition of redundant color cues reduced the effects of both anxiety variables to marginal influence. The degree of embedding of the figures seemed to reduce, but not change the direction of, the effect of both anxiety measures.

A surprising finding in this study was the virtually zero correlation between the anxiety measures where at least a low positive relationship would be expected. Perhaps the subjects tended to experience anxiety either as an intellectual or emotional response and that this response would be captured primarily by only one of the instruments. This low correlation, however, increased the power of the test anxiety measure in adding variance in the multiple regression procedure.

Since the manipulation of the treatment was limited to the input stage, a question arises as to why there was not a larger residual effect of anxiety for the cued treatment group resulting from the effect of anxiety on the processing and output stages. Possibly for the test anxiety variable, presumably more of a measure of the arousal component, the demands of the task were minor enough that the throughput advantage compensated for any deleterious effects. Additionally, the high test anxious cued treatment group should have had an advantage in the input stage where they would be dominated by the salient criterial information. This might be an explanation for the higher scores achieved by this group.

These compensations were evidently not present for the trait anxiety measure as the high trait anxiety group actually did worse on the cued figures than the low trait anxious subjects did on the non-cued figures. This would be expected as the worry component of anxiety supposedly engenders neither an increase in processing rate or a narrowing of perception. Since the negative effects are a result of increased distraction, cueing would reduce, but not reverse, the effect of the trait anxiety component.

#### RECOMMENDATIONS

Clearly, more research in this area will generate an even clearer idea as to the interaction of the cueing and anxiety variables. Types of cues, the effect of scanning time, and population variables are but a few of the parameters that could be varied. A very important question that must be answered is the exact relationship of the anxiety measures to the components of anxiety referred to in this study. Crucial to useful research in this area are instruments that facilitate the reliable measurement of the chosen component.

With regard to the type of instructional task and presentation utilized, perhaps the research in this area should proceed in seemingly opposite directions. It should be determined what percentage of instructional materials used in actual classroom situations contain criterial information that is sufficiently embedded to cause input problems with high anxious learners. A second direction should be to develop research procedures that eliminate the processing and output stages in the learning sequence in order to isolate the effects of anxiety on the input stage.

Implications for the message designer, based on this study, would suggest no radical change in behavior. The addition of cues is a standard practice. This study justifies this procedure in visuals containing heavily embedded criterial information, particularly when such visuals will be used with highly anxious learners.

## REFERENCES

#### REFERENCES

- Agnew, N. and Agnew, M. Drive level effects on tasks of narrow and broad attention. <u>Quarterly Journal of Experimental Psychology</u>, 1963, 15, 58-62.
- Bovy, R. C. Successful instructional methods: a cognitive information processing approach. ECTJ, 1981, 29, 203-217.
- Broadbent, D. E. The current state of noise research: a reply to Poulton. Psychological Bulletin, 1978, 85, 1052-1067.
- Bruner, J. S., Goodnow, J. J., and Austin, G. A. <u>A Study in Thinking</u>. New York: Wiley, 1956.
- Deffenbacher, J. L. Worry, emotionality, and task-generated interference in test anxiety: an emperical teat of attentional theory. <u>Journal of</u> Educational Psychology, 1978, 70, 248-254.
- Dwyer, F. M. <u>Strategies for Improving Visual Learning</u>. State College, Pennsylvania: Learning Services, 1978.
- Easterbrook, J. A. The effect of emotion on cue utilization and organization of behavior. <u>Psychological Review</u>, 1959, <u>66</u>, 83-201.
- Endler, N., Hunt, J., and Rosenstein, A. An S-R inventory of anxiousness. Psychological Monographs, 1962, 76 (17) 1-33.
- Eysenck, M. W. Anxiety, learning, and memory: a reconceptualization. Journal of Research in Personality, 1979, <u>13</u>, 363-385.
- Green, B. F., and Anderson, L. K. Color coding in a visual search task. Journal of Experimental Psychology, 1956, 51, 19-24.
- Hockey, R. Stress and the cognitive components of skilled performance. In Hamilton, Vernon and Warburton, D. M. (Eds.) <u>Human Stress and Cog-</u> nition. New York: John Wiley, 1979.

598

Jones, M. R. Color coding. Human Factors, 1962, 6, 355-365.

- Levin, J. R., Bender, B. G., and Lesgold, A. M. Pictures, repetition, and young children's oral prose learning. <u>AV Communications Review</u> 1976, 24, 367-381.
- Liebert, R. M., and Morris, L. W. Cognitive and emotional components of test anxiety: a distinction and some initial data. <u>Psychological</u> Reports, 1967, 20, 975-978.
- Reynolds, R. E., White, and Hilgendorf. Detection and recognition of colored signal lights. Human Factors, 1972, 14, 222-36.
- Smith, S. L. Color coding and visual separability in information displays. Journal of Applied Psychology, 1963, 47, 358-364.
- Smith, S. L., Farquhar, B. B., and Thomas, D. W. Color coding in formatted displays. Journal of Applied Psychology, 1965, 49, 393-398.
- Spielberger, C. D., Gorsuch, R. L., and Lushene, R. E. <u>Manual for the</u> <u>State-Trait Anxiety Inventory</u>. Palo Alto, CA: Consulting Psychologists Press, 1970.
- Tecce, J. J., and Happ, S. Effects of shock-arousal on a card sorting test of color-word interference. <u>Perceptual and Motor Skills</u>, 1964, <u>19</u>, 905-906.
- Tobias, S. Anxiety research in educational psychology. Journal of Educa tional Psychology, 1979, 71, 573-582.
- Wachtel, P. L. Anxiety, cue utilization, and patterns of ego defense. (Doctoral Dissertation, Yale University, 1966). <u>Dissertation Abstracts</u>. 1966, 27, 2149.
- Wachtel, P. L. Anxiety, attention, and coping with threat. Journal of Abnormal Psychology, 1968, 73, 137-143.

Weiss, W., and Margolius, G. The effect of context stimuli on learning and retention. Journal of Experimental Psychology. 1954, <u>48</u>, 318-322.
West, C. K., Lee, J. F., and Anderson, T. H. The influence of test anxiety on the selection of relevant from irrelevant information. <u>The Journal of Educational Research</u>, 1969, <u>63</u>, 51-52.

- Wine, J. Test anxiety and direction of attention. <u>Psychological Bulletin</u>, 1971, <u>76</u>, 92-104.
- Zaffy, D., and Bruning, J. L. Drive and range of cue utilization. Journal of Experimental Psychology, 1966, <u>71</u>, 382-384.
19

TABLES

## Analysis of Variance Lightly Embedded Figure Scores with Trait Anxiety and Cueing

				and second
Source	SS	đf	MS	F
Trait Anxiety	184.08	1	184.08	7.59*
Cueing	12.0	1	12.0	.49
Interaction	21.3	1	21.3	.35

\*p<.01

t

¢

3

.

## Table 2

#### Means and Standard Deviations for Lightly Embedded Figure Scores by Trait Anxiety Level and Treatment

	Tra	it Anxiety Level	5	
		Low	High	Total
		<u>x</u> = 27.0	<u>X</u> = 24.5	x = 25.8
	Cued	SD = 5.07	SD = 6.86	SD = 6.02
Treatment		N = 12	N = 12	
Groups		$\underline{\mathbf{X}} = 27.4$	<u>x</u> = 22.17	$\overline{X} = 24.8$
	Non-cued	SD = 3.42	SD = 3.73	SD = 4.4
		N = 12	N = 12	
	Total	x = 27.25	$\overline{X} = 23.33$	1
	IOCAL	SD = 4.20	SD = 5.53	

Analysis of Variance Heavily Embedded Figure Scores with Trait Anxiety and Cueing

Source	SS	đf	MS	F
Trait Anxiety	229.68	1	229.68	11.37**
Cueing	143.5	l	143.5	7.1*
Interaction	77.5	1	77.5	3.84*

\*\*p<.005

\*p<.05

## Means and Standard Deviations for Heavily Embedded Figure Scores by Trait Anxiety and Treatment

	Tra	it Anxiety Level	<u>s</u>	
		Low	High	Total
		$\overline{X} = 26.67$	X = 24.83	<b>x</b> = 25.8
	Cued	SD = 4.2	SD = 5.9	SD = 5.11
Treatment		N = 12	N = 12	
Groups		$\overline{X} = 25.75$	<del>X</del> = 18.83	$\overline{X} = 22.29$
	Non~cued	SD = 3.1	SD = 4.28	SD = 5.07
		N = 12	N = 12	
	Total	$\bar{x} = 26.21$	x̄ = 21.83	
	LOCAL	SD = 3.67	SD = 5.89	

## Analysis of Variance Lightly Embedded Figure Scores with Test Anxiety and Cues

Source	SS	df	MS	P
Test Anxiety	.122	1	.122	.004
Cueing	11.872	1	11.87	.41
Interaction	21.9	1	21.9	.76

## Analysis of Variance Heavily Embedded Figure Scores with Test Anxiety and Cueing

A designed and the second			and the second se	
Source	SS	đf	MS	F
Test Anxiety	10.5	1	10.5	.40
Cueing	146.5	1	146.5	5.62*
Interaction	39.4	1	39.4	1.51

\*p<.05

# Means and Standard Deviations for Lightly Embedded Figure Scores by Test Anxiety and Treatment

		Low	High	Total
		<del>x</del> = 25.0	$\overline{X} = 26.46$	$\overline{X} = 25.8$
	Cued	SD = 6.9	SD = 5.3	SD = 6.02
Treatment	t	N = 12	N = 12	
Groups		$\overline{X} = 25.4$	x = 24.1	$\bar{x} = 24.8$
	Non-cued	SD = 3.8	SD = 4.9	SD = 4.4
		N = 12	N = 12	1
	Total	$\overline{X} = 25.21$	$\overline{X} = 25.36$	
	IUCAL	SD = 5.4	SD = 5.19	

608

. .

