43rd annual Proceedings

Selected Research and Development Papers - Volume 1
Selected Papers on the Practice of Educational Communications and Technology - Volume 2

Presented Online during The Annual Convention of the Association for Educational Communications and Technology

Editors
Michael Simonson, Ph.D.
Fischler College of Education
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Davie, FL

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Extended Learning
Academic Affairs
Barry University
Miami Shores, FL

2020 Annual Proceedings – Volumes 1 & 2

Volume 1: Selected Research and Development Papers
And
Volume 2: Selected Papers
On the Practice of Educational Communications and Technology

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Preface

For the forty third time, the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. Papers published in this volume were presented line during the annual AECT Convention. A limited quantity of these Proceedings were printed and sold in both hardcopy and electronic versions. Volumes 1 and 2 are available through the Educational Resources Clearinghouse (ERIC) System. Proceedings volumes are available to members at AECT.org.

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The Proceedings of AECT's Convention are published in two volumes. Volume #1 contains papers dealing primarily with research and development topics. Papers dealing with the practice of instructional technology including instruction and training issues are contained in Volume #2. This year, both volumes are included in one document.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship 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 Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

Michael R. Simonson
Deborah J. Seepersaud
Editors

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TABLE OF CONTENTS

VOLUME 1 – SELECTED RESEARCH AND DEVELOPMENT PAPERS

VOLUME 2 - SELECTED PAPERS ON THE PRACTICE OF EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY

Volume 1

Selected Research and Development Papers

Training, Planning, Designing: Purposeful Professional Development

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One purpose of school has always been to help students become competent readers, writers, reasoners, and calculators. Implicit in this is that teachers will be prepared to incorporate common information technologies into their lessons. For many generations of students in public schools, information technologies used for print and the written word dominated schools, but the arrival of desktop computers changed that.

The digital tools installed in schools in recent decades are the latest of the long series of electronic media that were developed in the 20th century. Despite promising rhetoric from advocates, efforts to use radio, movies, and television in education largely failed (Cuban, 1985) and they disappeared from classrooms or were used for marginal purposes. Advocates for computer-based instruction appear to have reversed that pattern as those devices and media have become important tools for all students

Researchers associated with the Apple Classrooms of Tomorrow (ACOT) project, one the early initiatives to study computers in schools, found teachers will use computers if they are taught to use them and if they are supported in learning to teach with them (Sandholtz, Ringstaff, & Dwyer, 1997; Schofield, 1995). Following that finding, school and technology leaders have implemented professional develop to support teachers' learning about all aspects of technology.

Organizing and presenting effective professional development continues to be a problem faced by practitioners, leaders, and scholars (Jin, Li, Meirink, and der Want, & Admiraal, 2019; Merchie, Tyytens, Geert, & Vanderlinde, 2018). The rapid evolution of technology (de Reuver, Sørensen, & Basole, 2018), the effects of technology on pedagogy (Gordy, Jones, & Bailey, 2018), the lack of a dominant theory of educational technology (Hew, Lan, Tang, Jia, and Lo, 2019), and a variety of teachers' personal skills and beliefs (Joo, Park, & Lim, 2018) are all factors that have been found to affect teachers' learning about computers and technology.

Meeting the professional development needs of teachers can be particularity challenging for leaders in rural schools that tend to be smaller and have fewer resources that can be dedicated to professional technology staff than suburban and urban schools. This paper describes the efforts of one rural school district to improve the professional development opportunities available to teachers in the schools they lead.

Purpose

A curriculum coordinator summarized the current situation regarding her district's professional development related to information technology for teachers, "we offer technology workshops and different people show up expecting different things." She continued "We need to give everyone better information so principals and teachers can make better decisions... so we [avoid] frustrating those faculty who make the effort to attend workshops, but [then] leave feeling it was a waste of their time." In order to address this situation, the curriculum coordinator initiated a project to design a comprehensive plan for supporting teachers' learning about technology and its role in the classroom. The author was retained as an external consultant to support this project. Several themes emerged during the work; eventually, these were sufficiently well developed that they were used to define a typology. This paper contains a description of the project, the typology that emerged, and the some of the observations of the leaders who participated.

Setting

This project involved the leaders of a school district in the northeast United States. The district comprises six schools, one secondary school (enrolling about 480 students in grades 7-12) which is located near the geography center of the school district and five small schools enrolling students in grades PK-6 dispersed throughout the towns of the district.

A team, led by the curriculum coordinator and comprising the principals from all of the elementary schools and the assistant principal at the 7-12 school, are largely responsible for the instructional leadership decisions in the district. One member of the leadership team captured the consensus of the team when she said, “Technology is in our vision statements and the school board is supportive... but sometimes we just don’t have the needed experience... my background is literacy, I can help our teachers help struggling readers, but technology is not my field.” Pointing at another, she continued, “he can do the same for science, and I trust his judgement, but who here can we trust when we talk about technology?”

They described their existing technology support system and professional development as “ad hoc” to capture the lack of consistency and direction. In the past, the district had retained a technology coordinator who was responsible for both managing the infrastructure and organizing and presenting professional development in educational technology. The curriculum coordinator described the failed search to fill that position, “We realized [our best candidate] was really good at technology but had no education background... so we left the position open.” The leadership team concurred the technicians that remined were keeping the technology reliable and robust, but “After hiring consultants to do some technology workshops, we decided—as educators—we needed to take a more active role leading our work with educational technology,” explained the curriculum coordinator.

Data collection

Following the recommendation of the author, the leadership team decided to focus their work on the question “What can we do to improve our practices related to professional development specific to technology?” and to modify Delphi research methods (Delbeq, Van De Ven, & Gustafson, 1975) for this project. Similar methodology methodology has been used to address planning and procedural problems in situations in which new strategies are deemed necessary (Malekpour, de Haan, & Brown, 2016). This project found a panel of experts participating in focus group interviews to discuss and give feedback on a series of documents prepared by the leadership team (see figure 1).

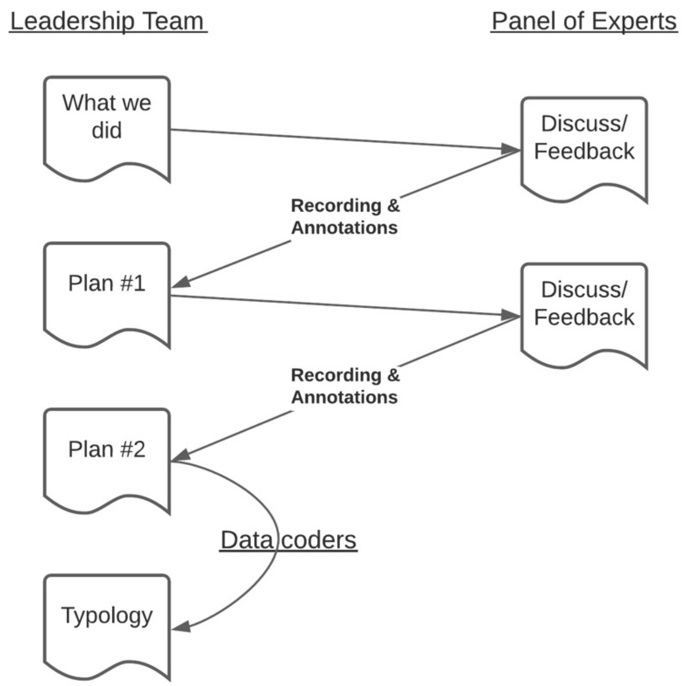

Figure 1. Illustration of the modified Delphi process

The leadership team began by composing a collection of two-page documents in which they identified the professional development that had been held in their building in the previous year along with a reflection on how successful or effective they found the efforts to be. That collection was forwarded to a panel of experts who discussed the summaries and provided feedback in a focus group interview held via video conference

The annotated documents and audio recordings of the focus group interviews was used by the leadership team to compose a draft of a professional development plan for the following year. That plan was discussed by the same panel of experts who also provided feedback to the leadership team. Audio recordings and the annotated documents from the second focus group were incorporated into a second draft of the professional development plan.