27

#### Table 8

## Means and Standard Deviations for Heavily Embedded Figure Scores by Test Anxiety and Treatment

Test Anxiety Levels

		Low	High	Total
		$\overline{X} = 25.2$	X = 26.15	$\overline{X} = 25.75$
	Cued	SD = 5.2	SD = 5.1	SD = 5.11
Treatment		N = 12	N = 12	
Groups		$\overline{X} = 23.6$	$\overline{X} = 20.9$	$\overline{X} = 22.29$
	Non-cued	SD = 5.1	SD = 4.7	SD = 5.07
		N = 12	N = 12	
	Total	$\overline{X} = 24.4$	$\overline{X} = 23.64$	
	iotai	SD = 5.18	SD = 5.5	

#### Correlation Coefficients of Anxiety Measures and Non-cued Figure Scores

	Lightly Embedded Non-cued Figure Scores	Heavily Embedded Non-cued Figure Scores	Trait Anxiety Score	Test Anxiety Score
Test Anxiety Score	32	47	06	-
Trait Anxiety Score	47	59	-	06

## Multiple Regression Summary Table for the Lightly Embedded Figure Scores/Non-Cued Treatment Group

Independent Variables	Multiple R	R Square	RSO Change	Simple R
Trait Anxiety Score	.4776	.2281	.2281	4776
Test Anxiety Score	.5832	.3401	.1120	3275

Multiple Regression Summary Table for the Heavily Embedded Figure Scores/Non-Cued Treatment Group

Independent Variables	Multiple R	R Square	RSO Change	Simple R
Trait Anxiety Score	.5934	.3521	.3521	5934
Test Anxiety Score	.7348	.5400	.1878	4717
			1.1	

## Multiple Regression Summary Table for the Lightly Embedded Figure Scores/Cued Treatment Group

Independent Variables	Multiple R	R Square	RSO Change	Simple R
Trait Anxiety Score	.1727	.0298	.0298	1727
Text Anxiety Score	.2123	.0450	.0152	1014

Multiple Regression Summary Table for the Heavily Embedded Figure Scores/Cued Treatment Group

Independent Avriables	Multiple R	R Square	RSO Change	Simple R
Test Anxiety Score	.1868	.0349	.0349	1868
Trait Anxiety Score	.2733	.0747	.0398	1753

FIGURES

LEARNING BY INSTRUCTION



Figure 1: THE EFFECTS OF ANXIETY ON LEARNING FROM INSTRUCTION



Figure 2: HEAVILY AND LIGHTLY EMBEDDED FIGURE SETS

## APPENDIX A

# Anxiety Measures

#### SELF PERCEPTION SCALE II

Please circle the number that most closely approximates your reactions to the following situation:

## NAME

DIREC

used to

#### YOU ARE ABOUT TO TAKE A FINAL EXAM:

Convrient	619	
1 2 3 4 5 inter not at all very much	Experience nausea	.4.
not at all very much 40. I get	HATE LOOSE DOWELS	
1 2 3 4 5 39. I am	Have loose howels	3.
not at all very much 38. I tak	Seek experiences like this	.2.
37. Som		
1 2 3 4 5 not at all very much 36. I am	Get full feeling in stomach	11.
not at all very much 35. I fee	Become immobilized	.0.
1 2 3 4 5 34. I tr		
1 2 3 4 5 not at all very much 33. I faw	Mouth gets dry	9.
not at all very much 31. I an		
1 2 3 4 5	Enjoy the challence	8.
not at all very much 29. I we	Need to urinate frequently	7.
28. I fe		
1 2 3 4 5 27. I ar	Perspire	6.
not at all very much 26. I fe	Want to avoid situation	5.
1 2 3 4 5 25. I a		
1 2 3 4 5 not at all very much 24. I w	Feel exhilarated and thrilled	4.
not at all very much 23. I fe		000
1 2 3 4 5 22. I ti	Emotions disrupt action	3.
not at all very much 21. I fo	Get an "uneasy feeling"	2.
one sta how yo		
1 2 3 4 5 the sta not at all very much right o	Heart beats faster	1.
1 2 3 4 5	Reart beats factor	1

Copyright & thereof by t

## SELF-EVALUATION QUESTIONNAIRE

#### STAI FORM X-2

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each state- ment and then blacken in the appropriate circle to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.		SOMETIMES		ALMO
			OFTEN	OST ALWAYS
21. I feei pleasant	)	٢	0	۲
22. I tire quickly	)	٢	٩	۲
23. I feel like crying	0	٢	٢	۲
24. I wish I could be as happy as others seem to be	D	۲	٩	۲
25. I am losing out on things because I can't make up my mind soon enough	D	۲	٢	۲
26. I feel rested	D	0	٩	۲
27. I am "calm, cool, and collected"	Ð	0	۲	۲
28. I feel that difficulties are piling up so that I cannot overcome them	D	٢	۲	۲
29. I worry too much over something that really doesn't matter	D	٢	٩	۲
30. I am happy	D	٢	3	۲
31. I am inclined to take things hard	D	٢	٩	۲
32. I lack self-confidence	D	0	0	۲
33. I feel secure	D	0	0	۲
34. I try to avoid facing a crisis or difficulty	D	0	٩	۲
35. I feel blue	D	٢	٩	۲
36. I am content	D	۲	3	۲
37. Some unimportant thought runs through my mind and bothers me	D	0	3	۲
38. I take disappointments so keenly that I can't put them out of my mind	D	٢	٩	۲
39. I am a steady person	D	٢	۲	۲
40. I get in a state of tension or turmoil as I think over my recent concerns and				
interests	D	0	0	۲

620

Copyright © 1968 by Charles D. Spielberger. Reproduction of this test or any portion thereof by any process without written permission of the Publisher is prohibited.

TITLE: Presence of Observable Conditions of Positive Self-Concept In Elementary School Media Centers: A Descriptive Study

AUTHOR: Dianne McAfee Williams

#### PRESENCE OF OBSERVABLE CONDITIONS OF POSITIVE SELF-CONCEPT IN ELEMENTARY SCHOOL MEDIA CENTERS: A DESCRIPTIVE STUDY<sup>1</sup>

Dianne McAfee Williams, Director Bureau of Instructional Media Programs Wisconsin Department of Public Instruction 125 South Webster Street, P. O. Box 7841 Madison, Wisconsin

A paper presented to the Research and Theory Division at the annual convention of the Association for Educational Communications and Technology, Dallas, Texas, May, 1982

Research for this paper was taken from the author's doctoral dissertation, which was completed at the University of Wisconsin-Madison under the direction of Dr. Ann D. Becker.

#### Observable Conditions of Positive Self-Concept in Elementary School Media Centers

# by Dianne Medfee Williams

be

st

CC

su

Ba

ela

and

clu

the

ear

as I

coni

for

cho1

1930

Mas 1

suppi

Quanc

self-

larly

self-

home .

self-

3

#### Introduction and Purpose

The following situation occurs too often. School district officials find that they must make cutbacks in the district's budget. They determine that the position of instructional media specialist\* at the elementary level should be eliminated; <u>OR</u>, having never felt that a professionally-run IMC program at the elementary level was important, they have never had a professional media specialist at the elementary level. In Wisconsin, for example, it is estimated that 69 percent of the elementary schools lack professionals either on a full- or part-time basis in the media center.

Actions speak louder than words. In a glaring way, it is obvious that decision-makers and citizens on the whole are not convinced that elementary school IMCs make a necessary and important difference to a young child's education. Perhaps this is due to the lack of concrete research which focuses on the contributions of instructional media center (IMC) programs to educationa programs.

In an effort to focus on important contributions of elementary school IMCs to the educational program, a study was conducted (McAfee, 1981) to determine the presence of conditions of positive self-concept in elementary school IMCs. The purpose of the study was to determine whether an elementary school IMC with a full-time media specialist, full-time aide, variety of current printed and audiovisual materials, and a program of activities and services had components which could be identified as being those which could

\* instructional media specialist: a person with appropriate certification and broad professional preparation, both in education and media (library and audiovisual areas), with competencies to carry out a media program. The media specialist is the basic instructional media professional in the school media program. be said to promote or enhance positive self-concepts in elementary school students. The following conditions which appeared most frequently in selfconcept literature were selected for study: cooperation, independence, success, positive atmosphere, challenge, feeling of value or acceptance.

-2-

#### Background

na

In order to focus most clearly on self-concept contributions in an elementary IMC setting, it was necessary to examine theories of self-concept and learning, in general, and their applicability to school settings, including the goal and aims of school IMCs. The examination provided a strong theoretical basis for the study.

The literature is consistent in its emphasis on the effect of a child's early years in the development of a self-concept. Major theorists as early as William James in his 1890 historic book, <u>Principles of Psychology</u>, and continuing through Freud in the 1900s, provided theoretical foundations for beliefs in the importance of self-concepts. In the 1920s, social psychologists Alfred Adler, Karen Horney, and Harry Stack Sullivan, in the 1930s, George Mead and Gordon Allport, and beginning in the 1940s, Abraham Maslow -- all supported the importance of self-concept.

The emphasis on formation of concepts of self in the early years is supported by research of Coopersmith (1967), Gordon (1972), Purkey (1970), Quandt (1972), and Rogers (1969). While literature on the early years and self-concept put greatest emphasis on the home and its environment, particularly on the role of parents, schools also were found to influence a child's self-concept. In fact, some, like Purkey (1970), found that next to the home, the school was the single most important force in shaping the child's self-concept.

Self-concept would probably not receive so much attention were it not for its relationship to learning. While research data do not provide clearcut evidence of what comes first-a positive self-concept or scholastic success--the data stress a strong reciprocal relationship and provide evidence that enhancing the self-concept is a vital influence in improving academic performance (Purkey, 1970).

With schools having such an important part in shaping self-concept and with scholastic achievement tied to self-concept, it would seem imperativ to provide experiences in elementary schools which will reinforce conditions of <u>positive</u> self-concept. A number of previous studies focused on the classroom atmosphere and teacher activities (La Benne and Greene, 1969). Yet classrooms, with their grading system and structure, may not always encourage positive self-concept reinforcement.

Prevailing theories of learning emphasize such basics as:

children learn as individuals

children learn at various rates

children learn according to different styles and patterns education is a continuous process (Gillespie and Spirt, 1973).

Aims of IMCs are consistent with basic theories of learning, focusing on such common areas as creating the right environment for learning, providing materials, meeting curricular needs, meeting personal and instructional needs of students, encouraging creativity, self-fulfillment, and inquiry. Because of the similarity of aims of school IMCs and major factors contributing to self-concept, namely cooperation, independence, success, positive atmosphere, challenge, feeling of value or acceptance, the study examined the broad question of whether the IMC and its staff contribute to a positive

-3-

self-concept in children. After this overall objective, other objectives were:

-4-

to compare similar IMC programs offered in a rural, an urban, and a suburban setting,

to interpret the impact of the philosophy of the media specialist on the IMC program,

to discover student attitudes toward the IMC, the media specialist, and IMC activities,

to identify those conditions to which the IMC contributed most substantially,

to identify which observed activities most substantially supported each condition studied,

to describe emerging patterns or relationships,

to identify especially desirable IMC activities to promote positive self-concepts, and

to generate hypotheses for further study.

A number of questions were formulated to investigate the overall concern about whether IMC programs have conditions which are said to promote positive self-concept in children. Among the questions, which were divided according to the research method utilized, were the following:

If the IMC programs studied were found to contribute to the condition(s) being examined, did the IMC programs appear to contribute equally?

Were there activities which occurred more or less frequently at certain grade levels than others?

Which activities which were expected to occur did not?

Did the IMC contain or have access to materials which would be appropriate for a variety of learning styles and levels?

Was there evidence of a focus on concrete IMC experiences, such as those which focused on the senses?

How did students feel about using the IMC?

Were there any major differences in student responses by grade level? By sex?

What unique features or commonalities existed by type of IMC?

-5-

#### Methodology

The research method was designed to focus on the broad range of activities Met and experiences available to elementary-age children in school IMCs. All Obs vat instruments and overall methods were reviewed by a panel of experts which included experienced building-level elementary school media specialists, Phy set district-level media director, university professor in librarianship, and state department of education media consultant. Utilizing this panel Moc of experts, two study observers and the researcher, observable indicators Int were agreed upon for each of the six conditions being examined. (See Appendix A) Di

The study employed a descriptive case study research design which con-

Figure 1 Research Design observation urban suburban diary interview

In most instances, the research methods, i.e., observation, interviews, diary, were used to obtain data about all the conditions being studied. Table 1 illustrates the conditions described within each method utilized.

wer dow

Wisc

full

an ı

inst

bett

of .

inf

#### TABLE 1

-6-

#### Conditions Studied According to Method Utilized

	Condition				
Cooperation	Independence	Success	Challenge	Value	Positive Atmosphere
с <sup>и</sup> с			х 	x	x
x	x	x			i
x	x	x	x	x	x
x ,	x	x	x	x	x
	Cooperation X X X	Cooperation Independence X X X X X X	CooperationIndependenceSuccessXXXXXXXXXXXX	CooperationIndependenceSuccessChallengeXXXXXXXXXXXXXXXX	CooperationIndependenceSuccessChallengeValueXXXXXXXXXXXXXXXXXXXXXXXXX

Following a pilot study, the case study approach was utilized in three Wisconsin elementary schools having IMC programs as described earlier (e.g., full-time professional and aide). The three schools represented a rural, an urban, and a suburban setting. Schools were selected utilizing a survey instrument which had been field-tested. Basic similarities

between schools such as size of collection, student enrollment, certification of the media specialist were sought. A system of assigning points to survey information for the purpose of objectively evaluating the surveys was used.

#### Observation

Instruments designed other than the survey instrument for selection were the observation model used in the on-site study (Appendix B), the breakdown of general IMC activities according to self-concept conditions being

examined (Appendix A), and interviews with media specialists and students.

re

we

St

at

na

ch

th

tŀ

of

ar

R€

ir

tl

01

w

SI

ti

m

n

0

a

ď

4

-7-

In actual practice during the week-long case study in each school, activities in the IMC were observed by a full-time observer who used the observation model described in the previous paragraph for five-minute intervals over a one-week period in each school. Inter-observer reliability was attained by having a second observer observe 20 percent of the total week in each school. Observers were trained together. In order to ascertain interobserver reliability, Kappa co-efficients were obtained for each school on the second day of the study. The Kappa co-efficients yielded the following data: rural school reliability between observers was .86; urban school reliability was .87; suburban school reliability was .90. These figures indicate that observations between the two observers were very consistent.

The observation method, in addition to utilizing the observation model, also utilized a description of the physical setting according to predetermined criteria found in Appendix A focusing on the conditions of positive atmosphere, being challenged, and being valued.

#### Diary

A written diary of all IMC activities was kept throughout the week. Interactions between individual students and the media specialists, between individual students and the aide, as well as interaction between students were particularly noted. Any formal interactions between the media specialist and a class or a group of students were also noted.

#### Interviews

Student interview questions were asked of some students from each grade beginning at the third grade level in each school studied. Overall, students

represented both sexes, range of normal IQ levels, were conversable, and were representative of various ethnic/minority groups found in the school. Students to be interviewed were selected by media specialists and teachers at each school. Interview questions focused on all conditions being studied, namely cooperation, independence, success, feeling valued/accepted, being challenged, positive atmosphere. Questions asked reflected attitudes toward the IMC, its activities, and its staff.

-8-

Interviews with media specialists focused on gaining information on the philosphy undergirding the media program, as well as the perception of the media specialist of student use and preferences, role of teacher and principal, parental support.

#### Results

Results of the study showed that all six conditions studied were present in the schools being studied. Findings of this study, therefore, indicate that the IMC can make a difference in the individual child's development of a positive self-concept.

The observational data which utilized the model found in Appendix B were submitted to analysis of variance to investigate relationships of observed activities as they related to the type of school and day of the week, to the type of school and the general grade level at which the activity most frequently occured. For those relationships in which statistical significance was found at the .05 level, Scheffés were also performed. The observation instrument focused on the conditions of cooperation, independence, and success. In general, there were no differences existing which varied depending on the day of the week. Some differences by level (e.g., K-3, 4-6) were found. For example, students in grades K-3 cooperatively used

audiovisual equipment and materials more. Students in grades 4-6 studied more in the IMC. Activities were most similar in the rural and suburban schools, for specific activities during the week's visit at the urban school served as attention-getters from usual IMC activities. Some expected activities such as production did not occur.

-9-

All schools visited had a stronger emphasis on independence than cooperation. However, the analysis of the observation instrument showed evidence of all the conditions being studied, namely independence, cooperation, and success.

The physical setting description in each IMC showed evidence of the conditions of positive atmosphere, feeling of value or acceptance, being challenged.

Student interviews showed that students of each grade found the IMC atmosphere to be positive, felt valued, had many experiences of success as well as opportunities for success, cooperated naturally, and found the IMC to be a place which challenged them.

The media specialists' interviews showed them to be generally of one mind in their belief of the worth of the individual student and the need for media programs to promote that worth.

Diary analysis showed clear examples in each school studied of the conditions being examined.

Each method utilized, i.e. observation, interview, and diary, ultimately complemented one another. Varied emphases of research methods, whether factual, conceptual, or attitudinal, in the final analysis supported and enhanced the findings of the other.