Digital versions of each document created during the process along with transcripts of the focus group and the leadership team meetings at which the professional development plans were drafted were coded in a multistep process. First, the words that appeared most frequently in the documents were used as major categories to code the data (Savin-Baker & Major, 2013). The author and one other researcher negotiated the results of the first coding and reduced the codes to six and coded the data a second time in a manner consistent with the constant comparative method (Glaser, 1965). When coding the data for the second time, both researchers identified three themes that dominated the documents. In the final negotiation of the codes, the researchers concurred that “focus on technology,” “source of expertise,” and “the role of the students” were the dominant themes. The themes were presented to the leadership team who concurred with the definitions and define the typology.

Dimensions of Professional Development

Because the three themes appeared to describe independent (although connected) factors that varied in opposite ways, they were interpreted as dimensions which can be defined along continua. Benchmarks along the continua were defined so that different values of each could be useful in predicting the nature of the professional development activities offered to teachers.

Focus on Technology

While it may seem unnecessary to recognize professional development to improve teachers' use of technology should have a focus on technology, the participants in this project developed a sophisticated understanding of technology during the project. Technology was differentiated into that which is the same regardless of the role of the teacher (labeled decontextualized technology) and that which depends on the situation in which it is used (labeled contextualized technology). These two types of technology were placed on the extremes of the Focus on Technology dimension (see figure 2).

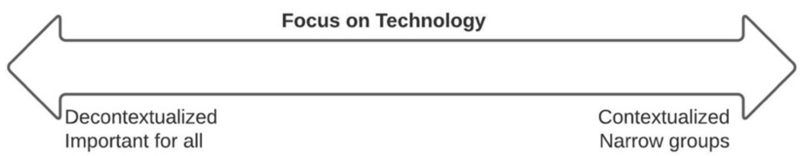

Figure 2. Focus on Technology dimension

Correlated with contexts in which the technology is used in the definition of the Focus on Technology dimension was the size of the population that needs to learn about. The assistant principal from the secondary school differentiated the two extremes. "There are some things everyone needs to know," he suggested, "our middle school art teacher does the same things to take attendance in [the SIS] as the high school chemistry teacher." This was contrasted with "the fancy graphing tools our calculus teacher uses." It was reasoned everyone could attend the same professional development on the SIS, but only one or two teachers would need to learn about the graphing tool.

The team decided it was not necessary to define benchmarks along the continuum representing the Focus on Technology dimension. They recognized the hardware and software that focused the professional development would vary in the contexts in which it was relevant and the groups that deemed it useful could make those decisions for themselves.

Source of Expertise

The professional development planned by the leadership team supports teachers as they become more competent in accomplishing curricular goals as well as more competent users of technology. The leadership team recognized three types of expertise are necessary to accomplish these two goals, and those three define the Source of Expertise dimension (see figure 3).

Figure 3. Source of Expertise dimension

At one extreme on the dimension, the expertise comes from a technician whose "knowledge is dispensed with little concern for who is using it." An example described by the leadership team was the representative from the publishers of their new student information who arrived to demonstrate the how to use the graphic user interface to enter data and generate reports. At the other extreme is the expertise of teachers who understand teaching and learning independent of the technology. Their expertise is in the nature of experiences necessary for students to learn the curriculum and methods for delivering those experiences.

Between the technician and the teachers, there are technology specialists. These individuals tend to be teachers who develop technology expertise. Placed between technicians and teachers, these individuals serve as a conduit for communication between the two sources of expertise. They both recommend technology solutions for teachers and recommend updates and reconfigurations of technology to meet teachers' needs. They help troubleshoot technology with teachers and communicate with technicians to seek clarification or to communicate needed changes. While technicians are expected to contribute to professional development for specific events that would not be repeated for individual teachers, technology specialists are expected to form on-going relationships with teachers.

Role of Students

The leadership team also recognized students are an important consideration in their plans. One of the principals suggested, "this may be the biggest part of what we did, we now know how to use students' experiences to inform professional development for teachers." The Role of Students dimension was defined with three benchmarks (see figure 4).

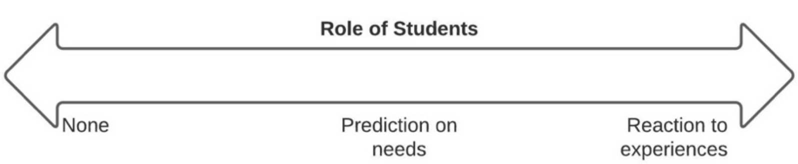

Figure 4. Role of Students dimension

Some professional development can be effective and can be conducted with no consideration to the students. These activities are unchanged when there are different populations of teachers in the audience. Other professional development is effective only when it is conducted with populations of students in mind and decisions are made in a manner that will benefit those students. The leadership team did differentiate those professional development activities that are conducted without real knowledge of how the technology would be experienced by the students and that professional development intended to improve future lessons by incorporating students' and teachers' experiences into the lessons.

Typology of Professional Development

The leadership team defined three types of professional development in terms of the three dimensions. For these leaders, these became conceptual artifacts (Bereiter, 2002) as they could agree on what would happen during professional development activities labeled as each and the team was committed to using the labels. The conceptual artifacts were expressed in a collection of planning documents and templates the leadership team developed as the project ended. The curriculum coordinator had the support of the rest of the leadership team when she concluded, "My office won't schedule or announcement anything that isn't classified as one of them."

Training

When professional development activities are focused entirely on how to operate technology and the steps were appropriate for any teacher to learn without regard to the students in their classes, the team described it as Training. The individual who provided the Training needed no expertise in teaching, although teaching expertise did not preclude them from delivering Training (see figure 5).

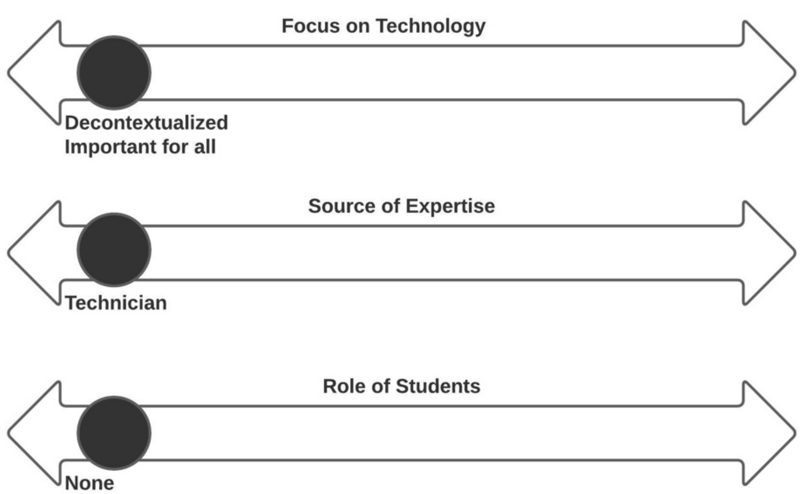

Figure 5. Definition of Training

In addition, the previously mentioned student information system workshops, the leadership team suggested learning how to use productivity suites be subject to Training. Further, this type of professional development is appropriate for on-boarding new teachers to ensure they understand the district's email, network, human resources, and other systems and procedures. Training is not exclusive to operational functions, however; the school librarians were asked to provide training in using the library databases and professional staff who work in the school's maker space Trained teachers in using the printers and other devices located in that studio.

Planning

The leadership team summarized Planning as "professional development activities in which teachers prepare technology-based lessons but they don't know for sure how they will turn out with students." In terms of the three dimensions, planning is narrowly focused and contextualized. Even then they are planning in groups, teachers prepare for the students they will teach during a planned period of time. While technology specialists are often present during Planning, they usually defer to the expertise of teachers in during this type of professional development (see figure 6).

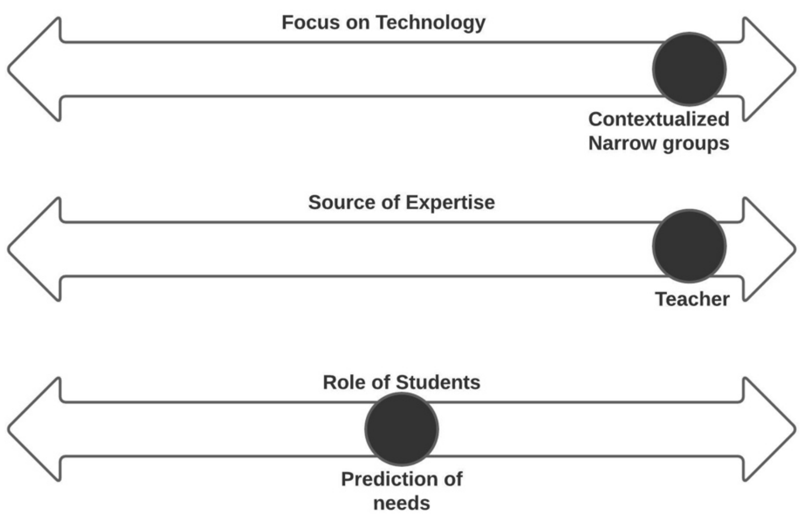

Figure 6. Planning defined

The leadership team had intense discussions about the Role of Students in Planning, especially with the fact that plans may not actually result in the intended experiences for students. The choice of the words "prediction of needs" to define the roles of students resulted from negotiation within the team about the multifarious factors that affect student learning and the final agreement that "good plans make the outcome likely but doesn't guarantee them."

Design

The final type of professional development the leadership team is intended to improve the effectiveness of the planned activities. Recommendations are made to improve both make the technology more efficient and the learning experience more effective. Compared to Planning, Design finds a shift towards more broadly applied technology, a greater role for technology specialists, and decisions made in response to the experiences of the students (see figure 7).

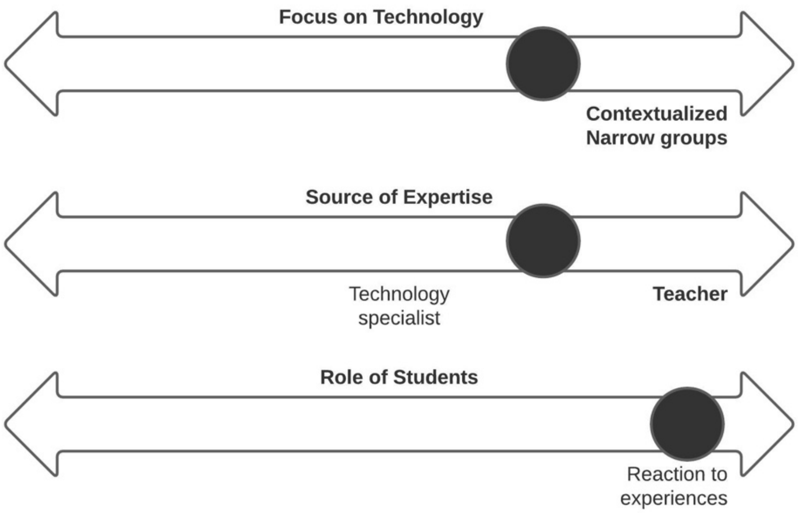

Figure 7. Design defined

In some cases, the technology specialists will be present when the planned activities are implemented. In the Design that follows the implementation, the technology specialist interprets their observation of the efficiency and effectiveness of the technology and recommends changes to improve it for future users. Because future users include both similar groups as well as different group that use the same tool for similar purpose, the focus on technology is less contextualized than it is for Planning. The recommendations may focus on changes in how the technology is configured as well as practiced for how students are directed to use it.

Perhaps the most innovative aspect of this plan from the leadership team's perspective was the active role that students would play in Design. Their intent was to encourage teachers to use this information to inform Design decisions, so the curriculum coordinators clarified she would not support Design activities unless they incorporated data regarding students' experience. Further, to encourage Design, Planning proposals were expected to include strategies to gather student experiences.

Discussion

This project can best be described as an action research project. The participants originally intended to simply create a plan for professional development related to technology for the following year. It is only after the potential for including the expert panel that the importance of including outside participation for creating new strategies was recognized. While the leadership team did plan to gather and use the recordings and annotations of the documents for their own planning, the decision to code the data was made only after one of the experts on the panel asked permission to code the data to gain experience for their forthcoming dissertation that would analyze qualitative data. For these reasons, the project can be discussed from the perspective of the participants, but generalizations are difficult to justify.

The members of the leadership team concurred the project had been a valuable learning experience, although it had expanded to include more of their time than they originally intended.

On several instances, the team extended the hours of their regular meetings to accommodate work on this project and gave themselves tasks to complete before they next convened. One of the principals noted at the end, “I would not have agreed to this knowing how would grow, but I see we have a structure for PD into the future rather than just a plan for next year. I definitely learned about technology in my school.”

In discussing the project and the typology, the curriculum coordinator agreed with the author that the dimensions and typology were sound and had emerged from the data, but they “probably aren’t original. I’m not sure I could point you to them right now, but I bet we could find similar ideas with a quick search.” In response, she concluded, “You probably could have told us this, but I’m not sure we really would have understood it in a deep manner. Because we argued over the feedback, we all share a common understanding. That doesn’t come from being told.” For the members of this team, their participation in drafting the plans and negotiating and interpreting the feedback from the expert panel interviews was an irreplaceable part of their learning.

The project also represented a shift in operational decisions related to professional development. The team intended to schedule training sessions based on the business and data requirements of the school district, and to allow and encourage teachers to take a more active role in defining, scheduling, and leading their own professional development to plan and design curriculum and instruction. Previously, decisions related to professional development offerings and attendance were made by the leadership team. Their new understanding led to leadership team to decide that, except for Training, many professional development decisions related to Planning and Design would be made by teachers and managed by them as well. This change was instantiated in the templates and forms the team produces as part of the project as well.

The final effect on the members of the team was change in their perceived capacity to provide effective leadership. At the start of the project, they recognized that (as individuals and as a group) they lacked the expertise to provide effective leadership specific to technology. “Before this, I saw technology and workshops as a cloud. I wasn’t sure what they did and why, and I avoided it whenever I could,” noted one of the participants who continued, “now I at least have some questions I can ask to help me understand what teachers need and what workshops will entail. That makes be a better leader, as I can facilitate good decision making by my staff.”

Conclusion

In conclusion, this project describes how a group of rural school leaders addressed a gap in their professional knowledge. While the project did become greater than they originally intended, it produced a typology that was not part of the original intent and that increases their capacity to provide effective leadership. In reviewing the final report of the work, the curriculum coordinator observed, “The typology isn’t what we wanted when we started, but it is what we needed.”

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Feminist Pedagogy in Digital Spaces: Brief Systematic Literature Review

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This paper presents a systematic structured review of recent research that explicitly underscores teaching and learning aspects of online feminism. The purpose of this paper is to draw attention of higher education professoriate, policy makers and practitioners to social media platforms as potential supplementary teaching tools in higher education contexts.

In this digitally driven world, many people around the world access social media and other online platforms, proving that the power of the internet becomes indisputable in modern age (Fotopoulou, 2016). Digital media is praised for its potential in fostering global communities of feminists who participate in social networks to debate, discuss, share information and call for action (Munro, 2013). Women's voices are amplified in neoliberal digital spaces because social media affords interactivity (Pruchniewska, 2018). Digital spaces facilitate the paradigm shift in that serving as a new means of organizing campaigns against issues of inequality and social injustice (Eudey, 2012). To analyze how feminist pedagogy is practiced in the digital spaces, this systematic literature review looks at ten seminal articles that explicitly talk about teaching and learning aspects of online feminism. This paper is structured in the following way: first, I discuss the rationale of choosing feminist pedagogy as a theoretical framework. Second, I provide various scholars' definitions of feminist pedagogy to enhance our understanding of feminist pedagogy. Third, I explain this study's mode of inquiry and research questions that helped me examine the content of the articles. Fourth, I relay findings in relation to the research question. Then, I will conclude the paper by making recommendations for key stakeholders in higher education.