#### Recommendations for Practice and Further Study

Results of the study point toward providing, wherever possible, elementary

school IMCs which focus on a program which can promote and enhance positive self-concept in elementary school children. The study suggests that those who utilize an elementary school IMC as simply a place where an aide decorates a bulletin board or checks out materials to students are not scratching the surface in terms of what a professionally-directed media program can provide. It suggests that a seemingly natural and spontaneous program of activities and services may bely the amount of planning, time, and effort involved in making it so.

Implications for practice and further research include the following:

- IMC programs should be designed to promote the development of positive self-concepts in elementary-age children.
- The philosophy of the teaching staff, as well as the media aide (in addition to the media specialist), also determines how students utilize the IMC.
- Wherever possible, IMC programs which permit flexible use by students should be encouraged.
- Further study of each condition included in this study should be conducted independently.
- Broad studies similar to the one conducted are needed at other levels, including:
  - IMCs with a half-time professional media specialist and full-time aide,
  - b. IMCs with a full-time professional and no aide,
  - c. IMCs with a part-time professional and no aide,
  - d. IMCs with a full-time aide and no professional,
  - e. IMCs with a part-time aide and no professional.

As is important with descriptive studies, replication is encouraged.

-10-

#### References

- Wisconsin Department of Public Instruction. <u>A statewide report of staff</u> and facilities of instructional media programs in Wisconsin public schools--1978. Madison: Author, 1979.
- McAfee, D. T. "A study to determine the presence of observable conditions of positive self-concept in elementary school media centers." Unpublished doctoral dissertation, University of Wisconsin-Madison, 1981.
- Coopersmith, S. The antecedents of self-esteem. San Francisco: W. H. Freeman & Co., 1967.
- Gordon, I. J. <u>Children's views of themselves</u>. Washington, D.C.: Association for Childhood Education International, 1972.
- Purkey, W. W. <u>Self-concept and school achievement</u>. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1970.
- Quandt, I. <u>Self-concept and reading</u>. Newark, Del.: International Reading Association, 1972.
- Rogers, C. R. Freedom to learn. Columbus, Ohio: Charles Merrill Publishing Co., 1969
- La Benne, W. and Greene, B. Educational implications of self-concept theory. Pacific Palisades, California: Coodyear Publishing Co., Inc., 1969

S

Gillespie, J. T. and Spirt, D. L. Creating a school media program. New York: Bowker, 1973.

#### Appendix A

#### Conditions to be Examined

fostering cooperation independence success positive atmosphere being challenged feeling valued/accepted

#### Fostering cooperation

#### Observe:

children playing games; activities requiring a minimum of 2 people. IMC skills activities designed for groups

teaming of primary/intermediate students for storytelling, etc.

peer couple activities. Eg. - studying together, selecting books
together, and voluntary couple activities.

Independence (Utilization alone). Observe:

use of audiovisual equipment alone

use of audiovisual materials alone

production of media alone or with limited assistance

ability to use card catalog and find what is being sought

ability to go to IMC alone

Success Observe:

satisfactory participation in or completion of an IMC/game/ activity/production

location skills in finding what is desired

steps used in locating and using what is desired

#### Being challenged

#### Observe:

presence of variety of materials in varied formats, interests, level of difficulty

OBSERVER:

eq./How Har

WINED:

presence of games like calendar clues

production opportunities

other activities - write a letter to author, etc.

use of a variety of materials by children, eg. small children using advanced material

#### Feeling valued/accepted

#### Observe:

displays of student work in the IMC

work as student assistant (describe)

ease in talking with librarian

ease in seeking help from librarian, others

ease in browsing or seeking out what is needed, even alone

44

student taking initiative in class discussions in the IMC

#### Positive Atmosphere (physical characteristics)

#### Look for:

- lots of materials/displays which focus on senses -- feel, touch, smell, sight, hearing, and seeing students use them.
- presence of equipment, materials, which are accessible, not locked in a closet
- decorated in ways that would invite/encourage student use, i.e., warm colors, plants, student work, comfortable furniture, animations, subjects of interest to children.

accessibility for small children -- ease of reach to touch and manipulate.

Appendix B

	DLS OBSERVAT	ION MODEL	2.5.2	
OBSERVER:	DATE:	NAME OF	SCHOOL :	
MINED:	TIME PERIOD:		AGE GROUP RANGE:	
19. /How Hany Jogether	Pr.	Pr. Freg/How Many	alme	Compared to What
	Going to IMC	-		
	Using card cat.			
	Browsing			
	Select. books			
	Select. AV mat.			
	Check. out books			
÷	Check. out AV mat.		Ш	
1	Return. mat.			
	Reading			
	Studying			
	Using AV mat.			
	Using AV equip.			
-	Using Int. Ctrs.			411
14	Production			
	Using models		11	
	Pr.	Freq/How Many		Compared to What
--	-----------	----------------------	---	------------------
Teaming of int./primary students				
Same playing				
skills activities together				
roduction w/limited assistance				
ising AV equipment w/limited assistance	$\square$	-		
kills activities alone	Ц			
ocation skills used in searching				
atis. participation/completion IMC activities				
atis. participation/completion		п. н. — <sup>—</sup>		3
)ther:	Π		-	1.1
• • •			-	
5. 1. S				100 C
= 54				

TITLE: Status and Trends in Visual Information Processing

AUTHOR: Bill Winn

Status and Trends in Visual Information Processing.

Bill Winn

University of Calgary

2

Presented at the annual convention of AECT, Dallas, May, 1932.

There is considerable confusion in our area as to what visual information processing really is. It is instructive to make a list of the various "dichotomies" that run through our research literature, and to discover that many researchers are not only unsure about what is related to what, but often claim relationships among categories of variables that do not have any empirical support. Such a list would include, among other dichotomies, "Visual" versus "Audio", "Pictorial" versus "Verbal", "Simultaneous" versus "Successive", and "Image" versus "Proposition". When these dichotomies are presented baldly like this, shown of the verbal packaging in which they are couched in research papers, it becomes clear that each belongs to a different category of phenomena, and because of this they are difficult to link either conceptually or empirically. The "Visual-Audio" adjective pair refers to sensory channel, "Pictorial-Verbal" to media format, "Simultaneous-Successive" to ways in which information is processed, and "Image-Proposition" to forms in which information is represented internally.

These four Jichotomies fall naturally into two groups on the basis of how they relate to learning. Superficially, sensory channels and madia format have to do with processes external to the learner. The selection of audio or visual channels through which information is presented, and the selection of pictorial or verbal signs (Knowlton, 1966) by means of which concepts are

2

expressed, are usually under the control of the instructional designer or the instructor. On the other hand, the processes that are brought to bear on this information, and the way in which that information is represented internally, are under the control of the learner (Neisser, 1976; Salomon, 1979; Winn, 1981b). (It should be noted that the word "control" does not imply conscious processing in the sense in which it is used by Schneider and Shiffrin (1977). Processing and representation can be either automatic or controlled, as will be seen later.) More specifically, the channel and format that the information is help determine "perceived demand presented in the characteristics" of the task (Salomon, 1981, 1982), which determine how much mental effort a learner will invest, and how much will be learned. However, since, according to Salomon, the demands of the task are those that are attributed to it by the learner, the actual processes applied to the information and the way in which it is represented as schemata results from an interaction between channel and media format and the perception of them by the learner. So the major difference between phenomena that can be labelled "visual-audio" or "pictorial verbal", and those that can be called "simultaneous-successive" or "imaginal-propositional" lies in the fact that the first two dichotomies have to do with the way tasks are presented to learners, while the second two have to do with the way the learner reacts to what the task is perceived to be.

3

In spite of this major difference between the two types of dichotomy in terms of the learning task and how it is perceived, many researchers still cling to the hypothesis that these four dichotomies are related. It is, after all, intuitively appealing to suppose that pictorial media, presented in the visual channel, are processed simultaneously and stored as images, and to suppose that verbal media, presented in the aulio channel, are processed successively, and stored as propositions. However, this hypothesis is somewhat naive. Cognitive processes are not always determined by media format and channel, and when they are, the learning tasks tend to be not very demanding intellectually. What is more, there is no certainty that information that is processed simultaneously will be stored as images.

There is evidence in research that supports these claims. For instance, the link between media format and type of processing has been shown to be tenuous. Kirby and Das (1978) found that whether written text was processed simultaneously or successively depended upon the amount of effort subjects had to put into comprehension of the text, that is upon the nature of the task. Intuitively, people tend to think of reading as a linear, successive process. However, Kirby and Das found this to be so only when the text was easy to comprehend. With more difficult materials, more simultaneous processing was required than successive. Gener examples of the failure of research to establish clean relationships between media format and mental

6.12

skills and processes have been presented by Cronbach and Snow (1977, chapter 9). There is an important exception to this though. Media format does influence processing when the media are designed deliberately to <u>model</u> the cognitive processes that the learner should use if learning is to be optimal. Salomon's (1974) studies of using zooms in film to model the process of mentally moving from a general overview to details of visual displays offer examples of the modelling process. This theme will be returned to later in the paper.