Perspective(s) or theoretical framework

Feminist pedagogy is adopted as a theoretical framework in analyzing the content of the articles. Based primarily on feminist theory, this pedagogy includes a set of teaching strategies that considers knowledge as socially constructed (Weiler, 1995). The core of feminist pedagogy, however, is a teaching method that is geared to empowering the mode of learning that places women at the forefront (Luke,1994). Empowering women in learning is essential in contemporary higher education because male styles of learning is rooted in institutional culture, making women students feel incapable of succeeding as students (Sengupta & Upton, 2011). According to Luke (1994), feminist pedagogy helps women's identity be more visible in the mainstream academic discourse. Second, focusing on feminine scholarship and politicizing women's issues, it offers approaches to educational and consciousness raising practices. Third, it acknowledges the diversity of women's experiences and fosters inclusive content delivery in teaching and learning. Before proceeding to the systematic analysis of the articles, I have reviewed some articles that define feminist pedagogy to provide a detailed analysis of the framework of this study.

Definitions of Feminist Pedagogy

As a term, feminist pedagogy was coined during the 1980's to describe teaching methods that were used by feminist scholars in women's studies programs (Shackelford, 2020). Since that time, scholars developed various definitions of feminist pedagogy. Shackelford (2020) describes feminist pedagogy as student-centered and the one that emphasizes cooperation in the learning and teaching process. Since feminist pedagogy focuses on developing critical thinking, Shackelford recommends economists to practice feminist pedagogy for as they can utilize dialogic approaches to teaching and to collaborative learning. Grande (2003) defines feminist pedagogy as a teaching practice that fosters teaching practices that encourage student-centered learning. When applying the values of feminist pedagogy in higher, such as its student-centered and cooperative styles, the author recommends analyzing gender through its intersections with race, class, and sexuality. Discussing the underrepresentation of women (and men of color) in science, Mayberry (1998) describes feminist pedagogy as a teaching practice that helps resist the dominant discourse and transform current learning practices by advocating for collaborative learning in science. Feminist pedagogy helps educators teach students how to question scientific systems and the relationship of those systems to power, oppression, and domination (Mayberry,1998). Maher (1987) defines feminist pedagogy as a teaching practice that is made of two sources: liberation pedagogy and feminist theories. As the author argues, these two approaches complement each other, and when practiced together, they produce a robust pedagogy, which is feminist pedagogy, that can challenge traditional teaching practices in higher education. Using such pedagogy in higher education helps promote the role of women in education, helping improve teaching both women and minority students (Maher, 1987).

Modes of Inquiry

A systematic literature review was chosen as a mode of inquiry for this study with the aim of conducting critical content analyses of the studies that are included in this literature review. Structured literature review (SLR) is a systematic approach of identifying, collating and analyzing a set of studies by defining its boundaries in terms of what will be included and excluded (Bisogno, Dumay, Rossi, & Polcini, 2018). Adopting a structured literature review methodology and applying the topical category of SLR was deemed as appropriate to directly analyze the articles in their relation to research questions.

This review did not apply exclusionary criteria to methodology with the aim of learning different approaches in analyzing hashtag feminist activism that is practiced in online platforms. The inclusion criteria of the studies were as follows: a) studies that utilized feminist media research; b) the articles that were published in 2017-2019; c) studies that explicitly highlighted teaching and learning aspects of the hashtag activism. The articles that did not explicitly talk about teaching and learning/raising consciousness awareness aspects of digital feminism were excluded.

Since the search engine ERIC (EBSCO) did not sufficient number of relevant resources for the review, Google Scholar was used, targeting peer-reviewed journal articles and excluding dissertations and books that are not available open source or through the NIU library database. Over 40 entries were scanned for eligibility before the ten articles were selected. The following research questions were formulated to analyze the content of the articles:

1. Within research that highlighted teaching and learning aspects, what is the context of

their foci?
2. Which theoretical framework(s) di the studies use?
3. What methodologies did the studies employ?

Findings

To analyze the content of the seminal studies, a free and open source software- Docear was used. Docear is a new solution to academic literature management allowing the most comprehensive organization of literature. As this software offers PDF metadata retrieval, it allowed me to transfer the annotations from PDF files selected for the study. This process helped me identify the similarity of words/concepts related to teaching and learning aspects featured in the study.

Summary of Findings for RQ1

In relation to RQ1, teaching and learning as well as consciousness raising as the characteristic of research has been identified as the foci of the selected studies. The content of the articles highlighted educational aspects of the blogs through which feminist movements, using the feminist mantra “personal is political,’ empowered women to share their experiences with racism, sexism and other “isms” and to create collective identities in their fight against social injustice in relation to women. Some of the research highlighted the connection between the second and firth wave feminism, stating that “personal is political” slogan of the second wave feminism was used in the discussions online feminist movements. The phrase was coined by Carole Hanisch in 1969 and later was recuperated by Audrey Lorde (Troutman, 2014).

Personal is political. To describe how personal stories shared in digital platforms have gained political meanings, the majority of the articles discussed different contexts of application of the popular feminist slogan “personal is political” in the fourth-wave feminism. In those digital spaces, women shared individual stories related to sexual assault, rape and other issues to raise consciousness among the online community and feminist circles, thus proving the appropriateness of the slogan in digital platforms. For instance, Aitken’s (2017) article opened up a conversation about the empowering and consciousness raising power of the fourth-wave feminism through relevant examples. As she noted, the use of the second wave feminists’ famous slogan “personal is political” in the fourth-wave digital movements connected this wave to the second wave of feminism because shared personal stories raised salient political issues. Although Aitken (2017) talked about active digital movements in general without focusing on the specific hashtag movement, she underscored the power of digital tools in amplifying the diverse voices in inclusive global platforms. Online platforms have the power of unite and inform women, especially young women, discovering feminism and developing collective identities across digital spaces on issues that resonate with their experience (Aitken, 2017). Drawing a parallel between second wave and the fourth wave feminism, Zimmerman (2017) explained that the important message of the second wave, which states “personal is political,” as a tool for collective consciousness raising, was transferred to the fourth wave in that digital technology has become organizing and consciousness raising tool. To highlight the importance of the Twitter community in the analysis of the discourses on racism, feminism, and online representation, Zimmerman (2017) traced the genealogy of the fourth-wave feminism, noting that the this movement combines the important elements of the second and third wave feminism, such as resistance to oppression of the second wave and the third wave's recognition of digital culture to facilitate feminist discourses. Initially taking a critical stance on the political role of the fourth-wave feminism, Rogan and Budgeon (2018) posed a question about the applicability of the second-wave movements definitive 'personal is political' slogan to digital feminism. Collecting data through the questionnaire posted on Facebook and Twitter from young women under the age of 21 across the UK, posted on social media, the authors drew conclusion that about the importance of social media providing a political space that is consistent with the definitions of the political advocated by the second wave feminist, while helping women define their personal identities through the connection with others who shared similar experiences with them through Facebook events and tweets engage with politics. Discussing experiences of young girls at a secondary school in England with digital feminism, Kim and Ringrose (2018) recommended that the social media could serve as a strategic tool for exploring rape culture and other topics. The girls joined feminist movements for personal reasons, such as raising their consciousness about feminism. Through their engagement with online feminism, they could challenge "notions of youth as politically indifferent and inept" (p. 47).

Focusing on the feminist analysis of hashtag movements, several other articles highlighted the links between trending (personal) topics with a larger structural framework (political). For example, analyzing frequently used terms in #YesAllWomen, Barker-Plummer and Barker-Plummer (2017) notes that this hashtag feminism is both personal and political discourse because the majority of the shared stories comprises first-person accounts on oppression, gendered violence and sexual assault. The hashtag #YesAllWomen reinforces a feminist rhetoric links trending topics with a larger structural framework, i.e., creates links between the personal and the political. Through the analysis of discourses of hashtags #MeToo and #BeenRapedNeverReported movements, Mendes, Ringrose and Keller (2017) discuss how these popular online feminist movements create safe spaces that challenge sexism, patriarchy and other forms of oppression via digital platforms. Extending this conversation to #MosqueMeToo movement, Point's (2019) article examines the potential of this hashtag feminism for empowering Muslim as it encompasses the real-life experiences and views of Muslim women across the globe. The unique aspect of this movement is that it analyzes feminist and religious discourses together, raising consciousness about the interrelatedness of these topics in regard to Muslim women's experiences. Turley and Fisher (2018) discuss British feminists' hashtags, namely #everydaysexism and #shoutingback, for their individual protests against unequal treatment of women in the patriarchal culture while advocating for issues that affect women around the world. Highlighting the importance of social networking sites for fostering feminist movements, the authors note that digital spaces are vital for practicing the fourth wave of feminism to creating global communities. Taking a different stance on digital feminism, Jester (2018) analyzes the three curriculum groups (Rhodes Must Fall, Why is My Curriculum White?, and Women Also Know Stuff) to underscore the importance of representation of diverse experiences in the dominant Western academic discourse, which operate to bring changes to higher education. Through Twitter and Facebook, these movements have become successful in bringing to the forefront the curriculum issues to the attention of higher education practitioners, academicians and policy makers. Therefore, Jester (2018) proposes that scholarship on the feminist fourth wave can be enhanced through the examination of these groups as some successful events offer promising opportunities. For example, re-tweets and hashtags allowed showcasing the work of women in history (@womnknowhistory (through Women Also Know Stuff website's 'Women Also Tweet' section) while global Facebook groups of Why is My

Curriculum White? helped organize events garner support and garnering support for making curricula diverse and representative of all groups of people. Ringrose (2017) also discusses the benefits of using Twitter as a teaching tool in higher education contexts, detailing her a lecture where she deconstructed her personal activism through Twitter account. Her participation in major feminist Twitter discourses about the U.S. election in 2016 helped her to initiate a debate on raising awareness among her students about the importance of fostering the feminist slogan the 'the personal is political' through tweet cultures.

Summary of Findings of RQ2

In relation to the findings of RQ2, the findings revealed two major themes: (a) intersectionality as a framework; (b) feminist pedagogy and (c) Freire's Pedagogy as a theoretical basis.

Intersectionality as a framework. Although Aitken (2017) does not frame her study within the intersectionality, she recommends that combination of community education with feminist pedagogies can help raise consciousness about intersectional identities. Criticizing #YesAllWomen from the intersectional feminist lens, Barker-Plummer and Barker-Plummer (2017) point out to the movement's failure to be adequately intersectional due to its dominant white discourse thereby making intersectional feminists set up parallel hashtags. Jester (2018) argues that intersectionality is the foundational principle of curriculum activism is a core component of fourth-wave feminism and within the higher education context, it is. Drawing from the works of Tara L. Conley and Kimberlé Crenshaw, Point (2018) explores the potential of hashtag movements to raise intersectional awareness about Muslim women's struggles for equality, contributing to the debates regarding gender and Islam, and transnational feminist studies. Although Turley and Fisher (2018) do not use the intersectionality framework, they underscored the importance of social media campaigns for fighting against sexism, misogyny and rape culture through discussions. To enhance the discussion, they recommend analyzing online feminism through the lens of transdisciplinary literature, namely national, transnational and global academic literature. Drawing on Black feminist and intersectional feminist scholarship, Ringrose (2017) explores racism and misogyny in the debates on Twitter surrounding the 2016 election in the United States. Mendes et al. (2017) also recommend reviewing public discourse on Twitter with intersectional lens because this framework allows understanding the accessibility to the discourse in terms of ability, race and class privilege, which is the main aspect of digital feminism. Zimmerman (2017) also draws on intersectional scholars' works, noting that intersectionality serves as the political driver and theoretical framework employed by fourth wave feminists. According to Zimmerman, this framework is necessary for analyzing hashtag movements to foster dialogues on intersectional identities and their representation in online platforms.

Feminist pedagogy. All the articles reviewed highlighted explicitly or implicitly the importance of feminist pedagogy to understand the discourse happening in hashtag movements. Therefore, it is important how the scholars describe feminist pedagogy in those articles. For instance, Aitken (2017) summarizes research on feminist pedagogies by drawing attention to relationship between community education and feminist pedagogical practice. Critically analyzing feminist teaching and consciousness raising practices, the author explored their consistency with a community education approach. Focusing on the fourth-wave feminism, Aitken (2017) underscores the power of online platforms to evoke debates on gender inequality through campaigns and to amplify feminist voices. Trying to explain how feminist pedagogy is practiced through a hashtag movement, Barker-Plummer and Barker-Plummer (2017) draws attention the discursive activism that took on the platform in two forms: (a) a site for collective identity to raise consciousness (sharing of experiences and stories) and (b) recirculation of shared stories and experiences through other platforms, affecting public discourse beyond Twitter. Although not explicitly, Point's (2018) study notes that the fourth-wave feminism focuses affords a contemporary method of community building, namely through the sharing of collective experience. When discussing the importance of feminist pedagogy in raising consciousness about racism and sexism through Twitter, Ringrose (2017) reflects on the dynamics of her own participation in Twitter as a public medium for practicing the feminist pedagogy.

Pedagogy of Oppressed as a theoretical basis of feminist pedagogy. Some articles trace feminist pedagogy back to Freire's Pedagogy of the Oppressed and comment on the importance of the pedagogy in exploring feminist issues discussed in their studies. Indeed, *Pedagogy of the Oppressed* provides an appropriate departure point for feminist pedagogies because the knowledge production is a dynamic dialogue in which the learner is directly involved (Freire, 2005). Citing some scholars works, for instance, Aitken (2017) notes that feminist pedagogies replenished Freire's work, putting an emphasis on gender in traditional educational contexts and creating inclusive framework that aims to restructure education as a space for all genders. Jester (2018) argues saying that Freire's *Pedagogy of the Oppressed* allows us to understand the feminist components of curriculum activist groups as it forms the basis of the groups, specifically of Why is My Curriculum White?

Summary of Findings of RQ3

In relation to RQ3, I have based classification on the authors' descriptions of their methodology, rather than applying a priori categories. The content analysis of blogs and groups revealed that the primary purpose of them were to teach, educate and raise consciousness of women about the existing problems. For example, Barker-Plummer and Barker-Plummer's (2017) case study's methodology was the content and discourse analysis of #YesAllWomen hashtag, including two million tweets and of 251 media and blog stories, the interactions of which are traced back to the hashtag. The rationale for choosing #YesAllWomen as a case study explained with the hashtag's potential for underscoring the importance of online discursive politics for public debate ad digital protest. Second, #YesAllWomen is a successful example of how feminists are developing new strategies to engage and utilize emergent communications platforms.

Other studies used different methodologies to explore teaching aspects of the social media discourses or reviewed the literature that discussed the potential of online platforms in uniting women across the globe. The table below provides detailed information about the methodology of the studies and outcomes reported in those studies, highlighting the importance of integrating non-academic tools to higher education to foster the inclusion of intersectional identities in the mainstream academic discourse.