5

As far as the relationship between sensory channel and processing is concerned, it appears that the link exists only for certain types of relatively low-level learning. Das and his colleagues (Das, Kirby and Jarman, 1975, 1979) have based their theory of simultaneous and successive cognitive synthesis in large part upon neurological evidence (Luria, 1970, 1973). Das and Jarman (1931) suggest that three cortical zones, identified by Luria, deal with sensory modality in hierarchical fashion. The primary zones are modality specific in the way they deal with information. The secondary zones serve to integrate information between sensory modalities. The tertiary zones deal with information across all modalities regardless of provenance. Das Jorman offer empirical evidence suggesting that as and information moves from one zone to the next, and as modaltiv specificity is lost, high-order analysis of information becomes possible. They even equate high intelligence with the ability to

integrate information across modalities (1931, p. 312).

Thus, modality specificity is transcended for higher-level tasks, but need not be so for low-level tasks. An example of the latter is to be found in a study by Metcalfe, Glavanov and Murioch (1931), where an interaction between modality and type of information recalled was found. It was reported that visual input resulted in better recall of spatial information, while auditory input led to better recall of temporal information. However, the task was recall, which is not as high-level a skill as reading a text.

5

In summary, it can be stated that the relationships between media format and sensory channel, and the way in which information is processed, are not straightforward as the "naive" hypothesis would have us believe. Media format does not determine how information is processed and stored, except when a deliberate attempt is made to model cognitive processes by manipulating the medium. Sensory channel only affects processing and learning for relatively low-level tasks. The reason for this is that the influence of format and modality on cognitive processes is <u>indirect</u>, being mediated by the learner's intellectual skills and the learning strategies the learner is using at the time. This is best explained graphically, and a model showing relationships among cognitive processes, mental skills and learning strategies is shown in figure 1.

Figure 1 about here

7

In this model, it is suggested that we all have the potential for using the same cognitive processes. However, only in some of them can we claim to be "mentally skilled". And even if we do possess the mental skills that are relevant for a particular learning task, we do not necessarily employ them as learning strategies when it is appropriate to do so. The broader implications of this model have been described elsewhere (Winn, 1982a), and will not be discussed here, beyond mentioning that instruction must aim at developing mental and strategic skills in learners as well as transmitting content. What is important for the present discussion, though, is the notion that instruction does not have a direct impact on cognitive processes. Any medium we present in any channel will only engage processes that the learner is skilled in and employs as a learning strategy at the particular time the material is presented. Without controlling skills and strategies (through modelling, or through instructions on how to learn, for example), there can be no certain cause and effect relationships between sensory modality or media format and cognitive processing or internal representation.

The discussion so far has not done much to remove the

confusion surrounding the question of what visual information processing really is. However, many of the problems encountered by researchers in this area, and many of the concerns about the "naive" hypothesis about the four dichotomies, have been described. What this paper is really about, then, turns out to be simultaneous and successive processing of pictorial and verbal melia presented in either channel, and stored as images or propositions. In other words, it is about learning and processing in general. Indeed, the more one studies cognitive psychology, the more one realizes that to separate learning from media from any other type of learning is arbitrary and counter-productive.

8

It is now time to look at the present state and discernible trends in research into information processing in our field. As the model presented above suggests, this is research that is concerned with cognitive processes, mental skills and learning strategies. If the model is extended to include the control of processing through modelling and instruction in skills and strategies, then research in instruction must also be included. While a number of scholars have addressed these issues (Salomon, 1979; Winn, 1932a; Clark, 1932; Bovy, 1981; Clark and Bovy, 1991), the approach taken by Bovy (1981) will serve as a basis for the following analysis.

Underlying Dovy's discussion is Rigney's (1973) theory of detached and embedded strategies. Embedded strategies are those

that are a part of instruction itself, and which model, in ways mentioned above, the cognitive processes the learner is best pivised to employ. Detached strategies are not part of the instruction in the same way, but are additional indications as to how the learner is to process the information that is presented. Thus, films, like Salomon's, that model, through zooming, the cognitive process of moving in on details of visual displays, are employing embedded strategies. Instructions to learners to learn maps by dividing them into quadrants (Thorndyke and Stasz, 1930) are not "embedded" in the maps themselves, and operate as detached strategies. Rigney further distinguishes between detached strategies that are "system assigned", and those that are "learner-assigned". In a system-assigned strategy, directions for processing arc given as part of the instruction the learner receives (as, for example, instructions on how to partition maps). A learner-assigned strategy is one that the learner decides to use without prompting.

Q.

The most important feature of Bovy's approach for the present discussion is the association of embedded, system-assigned and learner-assigned strategies with learner ability. (Here, ability is taken to be facility with cognitive processes, not scores on aptitude tests!) Bovy claims that low-ability learners need to use embedded strategies, because they have to be shown how to process the information they are to learn. Middle-ability learners do not need this degree of

support, but nonetheless need system-assigned strategies to tell them which particular skills to bring to bear on the task. Finally, high-ability learners are quite capable of deciding for themselves which learning strategy to employ. Modelling, or assigning detached strategies, could even interfere with the way they learn.

It is useful to point out links between these ideas and some of the things we have discussed above. In terms of our model, we might say that low-ability learners have only the potential for using cognitive processes appropriately. They possess the processes, but have not yet been able to translate them into skills and strategies. Middle-ability learners possess certain mental skills, but have not yet been able to develop the strategies that will allow their judicious deployment. High-ability learners possess both skills and the ability to use them as strategies. Implicit in this is a hierarchical structure. You have to have relevant mental skills before you can acquire and apply learning strategies. You have to have the potential for using cognitive processes before you can acquire mental skills. Looking at it from the point of view of instruction, embedded strategics need to demonstrate processes, skills and strategies for their deployment. System-assigned strategies describe both the strategy and when to use it.

It should be noted that often embedded strategies are not

10

sufficiently direct in telling learners when they should be used. For example, Gick and Holyoak (1980) modelled a particular problem-solving strategy which failed to transfer to a second problem that was analogically identical to the first. However, when learners were prompted to solve the second problem in the same way that they had solved the first, they succeeded. Similar results, indicating the need for system assigned strategies to accompany modelling in studies of learning by analogy, have been reported by Recd, Ernst and Banerji (1974).

When looking at the research in these areas, we must not lose sight of the fact that strategies of any kind are determined primarily by the learning task. In the case of learner-assigned strategies, this pretty much means the perceived demand characteristics (Salomon 1931, 1982) of the task. In system-assigned and embedded strategies, the strategies are selected, more likely then not, on the basis of a task analysis performed by the designer or instructor. It is therefore important to consider the nature of the task in the following discussion. With this in mind, we will now look at research in embedded, system-assigned and learner-assigned strategies (involving cognitive processes, mental skills and learning strategies).

Embedded Strategies.

A great deal of research has been carried out in our area to do with the effect of pictures and more generally visual materials on learning. This research has been summarized elsewhere (Fleming and Levie, 1978; Levie and Dickie, 1973; Dwyer, 1972, 1973), and will not be presented here. When pictorial treatments have been found to be superior to non-pictorial treatments, results have been interpreted to support either a "realism" theory or a "cueing" theory of learning. The first claims that pictorial materials are effective because they present information in ways that make it easy for the learner to recognize concepts. Cueing theory supposes that using graphic cues, such as color or arrows or underlining, make learning concepts easier by drawing attention to their critical attributes.

Recognition and concept learning are different types of learning. As a result, pictorial materials designed to teach recognition of old concepts and the acquisition of new ones should model different types of cognitive process. However, realism theories and cueing theories (summarized by Dwyer, 1972, 1979) have never traditionally been conceived of in terms of modelling cognitive processes. They embody the belief of the naive hypothesis that there is a direct link between media format and learning. As Salomon has suggested, such a belief ignores the role of the learner in interpreting and attributing meaning to

12

information (Salomon, 1979). Where pictorial treatments have been successful, they probably modelled cognitive processes without the researchers deliberately intending that they should. As Bovy (1981) has stated, there is a need to relate cognitive processing to external stimuli.

In studies where researchers have attempted to model processes, pictorial materials have been successful in teaching. In a study that required grade nine students to learn about the evolution of dinosaurs, Winn (1982b) varied the degree to which classifying processes were modelled. When pictorial diagrams were presented, showing the dinosaurs evolving left to right across the page, category names were encountered by subjects, reading naturally from left to right, before the names of each particular momber of the category. This modelled a deductive process for learning concepts, which has generally been found to be effective. When the diagram was reversed, modelling ineffective processes where instances were processed before categories had been set up for them, learning was far less successful. Royer and Cable (1975, 1976) modelled analogical thinking by likening metal structure, through which heat flowed, to tinker-toy constructions. Learners were thus encouraged to establish an analogical association between the new information and schemata that they presumably already possessed. Dean and Kulhavy (1931) showed that forcing learners to employ certain cognitive processes, by having them draw maps of a territory they were to

651

learn about, improved learning. Drawing the map both modelled for them, and forced them to employ, spatial cognitive strategies, and improved their performance.