Table 1. Review of the Methodology of Articles in SLR

Articles	**Methods**	**Participants**	**Results reported regarding knowledge production/raising consciousness**
Aitken, M. (2017). Feminism: A fourth to be reckoned with? Reviving community education feminist pedagogies in a digital age. *Concept*, *8*(1), 1-18.	A review of research that recommends feminist pedagogical intervention as a possible method to combine the ideas of the fourth wave feminism and community education.	N/A	"The fourth wave deconstructs individualist discourses and, in true feminist spirit, makes the personal political (p.7). Community educators have a duty to resist agendas that seek to silence women's voices and through their practice for social change.
Barker-Plummer, B. & Barker-Plummer, D. (2017). Twitter as a feminist resource: #YesAllWomen, digital platforms, and discursive social change. In J. Earl and D.A. Rohlinger (Eds.), *Social movements and media*. (pp. 91-118). Bingley, UK: Emerald Publishing Limited.	Content and discourse analysis methods to analyze the #YesAllWomen hashtag qualitative coding of the news and blog stories	An analysis of a sample of 251 media and blog	Participants in discourse focused on core feminist concerns – rape, harassment, sexual entitlement and inequality All key elements in discursive activism were revealed, such as building collective identity/collective consciousness.
Jester, N. (2018). Representation within higher education curricula: contextualising and advocating for feminist digital activism. *Teaching in Higher Education*, *23*(5), 606-618.	Content analysis of *Rhodes Must Fall*, *Why is My Curriculum White?* and *Women Also Know Stuff*	Actual number of participants contributed to the movements is not reported	Curriculum movements offer promising opportunities for higher education. Followers of the movements reported that higher education institutions are starting to change their curricula

Kim, C., & Ringrose, J. (2018). "Stumbling Upon Feminism": Teenage girls' forays into digital and school-based feminisms. *Girlhood Studies*, *11*(2), 46-62.	Research on participants' activism on social media platforms (Facebook, Instagram, Tumblr, and Twitter) to explore their postings over four-week period	Qualitative study: Interviews with four most active members of the feminist society and artifact analysis of their accounts in social media	The failure of the school to use non-academic pedagogies via social media engagements as it is important—even transformative—sources of learning
Mendes, K., Ringrose, J., & Keller, J. (2018). # MeToo and the promise and pitfalls of challenging rape culture through digital feminist activism. *European Journal of Women's Studies*, *25*(2), 236-246.	Over 800 pieces of digital content, including blog posts, tweets, and selfies.	Feminist media research and qualitative study (the views of 82 girls, women and men who contributed to the blogs/tweets) .	Despite fear of attack and experiences of trolling, digital feminism can be experienced as extremely positive in generating community, connection, and support for feminist views, and solidarity in calling out rape culture
Point, C. (2019). # MosqueMeToo: Islamic Feminism in the Twitter sphere.	#MosqueMeToo as an artifact to analyze Twitter dsicourse	No actual number of screenshots from Twitter presented	#MosqueMeToo serves as a statement of justice, requiring a demand for both intervention and visibility of Muslim women.
Ringrose, J. (2018). Digital feminist pedagogy and post-truth misogyny. *Teaching in Higher Education*, *23*(5), 647-656.	The experience of having the feminist content of personal public Twitter account	The author used the digital affordances of hashtags and trends on Twitter to spread a message, as it offers a unique pedagogical dimension for feminists	Anti-feminist threats travel beyond the digital sphere into the personal lives as feminist academics .

		to raise awareness and spreading ideas around gender and sexual violence	
Rogan, F., & Budgeon, S. (2018). The personal is political: Assessing feminist fundamentals in the digital age. *Social Sciences*, *7*(8), 1-19.	Mixed methods study focused on a set of important questions regarding the nature of young women's relationship to feminism in the age of digital femininities	50 responses from young women under the age of 21. The nine focus groups in three urban locations in England—one in the South-East, one in the West Midlands and one in the North West	The 'personal is political' falls under four interrelated categories: power, the private/public dichotomy, political action, and subjectivity. Each of these key dimensions remains central to a contemporary feminist analysis of the experiences of young women's engagement with digital practices.
Turley, E., & Fisher, J. (2018). Tweeting back while shouting back: Social media and feminist activism. *Feminism & Psychology, 28*(1), 128-132.	Review of two social media-based feminist campaigns	N/A	Social media is not the only mode of online feminism; importance and value of offline feminist movements should not be ignored.
Zimmerman, T. (2017). # Intersectionality: The fourth wave feminist twitter Community. *Atlantis: Critical Studies in Gender, Culture & Social Justice*, *38*(1), 54-70.	Review of scholarship on genealogy of the fourth wave feminism and the analysis of the term "intersectionality"	N/A	Intersectionality is the most appropriate theoretical framework for the fourth wave movement for its potential to practice political intervention and visibility without segregation and/or marginalization of people

As it is seen from the table above, some authors of the articles were analyzing the content of the blogs/groups, being engaged in feminist media research. Contemporary feminist researchers are engaged in feminist media research to better understand how power dynamics is represented in media. In this process, the researchers get connected to the text, and "become [s] part of the power structure that informs the text" (Hesse-Biber, 2014, p. 287). Getting connected to the text offers some advantages and disadvantages. The advantages can be explained by discovering multiple meanings of the text and having less interaction with people, and the disadvantages are mainly about how texts are perceived by the audience. This is a laborious process for researchers to analyze as they can only make assumptions. However, feminist media research has a certain role in social transformation as it aims at empowering women through feminist discourse.

Conclusion

The findings of the study underscore the importance of developing pedagogy centered on anonymous social media spaces. The online aggressive behavior should not be tolerated as it tries to suppress the democratic discourses. Educational practitioners, university professors and rhetoric scholars are, therefore, charged with an important task, and that is to participate in anonymous and pseudonymous digital social media to reveal opportunities for democratic participation using the discourse of digital media to foster active feminist movements.

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Online Courses Accessibility For Low-Vision

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Abstract

This qualitative study tends to explore what accessibility design can be most important to facilitate learning in an online course for postsecondary students with low vision. The study is conducted in a U.S. public university offering online courses in the Midwest. This study was guided by two research questions: (1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning? (2) What accessible features would students with low vision want to exist in future online courses? The theoretical framework for this study was Universal Design for Learning (UDL). Three participants were interviewed to share their experience with online learning and to explore which accessibility aspects were perceived the most helpful for students with low vision. The finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and accessible PDF files—were the most helpful accessible text format in the online courses. In addition, the finding showed headings and color contrasting for the online content are the main aspects of design to increase accessibility and to facilitate reading for students with low vision. The last finding revealed that students with low vision need two additional accessibility design to be employed in online courses: audio response and instructor video.

Keywords – Online learning, Accessibility, Low-Vision, Visual impaired

1. Introduction

In the last two decades, due to flexibility and accessibility, online courses are becoming increasingly popular among non-traditional students and learners who have (in)visible disabilities (Summers et al., 2014). Students with disabilities need support, particularly, students with low vision need special accessible features in online courses because they have some difficulties dealing with the technologies (Crow, 2008; Fichten et al., 2009; Summers et al.,2014). Universal Design of Learning (UDL) provides several accommodations for postsecondary students with low vision through using assistive technology and providing a variety of accessible features for this type of vulnerable population (Crow, 2008). Relevant research (Lorenzin & Wittich 2019; Okiki, 2019) shows that low vision students will succeed academically when they take online courses with proper accessibility design. To explore which types of accessibility design aspects, based on the UDL principles, are deemed to be appropriate for online settings, this qualitative study seeks to understand the perceptions of students with low vision.

2. Literature Review

2.1.Online Courses

Online courses attempt to create a type of learning environment and serve as a process of connecting students, instructors, and learning resources when they are not physically present in the same location (Park & Choi, 2009). In 1997, the first online course platform was launched at famous universities, such as Yale, Cornel, and University of Pittsburgh. In the same year, a Learning Management System (LMS) known as Blackboard™ was founded and has become widespread to deliver online instruction and it is still utilized in many educational institutions and universities across the globe (Morton, 2016). Online courses use asynchronous and synchronous technologies. Synchronous technology requires students and instructors to work at the same time but not in the same place through using video conference (Palmer, 2012). In contrast, asynchronous technology does not require students and instructors to work at the same time (Palmer, 2012). They can work independently at a convenient scheduled time for each of them.

In the last three decades, online courses have significantly increased in higher education (Betts et al., 2013). Recently, 30% of postsecondary students are enrolled in at least one online course in one of the U.S higher education institutions (Cole et al., 2014). Although online courses have increased, students with disabilities enrolling in institutions of higher education have also increased over the last twenty-five years (Lyman et al., 2016). Higher education has attempted to make online courses more effective and accessible for all students, however, some instructors and/or institutions may overlook the needs of students with disabilities (Kharade & Peese, 2012). Cook and Gladhart (2002) stated that 10% to 15% of postsecondary students identify themselves as disabled. According to the American Disabilities Act (ADA), a disability is a physical or mental impairment that substantially limits one or more major life activities. To be labeled as disabled, a person must have a history or record of such an impairment, or a person should be perceived by others as having such an impairment. These self-identified students with disabilities should have equal opportunities in their online courses as other students.

2.2.Online Courses for Students with Low Vision

Low vision is one of the common types of visual disabilities (Richardson, 2014). It is defined as the functional limitation of the eye or eyes or the vision system (The American Foundation for the Blind, 2015). The American Foundation for the Blind (AFB) defines low vision as a condition caused by eye disease in which visual acuity is 20/70 or poorer in the better-seeing eye and cannot be corrected or improved with regular eyeglasses (AFB, 2015). Students with low vision usually have several academic difficulties (Moola, 2015). One of these difficulties is using technology because sometimes they cannot adjust technology according to their needs. For purpose of this study, low vision identifies as “a person who has difficulty accomplishing visual tasks, even with prescribed corrective lenses, but who can enhance his or her ability to accomplish these tasks with the use of compensatory visual strategies, low vision and other devices, and environmental modifications” (Corn & Koenig, 1996, p.4).

Consequently, the emergence of online courses has brought challenges for students with low vision (Argyropoulos et al., 2019; Summers et al., 2014). The literature on the experiences of students with low vision is scarce, and most seminal articles focus on students with disabilities without specifying the type of disability (Lorenzin & Wittich 2019; Okiki, 2019). However, some relevant studies (e.g., Lee & Oh, 2017; Richardson, 2014) had observed that students with low vision are not often active in online courses due to the challenges they face in interacting with learning materials. On the contrary, several studies suggest online courses are beneficial for students with low vision since they provide remote learning experience (Barnard et al.,2012; Haegele et al., 2018; Kharade & Peese, 2012) and allow instructors to provide remote instructional assistance to the students anytime and anywhere even if they live far from the main campuses of the universities (Holmgren, 2018).

Online courses benefit students with low vision because they can find a solution for the challenges attending physically on campus, which poses great difficulty for them (Kharade & Peesa, 2012; William et al., 2006). Kharade and Peesa (2012) addressed that the flexibility in the location, scheduling, and delivery of online courses reduced the challenges for attending on campus by providing flexibility in time and place of delivery. Feucht and Holmgren (2018) reported that students with low vision drop out because they cannot drive to the campus and do not live close to the campus. Walking around campus is also a challenge because sometimes it requires students with a very low vision to use aids such as a cane or a guide dog. This is because in some cases students with low vision cannot even see the small things, or in other cases, students with low vision cannot see things in bright or dark places. Therefore, they often have a difficult time self-navigating outside of well-known environments and prefer to be indoors (Long et al., 1990), and some prefer to study and work in small physical spaces (Haegele et al., 2018). As a result, low vision affects a person's ability to learn or perform many job duties, which severely limits his/her main life opportunities for education and employment (Long et al., 1990). Therefore, online courses became such a great option for students with low vision to complete their educational degrees and be more motivated to succeed (Kharade & Peese, 2012).

Besides flexibility, online courses allow students with low vision to adjust the instructional material through assistive technologies according to their needs (Crow, 2008; Fichten et al., 2009) during learning, reading, writing and acquiring academic and nonacademic skills (Hewett et al., 2017; Rosner & Perlman, 2018). In addition, using assistive technologies in online courses help students facilitate learning and receive equal learning opportunities (Hewett et al., 2017). Because of this equality, students with low vision can be more active and motivated to participate in online activities such as discussion and group work. Assistive technologies help to improve the quality of learning for students with low vision (Crow, 2008). Online courses with assistive technologies encourage students with low vision to be active participants and share the ideas with classmates and instructors remotely in online course activities (Crow, 2008; Fichten et al., 2009; Hewett et al., 2017).

2.3.Accessibility

Accessibility is an important priority in online courses delivered by top universities such as Harvard University, UC Berkeley, and MIT (Alahmadi, 2017). Following their trend, many colleges and universities have started to make program and policy changes in their online courses (Zuriff, 1996). Accessibility addresses the design of technology rather than the needs of specific individuals (Alahmadi, 2017). Accessibility means using course materials and tools by all types of students, regardless of their physical and/or developmental impairments. When a course is accessible, most of the students even those with disabilities can reach the material equally. All can get access to the course delivery system, navigate the course content, submit assignments, and successfully use all course tools. The most common example of accessibility includes obtaining printed materials in alternate formats (Pittman, et al., 2014). Other examples involve the inclusion of a statement of support for students with disabilities in the course syllabus. In addition, all video content (web, DVD, and VHS) should be captioned, and transcripts of audio-based material and video-based materials should be available if they cannot be captioned.

There are several benefits of accessibility in online courses. The accessibility allows students to use flexible materials that can be adjusted according to their special needs and preferences (McKenna & Velasco, 2018; Pittman, et al., 2014). Audio, images, graphics, animations, video, or text which are often the tools to present information and the relationships between objects, actions, numbers, or events. However, visual representations are not equally accessible to all students, particularly visually impaired students (McKenna & Velasco, 2018).

3. Theoretical Framework

Most institutions of higher education in the U.S. incorporate the principles of Universal Design for Learning (UDL) into the educational and instructional materials. UDL is a framework for improving instruction because it helps provide equal opportunities for all learners to succeed. This strategy provides flexibility in how learners to access, engage with and demonstrate what they understand and increases the quality of learning materials for everyone (Rose & Mayer, 2008). UDL principles support students with low vision who have some challenges in online courses by providing resource and flexibility access to engage the students complete learning (Houston, 2018). Most of the research has found that UDL is essential for integrating students with visual impairments into higher education (Al-Azawei et al., 2016; Houston, 2018; McKenna & Velasco, 2018). According to CAST (2008) and Rose and Mayer (2008), there are three UDL principles: representation, action and expression and engagement. The first principle of UDL is "Representation," which involves providing learners with various ways of acquiring information and knowledge that have a connection to the accessibility formats, which require instructors to provide various resources to facilitate students' access to the learning materials. The second principle is "Action and Expression," which provides students with various routes to access the necessary materials using assistive technology. The third principle is "Engagement," which enables an instructor to tap into students' interests, challenges them appropriately, and motivates them to learn through facilitating resources.

This study sought to explore the perceptions of the current experiences of students with low vision in online courses to identify what accessibility design aspects offer the greatest support based on UDL guidelines and would be beneficial. This research is intended to provide recommendations for future instructors and instructional designers to consider when creating online courses for students with low vision.

4. Methodology

4.1.Setting, Sample and Participants

The study took place at a U.S. public university in the Midwest with a total enrollment of students 17,169 for Fall 2018. According to the university website (2018), there are 12,788 undergraduates, 4,121 graduates and 260 college of law. As the mission states, the school celebrates its diverse population in all its forms, including gender, race, ethnicity, ability, spirituality, sexuality, age, and individual identities. This Midwest public university offers approximately 20 undergraduate and graduate degrees online and about 10 additional certificates fully online.

For this study, purposeful sampling was used because the researcher purposefully selected the students with low vision who were enrolled in online course settings. Creswell (2009) stated that in qualitative research, researchers identify participants and sites using purposeful sampling based on places and people that can best help a researcher understand the central phenomenon. The participants were from different major and educational level and ages range from 22 to 54 years old. All the participants registered in the disability resources center (DRC) and had number of online courses taken between 3 to 6 courses. The participants had different low vision types; Retinitis Pigmentosa, Optic Nerve Coloboma, and Blurred Vision.