# System Assigned Strategies.

These are just some examples of how embedded strategies can successfully model cognitive processes in order to tell learners how to process information and improve their performance. In each of these cases, we can assume that performance was superior when compared to that of subjects who did not experience embedded strategies because the modelling showed them precisely what processes to employ. However, with learners who already possess the mental skills needed to learn, all that is necessary is to tell them which skills to apply as learning strategies. An interesting example of this is offered in a study by Cramer (1931) using the time-tried interactive imagery strategy for learning word paired associates. Many studies have shown that instructions to form interactive images, in which the two concepts in the pair have a memorable relationship with each other, improve recall. The interesting innovation in Cramer's sturly was that the effectiveness of the imagery strategy was compared for first and fifth grade subjects. Imagery instructions improved the performance of the fifth-graders more than that of the first-graders, which suggests that when subjects, like the first-graders, do not possess the necessary skills,

652

system-assigned strategies are effective. This suggestion is horne out by the fact that some of the first-graders were capable of using the imagery technique, and these performed better than their age-mates. This study illustrates part of the general principle that learners of low (or no) ability cannot learn from system-assigned strategies, while those who do possess the necessary skills, can process the information effectively.

Other studies offer further illustration of this point. Weinstein (1978) taught subjects a "loci" strategy based upon features of a university campus, and this was shown to improve recall of words in a list. Thorndyke and Stasz (1930) taught subjects effective map-learning strategies, such as partitioning and reheursal, and these too improved learner performance. Alesandrini (1931) instructed subjects to write paraphrases of texts on the battery, or to draw pictures from the text. These strategies improved learning, while instructions to process the information either analytically, by focussing on details, or holstically, by relating specifies to more inclusive concepts, did not change performance. (The nature and effectiveness of system-assigned strategies has been discussed in more detail by Winn (1932a) and Bovy (1931).

15

## Learner Assigned Strategies.

There have generally been two types of aptitude-treatment interaction found in research. The first type has supported the hypothesis that elaborated instructional materials assist students of low ability. The rationale behind this is that, as Salomon has suggested (1979), the materials do the work for the learners that they are unable to do for themselves. A typical example of this is to be found in a study by Holliday, Brunner and Donais (19??) in which adding a diagram to a text improved learning in low-verbal subjects more than it did in high-verbals. It is also this premise that underlies a lot of the studies summarized by Allen (1975). A second type of ATI has suggested an alternative hypothesis. Here, elaborated materials have improved the learning of high-ability subjects. Winn (1990b) found, contrary to Holliday et. al., that the addition of a diagram to a text improved the performance of high-ability and not low-ability learners. Similarly, in another study, Winn (1981a) found that adding arrows to cue critical attributes of concepts, only helped high-ability subjects. The difference between Holliday et. al. and Winn's diagrams lay in the degree to which they were elaborated. Holliday's diagrams were complex flow-charts, with small pictures added, illustrating the concepts of biochemical cycles. Winn's diagrams were block-word diagrams containing far less detailed information, about food chains and insect

654

metamorphosis. It is therefore quite likely that, though of the same general character, the two sets of diagrams functioned in entirely different ways, with Holliday's complex diagrams supplanting through their informational richness weak or absent mental skills, while Winn's diagrams, containing far less information, mercly activated skills that were already present.

These studies suggest that picture-like materials sometimes model cognitive processes for low-ability learners, and at other times cue high-ability learners as to which strategy they should apply. In other words, they cover the whole range of embedded and detached strategies. The study by Dean and Kulhavy (1981), mentioned briefly above, studied all three types of strategy at once. In their second experiment, these researchers divided the subjects into three groups, each of which had to learn information presented on a map. Each group had to read a text containing information about a fictitious country. In addition to the text, the first "forced-organizer" group had to label an outline map by copying from a complete map projected on a screen. The second "subject-controlled organizer" group were given a map that had already been labelled for them. The third group was simply presented with the text about the territory. Using our terminology, appropriate cognitive processes were modelled for the forced-organizer group, by compelling the subjects to process the information in a certain way. For the subject-controlled organizar group, the presence of the map served merely as a

17

suggestion that they process the information spatially. The last, text-only, treatment provided no information about strategy at all, leaving learners to do the task any way they thought best. This was essentially a subject-assigned strategy. The results showed that modelling increased learning. However, there were no differences between the subject-controlled organizer and text-only groups. An ATI suggested that forced processing helped low-verbal students more than high verbals.

The failure of Dean and Kulhavy to find an ATI between system-assigned and learner-assigned strategy treatments with ability as the predictor suggests that, in this case, either providing subjects with a labelled map did not help them learn the information, or that the high-ability learners were not capable of selecting the appropriate strategy for learning. The problem seems, therefore, to lie in the way in which the subjects were cued as to which strategy to use. This problem has been addressed directly in a recent study by Winn (1982c). Subjects were shown series of eight letters that appeared sequentially for 1.5 seconds each at random locations on a computer screen. The task was either to draw the patterns the letters formed, by marking X's on a pad of paper, or to write the letters down in the order in which they occurred. These tasks are clearly either simultaneous (draw patterns) or successive (draw sequence), and were chosen because they draw on two distinct sets of cognitive processes (Das, Kirby and Jarman, 1975, 1979). One group of

656

subjects were told which task to perform before the letters were presented (a system-assigned strategy) by cucing them with the word "pattern" or "sequence" in the center of the screen. A second group was cued after the letters had been presented, lcaving any decisions about strategy up to the subjects, as they did not know from one trial to the next what the task was to be. A third group of subjects, in addition to being precued, was given an elaborate set of instructions, with as much practice as they wanted, on how to perform each of the two tasks. Thus cognitive processes were modelled for them, and practiced. For the simultaneous task, they were shown how to divide the screen mentally into quadrants, and to learn the corner of the quadrant, and the quadrant, in which each letter occurred. A partitioning strategy was found to be successful by Thorndyke and Stasz (1980) for learning maps, a not dissimilar task. Subjects in this third group were also trained to learn sequences of letters (the successive task) by forming chunks of four letters, and rchearsing them covertly. The results of the experiment showed that cusing plus instructions was more effective for both tasks than precueing alone, and that precueing was superior to postcueing. In addition, ATI's were found between tests of simultaneous (figure copying) and successive (digit span) processing and the three treatments. These interactions indicated that modelling through partitioning and chunking helped all ability levels equally on both tasks, but that, for both tasks, precueing alone helped high ability subjects far more than those

19

of low ability. These results are illustrated in figure 2.

Figure 2 about here

The results of this study suggest that embedded strategies that model cognitive processes help both high and low-ability subjects equally, and that with system-assigned strategies, high-ability subjects are capable of selecting appropriate strategies on their own while low-ability subjects are not. The Dean and Kulhavy study, it will be remembered, found that embedded strategies helped low-ability learners more than the highs, but that system and learner-assigned strategies did not have different effects on learning. Each of these studies therefore provides evidence for one part of the Bovy theory. That neither provided support for all of the theory suggests that more research needs to be done in this area, especially since the results seem partly to contradict each other. However, it is quite likely that differences in performance as a function of type of strategy interacting with ability are very much related to specific tasks. And the tasks in the two experiments were really quite different. It should also be noted that Winn's task was much more controlled and "clinical" than Dean and Kulhavy's, which suggests that different types of relationships might

658

pertain when one looks at cognitive processes in pretty "pure" form than when tasks are closer to "classroom" learning in nature.

## Conclusions.

Mere does this leave us? What are the present state and current trends in visual information processing? The paper has provided some indirect answers to this question, but, more important, it has looked at some of the current thinking and research in the more general area of information processing as it relates to our area. The first thing to note is that the phrase "visual information processing" is not all that useful. This is because it is not easy, and certainly not very productive, to separate the processing of visual material from other kinds of processing. What is more, the equation of "visual" with "pictorial" is doubly misleading. In the first instance, "visual" refers to sensory systems and "pictorial" to media format. Second, as we have seen, there is no guarantee that presentation of information exploiting either variety of sensory channel or of media format has an effect on processing and learning.

A problem therefore arises from what has been referred to as the "naive hypotheses". This hypothesis suggests that the four "dichotomies" involving sensory channel, media format, type of processing and the way in which information is represented by

659

learners internally, are all related. By and large, such a relationship does not exist, and on those few occasions when research has provided support for it, the learning tasks have been relatively low-level, and have not required much mental effort to translate the information into higher-order and more abstract structures. Many respected researchers now believe that the way information is processed depends upon what the learner perceives the task to be and the amount of effort he should invest in it. The nature of the task determines information processing as much as learner ability.

Information presented in various media formats and sensory clunnels is mediated by the mental skills that learners possess and by the learning strategies that they bring to bear upon the task. It is therefore important for instruction to control learning strategies. This can be achieved in a number of ways. Instruction can model the cognitive processes learners are expected to bring to bear on the task. This strategy is appropriate for learners who possess neither the repertoire of skills nor of ability to be able to select the best strategy. Instructional systems can "assign" a particular strategy. This works for learners who possess a degree of necessary skill, but who do not yet possess the necessary metacognitive processes required for wise strategy deployment. Finally, with high-ability learners, instruction need not give specific directions as to strategy at all. These learners are quite capable of "assigning"

660

the appropriate strategy on their own. We looked at some research that supports this approach.

It should be obvious by now that I consider the most useful direction to follow to be that pointed to by such work as that of Clark and Dovy, and Salomon. The study of information processing of all kinds has been convincing in showing that concerns with media format and sensory channel are largely misplaced by researchers in our area, because, when all is said and done, they do not make all that much difference on their own. We should, as Clark (1932) has suggested, make clearer distinctions between media and methods. While materials may be produced, exploiting channel and sign differences of the various media, they will only be effective if they model the cognitive processes that learners should be using. And even then, modelling alone may not be sufficient. Some learners will require even further guidance, through detached strategies, before the modeled processes can be transferred to the task to be learned. What is more, learners need to be told strategies by the instructional system unless they are highly able. It is not sufficient simply to show a learner a diagram and expect him to process it simultaneously.

This paper has said virtually nothing about how information is represented. The "imagery debate" is still alive and well (Kosslyn, 1931; Pylyshyn, 1931), and clearly more research will be needed before the issue is resolved. However, as I have

23

pointed out before (Winn, 1930a), it is not really necessary for us to resolve the matter in order to continue our work on information processing and ability. I continue to believe that how information is represented in memory is determined, just as processing strategy is determined, by the perceived nature of the learning task. This view is consistent with most of what has been said above. Until we understand more fully the relationships that exist among the perception of demand characteristics of learning tasks, ability and processing, we will still be flying by the seat of our pants when it comes to instructing and instructional design. Let us not get ensnared with research into melia formats, but let us look rather at internal processes and interactions, where what the learner does really makes a difference.

662

#### References

Alesandrini, K.L. Pictorial-verbal and analytic-holistic learning strategies in science learning. <u>Journal of Educational</u> Psychology, 1991, 73, 358-368.

Allen, W.H. Intellectual abilities and instructional media design. AV Communication Review, 1975, 23, 132-170.

Povy, R.C. Successful instructional methods: a cognitive information processing approach. <u>Educaional Communication and</u> Technology Journal, 1931, 29, 203-217.

Clark, R.E. Instructional methods: operational definitions and criterial attributes. Paper presented at the annual conference of the American Educational Research Association, New York, March, 1982.

Clark, R.E. & Bovy, R.C. A cognitive, prescriptive theory of instructional method. University of Southern California, 1981.

Oramer, P. Imagery and learning: item recognition and associative recall. Journal of Educational Psychology, 1931, 73, 164-173.

Cronbach, L.J., & Snow, R.E. Aptitudes and Instructional

Methods. New York: Trvington, 1977.

Das, J.P., & Jarman, R.F. Coding and planning processes. In M.P. Friedman, J.P. Das, & N. O'Connor (Eds.). <u>Intelligence and</u> Learning. New York: Plenum Press, 1931.

Das, J.P., Kirby, J.R., & Jarman, R.F. <u>Simultaneous</u> and Successive Cognitive Processes. New York: Academic Press, 1979.

Dos, J.P., Kirby, J.R., and Jarman, R.F. Simultaneous and successive syntheses: an alternative model for cognitive abilities. Psychological Bulletin, 1975, 82, 87-103.

Dean, R.S., & Kulhavy, R.W. Influence of spatial organization in prose learning. <u>Journal of Educational Psychology</u>, 1931, <u>73</u>, 57-54.

Dwyer, F.M. <u>A Guide for Improving Visualized</u> Instruction. State College, Pa.: Learning Services, 1972.

Duyer, F.M. <u>Strategies</u> for <u>Improving Visual Learning</u>. State College, Pa.: Learning Services, 1979.

Fleming, M.L., & Lovie, W.H. <u>Instructional Message Design</u>: <u>Principles from the Behavioral Sciences</u>. Englewood Cliffs: Educational Technology Publications, 1979.

Gick, M.L., & Holyoak, K.J. Analogical problem solving. <u>Cognitive</u> Psychology, 1980, <u>12</u>, 306-355.

Holliday, W.G., Brunner, L.L., & Donais, E.L. Differential cognitive and affective responses to flow diagrams in science. Journal of Research in Science Teaching, 1977, <u>14</u>, 129-138.

Kirby, J.R., & Das, J.P. Information processing and human abilities. Journal of Educational Psychology, 1978, 70, 59-55.

Knowlton, J.Q. On the definition of "picture". <u>AV Communication</u> Review, 1966, 14, 157-183.

Kosslyn, S.M. The medium and the message in mental imagery. Psychological <u>Review</u>, 1931, <u>83</u>, 46-65.

Levie, W.H., & Dickie, K.E. The analysis and application of media. In R.M.W. Travers, (Ed.) <u>Second Handbook of Research on</u> Teaching. Chicago: Rand McNally, 1973.

Luria, A.R. The functional organization of the brain. <u>Scientific</u> American, 1970, 222, no. 3, 65-78.

Luria, A.R. The Working Brain. London, Penguin, 1973.

Metcalfe, J., Glavanov, D., & Murdock, M. Spatial and temporal processing in the auditory and visual modalities. <u>Memory and</u> <u>Cognition</u>, 1981, <u>9</u>, 351-359.

28

Weisser, U. Cognition and Reality: Principles and Implications of Cognitive Psychology. San Francisco: Freeman, 1976.

Pylyshyn, Z.P. The imagery debate: analogue media versus tacit knowleige. Psychological Review, 1991, 88, 16-45.

Reed, S.K., Ernst, G.W., & Banerji, R. The role of analogy in transfer between similar problem states. <u>Cognitive</u> <u>Psychology</u>, 1974, <u>6</u>, 436-450.

Rigney, J.W. Learning strategies: a theoretical perspective. In H.F. O'Neil (Ed.) Learning Strategies. New York: Academic Press, 1979.

Royer, J.M., & Cable, G.W. Illustrations, analogies and facilitative transfer in prose learning. Journal of Educational Psychology, 1976, 63, 205-209.

Royer, J.M., & Cable, G.W. Facilitative transfer in prose learning Journal of Educational Psychology, 1975, 67, 115-123.

Salomon, G. Communication and Education: Social and Psychological

Interaction. Beverly Hills: Sage, 1931.

Salomon, G. The differential investment of mental effort in learning from different sources. Paper presented at the annual conference of the American Educational Research Association, New York, March, 1992.

Selomon, G. Interaction of Media Cognition and Learning. Son Francisco: Jossey Bass, 1979.

Salomon, G. Internalization of filmic schematic operations in interaction with learner's aptitudes. <u>Journal of Educational</u> <u>Psychology</u>, 1974, <u>66</u>, 499-511.

Schneider, W., <sup>1</sup> Shiffrin, R.M. Controlled and automatic human information processing: I. Detection, search and attention. Psychological Review, 1977, 84, 1-56.

Thorndyke, P.W., % Stasz, C. Individual differences in procedures for knowledge acquisition from maps. <u>Cognitive</u> <u>Psychology</u>, 1980, 12, 137-175.

Weinstein, C.E. Elaboration skills as a learning strategy. In H.F. O'Neil (Ed.) <u>Learning Strategies</u>. New York: Academic Press, 1979.

Winn, W.D. The effect of attribute highlighting and spatial organization on identification and classification. <u>Journal of</u> Research in Science Teaching, 1931a, 18, 23-32.

Winn, W.D. The effect of block-word diagrams on the structuring of science concepts as a function of general ability. <u>Journal of</u> Research in Science Teaching, 1990b, 17, 201-211.

Winn, W.D. The meaningful organization of content: research and design strategies. Educational Technology, 1921b, August, 7-11.

Winn, W.D. The role of diagrammatic representation in learning sequences, identification and classification as a function of verbal and spatial ability. <u>Journal of Research in Science</u> Teaching, 1932b, 19, 79-39.

Winn, W.D. Simultaneous and successive processing of patterns and sequences. University of Calgary, 1932c.

Winn, W.D. Visual information processing: a pragmatic approach to the "imagery question". <u>Educational Communication and Technology</u> Journal, 1990a, <u>29</u>, 120-133.

Widen, N.D. Visualization in learning and instruction: a cognitive approach. <u>Educational</u> <u>Communication</u> and <u>Technology</u> <u>Journal</u>, 1922a, in press.

665







TITLE: The Differential Employment of Cognitive Skills As A Function of Increasing Iconic Stimulus Complexity т

A

(1-

pre

11;

AUTHOR: Richard E. Wise

The Differential Employment of Cognitive Skills As A Function of Increasing Iconic Stimulus Complexity

Richard E. Wise, Ph.D. Assistant Vice President Hartford National Bank and Trust Company 777 Main Street Hartford, Connecticut 06115

#### The Problem

he Problem under investigation in this study had two aspects:

- As iconic stimulus complexity ("realism") increases, are the cognitive processes involved in picture interpretation differentially employed (i.e., are there significant aptitude-treatment interactions between selected cognitive skills and "realism")?
- 2. If so, are the interactions dependent upon, or independent of, the type of learning the student is expected to demonstrate (i.e., are there significant aptitude-treatment-task interactions)?

## Related Literature

### Model of Picture Interpretation Behavior

The theoretical framework for the study was provided in part by Higgins' 1975) "Model of Picture Interpretation Behavior." The model integrates revious work by Piaget (e.g., 1950) on the nature and development of inteligence, and by Gagne (e.g., 1966) on problem solving.

The model suggests that picture interpretation comprises two interrelated
events: observation and inference-drawing. Observation includes processes such as deployment of attention, perception, and initial categorization of stimuli on the basis of "formal" attributes. Inference drawing involves further categorization, not necessarily on the basis of observable attributes, and generalization to other non-visual states and events. Inference drawing is "going beyond the information given" (Higgins, 1975).

p

e

n

-2-

The picture interpretation model comprises a large number of cognitive activities. The efficiency and effectiveness with which these activities are executed appear to be mediated by a number of individual difference variables. Two of these -- field independence and ideational fluency -- were selected for further study.

## Individual Differences in Picture Interpretation

<u>Field Independence</u>, which is described in detail by Witkin, <u>et al</u>., (1977), considers the extent to which a surrounding framework dominates the perception of an item within it. It is the "ability to overcome embedding contexts of perceptual functioning" (Goodenough, 1976, p. 675). Thus field independence should play an important role in the observation stage of the model.

In addition to its role as a variable mediating perceptual disembedding, field independence (as the Convergent Production of Figural Transformations) has been associated with the redefinition, recombination, and modification of arrangement of perceived elements (Guilford, 1959, cited in Nunnally, 1967). These are acts of categorization associated with the inference drawing stage of the model of picture interpretation.

Field Independence was indicated by performance on the Group Embedded Figures Test (Witkin, <u>et al.</u>, 1971). The test involves disembedding and tracing a simple figure hidden within a complex geometric display. Splithalf reliability with Spearman-Brown correction was .837 in this study.

<u>Ideational Fluency</u> also appears to be involved in the interpretation of pictures, in "the conceptual dissection of more cue-laden stimuli of which pictures, especially realistic pictures, are representative" (Higgins, 1978). Ideational fluency involves the Divergent Production of Semantic Units (Nunnally, 1967, pp. 454-455); i.e., the searching of episodic memory(Ekstrom, at al., 1967, p. 67), and the recalling and selecting of conceptual material.

-3-

In terms of the picture interpretation model, ideational fluency (the Divergent Production of Semantic Units) would seem to be a determinant of the way in which an observer uses available cues from the iconic stimulus to direct his categorizing. Agility in category generalization would allow the subject to take fullest advantage of the available cues.

Ideational Fluency was measured by performance on the Topics Test. The test comprises two parts of four minutes each. Given a topic, the subject's task is to write as many ideas about the topic as possible. Split-half reliability with Spearman-Brown correction was .936.

In this study, the correlation between the aptitude measures was .087.

## "Realism" In Instructional Materials

Dwyer's Systematic Program of Evaluation (e.g., 1978) has amassed a large body of evidence that offers convincing support for the theoretical position that "for the promotion of specific educational objectives, visuals possessing realistic detail beyond a certain point add very little or actually decrease student learning" (Dwyer, 1978, p. 8). More cues may simply complicate the disembedding, encoding, and categorization tasks -- often to the point that unless the student possesses a highly developed set of the cognitive skills requisite to performance of those tasks, achievement declines.

#### Procedure

-4-

#### Design

The study was designed as an aptitude-treatment-task-interaction experiment which investigated the interactions of several individual difference variables on two types of cognitive tasks, as complexity of iconic stimuli increased over two treatment levels. The design also allowed investigation of the extent to which aptitudes interact with each other, as well as with treatments.

For the analysis, a three factor multivariate analysis of variance was employed. The three factors were (1) Iconic Complexity (i.e., "realism"); (2) Field Independence; and (3) Ideational Fluency. Each had two levels: "High" and "Low", in the cases of the aptitude variables; "Simple Line Drawing" and "Realistic Photograph" for the treatment variable. Dependent variables were scores on tests of drawing and comprehension. Significant main effects and interactions were followed up by constructing simultaneous confidence intervals, and by conducting univariate analyses of covariance.

The stimulus materials used were based on those used by Dwyer (e.g., 1976), and included an audiotaped script accompanied by thirty-seven 2 X 2 photographic slides. The subject was "Structure and Function of the Heart." The script was edited to delete some verbal information and to include prompts to attend to the visuals.

#### Subjects

Forty subjects, all prospective trainees at the Naval Hospital Corps School at Great Lakes, Illinois, completed the entire study. None had begun the school's curriculum at the time the study was conducted. The sample in-

cluded 22 males and 18 females representing eighteen states and every major geographic area of the country. The mean age of subjects was 20.25 years; the mean number of years' education was 12.3. Subjects were randomly assigned to two groups prior to administration of the treatments.

-5-

# Analysis

The multivariate analysis showed that there was a significant main effect of Stimulus Complexity and a significant second-order interaction effect involving complexity, field independence, and ideational fluency. Other main effects and interactions were not significant.

Simultaneous confidence intervals were constructed as a follow-up to the significant MANOVA. Because of the relatively small N, power was a special concern. After MANOVA, univariate analyses of covariance were conducted on each dependent variable and (1-beta) power coefficients were obtained. For the drawing test, power of the 3-way ANCOVA was about 0.65; for the comprehension test, about 0.90. Patterns of significance were identical to those observed in MANOVA. The power of MANOVA to detect actual differences among group centroids was in the vicinity of 0.75 - 0.80 -- sufficiently high to continue the analysis.

## Results\*

### Results Involving the Drawing Test

Significant differences in achievement on the Drawing Test were found

\*For brevity, the following abbreviations are used:

- FI = Field Independence ("Hi" and "Lo" levels)
- IF = Ideational Fluency ("Hi" and "Lo" levels)
- SLD = Simple Line Drawing treatment
- RP = Realistic Photograph treatment

between the high field independence/low ideational fluency group that received the SLD treatment, and the same group receiving the RP treatment. The source of the main effect for complexity, in favor of the SLD group, seems to be isolated here.

## Results Involving the Comprehension Test

The significant second-order interaction appears attributable to the eight groups' performances on the Comprehension Test. Group differences are recapped below:

Hig	gh 1	Per	for	rmai	nce	8		Lower Performance					and	ce	
Group					_			Group						_	Comment
Hi	FI	-	Hi	IF	-	SLD	>	Lo	FI	-	Lo	IF	-	RP	Extreme Groups
															difference
Hi	FI	-	Lo	IF	-	SLD	>	Lo	FI	-	Lo	IF	-	RP	Weak treatment X
															FI interaction noted
Hi	FI	-	Lo	IF	-	SLD	>	Hi	FI	-	Hi	IF	-	RP	Weak treatment X
															IF interaction noted
Hi	FI	-	Lo	IF	-	SLD	>	Lo	FI	-	Hi	IF	-	SLD	In SLD, FI explains
															29% of comp. test
															variance

## Discussion

Results of the study suggest that:

- Field Independence and ideational fluency are important cognitive skills in the interpretation of pictorial stimuli;
- In the processing of pictorial information, the primary role of field independence is as an evaluative, analytic, problem-solving

-6-

skill, rather than as a perceptual disembedding skill;

-7-

- As the complexity of iconic stimuli increases, the psychological processes involved in their interpretation are differentially employed.
- The differential employment of cognitive skills is dependent, to some degree, on the type of learning the student is expected to demonstrate.
- Aptitudes may interact with each other, as well as with treatments and tasks; and
- Overall, the superiority of the Simple Line Drawing treatment over the Realistic Photograph treatment is confirmed. This is consistent with a large body of previous research.

#### LITERATURE CITED

- Dwyer, F.M. The effect of IQ level on the instructional effectiveness of black-and-white and color illustrations. <u>AV Communication Review</u>, 1976, <u>24</u>, 49-62.
- Dwyer, F.M. <u>Strategies for improving visual learning</u>. State College, PA: Learning Services, 1978.
- Ekstrom, R.B., French, J.W., Harman, H.H., & Dermen, D. <u>Manual for kit</u> of factor-referenced cognitive tests, (August, 1976 ed.). Princeton, NJ: Educational Testing Service, 1976.
- Gagne, R.M. Human problem solving: Internal and external events. In B. Kleinmuntz (Ed.), <u>Problem solving: Research, method, and theory</u>. New York: John Wiley, 1966.
- Goodenough, D.R. The role of individual differences in field dependence as a factor in learning and memory. <u>Psychological Bulletin</u>, 1976, <u>83</u>, 675-694.
- Guilford, J.P. Three faces of intellect. <u>American Psychologist</u>, 1949 14, 469-479.
- Higgins, L.C. Children's inference drawing behavior: Its psychological nature and responsiveness to educational intervention. Unpublished doctoral thesis, University of Sydney, 1975.

- Nunnally, J.C. <u>Psychometric theory</u>. New York: McGraw-Hill Book Company, 1967.
- Piaget, J. <u>The psychology of intelligence</u>. London: Routledge and Kegan Paul, 1950.
- Witkin, H.A., Moore, C.A., Goodenough, D.R. & Cox, P.W. Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 1977, <u>47</u>, 1-64.
- Witkin, H.A., Oltman, P.K., Raskin, E., & Karp, S.A. <u>A manual for the</u> <u>embedded figures tests</u>. Palo Alto, CA: Consulting Psychologists, Inc., 1971.