4.2. Research Questions

1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?
2) What accessible features would students with low vision want to exist in future online courses?

4.3. Data Collection

To obtain data, three students were interviewed, and the interviews were audio-recorded. Interviews were conducted either face-to-face or by telephone depending on the participants' preference. The duration of each interview was 45 to 60 minutes. They were asked around 20 questions, consisting demographic questions, questions related to their experience with online courses, and questions regarding accessibility and assistive technologies that helped them overcome their challenges.

4.4. Data Analysis

Using a professional transcription service (Rev.com) to transcribe the interviews. Then, the textual data of the interviews has been read multiple times to gain a deeper understanding on information contributed by participants (Creswell, 2012). Prior to proceeding to the data analysis, a codebook was created based on each research question: accessibility coded as AA and highlighted in pink; assistive technology coded as AT and highlighted in blue; and the wish list of the students with low vision coded as WLA and highlighted in red. The data had been analyzed line-by-line to code thoroughly. Then, applying an open-coding strategy to analyze the responses from the interviews by looking specifically for words that are related to pre-defined codes. For example, when the participants mentioned a screen reader, the researcher coded it as AT and highlighted it in blue. According to Patton (2002), the process of coding starts with segmenting and labeling similar codes to form descriptions and broad themes. Therefore, each of the pre-defined codes labeled as themes. The themes were used to respond to each research question.

5. Findings

5.1. What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?

The participants identified three accessibility design aspects: alternative formats for materials, headings, and color contrasting for online content as the most helpful accessibility regarding their learning experiences. Ruby responded that she has a lot of reading requirements to complete the online assignments as a graduate student. She clarified, "Word document and RTF are the most beneficial types of alternative formats for textual online materials. Having formats like word documents or RTF are super helpful to access the text and use Read Aloud feature when I need it."

Sarah added, "I avoided reading. I avoided doing anything that wasn't just hands-on like the building because I'm actually in the construction trades." Also, she mentioned that she has difficulty reading a book but she can read text font "Arial' and size 16 or 18. She said, "sometimes I get notes, teacher's notes and I actually have to change the font to just an Arial font because the New Times Roman is hard for me to read. Yeah, it has too many like little curves in it and the letters are too close." Thus, she requests alternative formats for the online textual materials to audio: "Well, everything needs to be audio for me."

In contrast, Karen described that she prefers Adobe accessible PDF version, which includes features that allow students with low vision access text to be more readable such as taking notes, searchable text, and tracking of information.

> *I would like to see that used more and more like accessible PDF documents instead of just like taking a picture. I think it's just giving me more access. For example, being able to look at like a PowerPoint in an accessible format. I can use it more easily to take notes and to keep track of information instead of having to like struggle through the slide.*

Sarah and Ruby use screen reader software, which they mentioned as the most helpful assistive technology for them. Ruby said:

> *And so being able to have, like for example, the articles that we had to read were in two formats. They were in like a scanned in PDF and they were in like a word document. And so I was able to use my screen reader to read the word document and I had access to the course material without having to ask somebody to help me read it or help me scan it and to be able to change the scanned document.*

Moreover, Sarah and Ruby use the "Read Aloud" feature in Word. For the web pages and other documents, they use screen reader software "Narrator" in Windows. They mentioned that they do not install JWAS or Kurzweil 3000 on their computers. Ruby has used JAWS in the past; however, she is not using JAWS anymore because the screen reader is available in Windows and helps her read long articles.

Additionally, the participants identified heading and color contrasting for online courses that helped them find and use online course materials. Ruby and Karen mentioned that designing online courses with headings guide them during navigating the online environment. Ruby said, "I'd say headings help split things into sections." Karen said, "have a lot of headings to navigate that makes things easier." In addition, Sarah mentioned that using contrast color for the text and background facilitates reading the PowerPoints. She described her current challenge reading some colors:

> *One of the classes I have now, he has a lecture, it's short, it's a simple lecture. But then he has a PowerPoint and that does not have any audio to it and it's kind of a struggle for me to read through that. It's actually on the university [brand]; the background is red with the black and the gray and that's actually hard to read. I think that's hard to read.*

An additional accessible design that one of the interview participants reported was added description for videos. Sarah said, "I'd say more ideal description from videos" would help students with low vision understand what is happening in the video.

5.2. What accessible features would students with low vision want to exist in future online courses?

The results revealed some of the improvement accessibility suggestions that students with low vision wished would exist in online courses. Audio and instructor video were the two alternative formats that did not exist in most of online course. The participants described two ways of using audio in online courses: audio with PowerPoint and audio response in the discussion boards. Sarah suggested that instructors in online courses should use audio with PowerPoint slides to facilitate learning; she said "when the teacher has a PowerPoint, it's great, but I have to read it. I want it to read to me and I want the word to stand out as are being read." Ruby suggested adding the option of "audio" to participate in the discussion boards; she said:

> *I think more audio would be really helpful. So I don't know if this is something that necessarily instructors would have jurisdiction over, but I guess just having it's different alternatives, communicating with discussion boards, you know maybe having like an audio option to leave audio responses. They're having a more simplified platform. So that would be one of the things on my wish list.*

Additionally**,** all the participants suggested that instructors in online courses should record videos to help the students be engaged in their learning. Karen would have more videos to understand some subjects; however, she did not specify the video types. She said, "Say we were assigned to read a chapter and then the teacher would have provided a video or something explaining certain things. I think that's always helpful." On the other hand, Ruby and Sarah specified to receive instructor-recoded videos. Ruby said, "I wish the professors would do in-person videotaping of themselves." Moreover, Sarah added that seeing the body language helps to engage the students in online courses; she said,

> *When the instructor goes into the connect and has a PowerPoint and he's just talking, I think that's okay. But it would be really nice if you actually saw him because movement, your body gestures are engaging.*

Sarah also recommended the instructors should record video to explain the course content to improve the students' learning performance; she said,

> *Everything was online. It would have been so cool if the teacher had done what my classroom teacher did and said, "Okay, here's 20 minutes, here's the problem on the chalkboard. I'm video recording myself and this is what you do and, oh, you think about this and now, you go to the next step and you have to remember that. And then ..." That would have been great. I mean I know that some minor technical classes, safety will say, "Look, my last class was a safety class." I mean, I can't imagine an instructor going, if I taught the class ... Ultimately I would like to teach but if I taught the class, I probably would read the book, they're like safety hazards. So let's say in the parking lot or in a building, I probably would record it. "This is a safety hazard."*

6. Discussion

6.1. Accessibility

There were three major findings related to accessibly. The first finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and Adobe accessible PDF files—were the most helpful accessible format in the online courses. These alternative formats allowed students with low vision to make changes according to their own needs and use text-to-speech assistive technology such as screen reader software or the "Read Aloud" Word file feature. All participants highlighted that the alternative formats provided them equal access to the online materials. In addition, this finding is consistent with literature (e.g. Pascual, 2014; Spooner, 2014) mentioned students with low vision preferred to use alternative formats because it allows them to edit and make changes that best suits their needs. For example, Sarah explained that she could only read the "Arial" font; therefore, having the materials in Word allowed her to change the font to "Arial" because "Times New Roman" was hard for her to read. This finding is consistent with Houston's (2018) study that recommends using Sans-Serif fonts in online course materials because Serif font types help make online content more legible to all students, including those with visual impairments. Common Sans-Serif fonts include Arial, Trebuchet, and Helvetica. On the other hand, some Serif font types—such as Times New Roman, Courier, New Century Schoolbook, and Palatino—have semi-structural details or small decorative curves on the ends of some of the strokes, making the letters and symbols challenging to read. Overall, this finding aligns with UDL "representation" principles, which entail the accessibility of instructional materials for all students, including students with disabilities, providing them equal access (CAST, 2008).

The second finding was that participants identified assistive technology within alternative formats as one of the most helpful accessibility features. The finding showed that text-to-speech reader software, such as screen reader, was the most helpful assistive technology for students with low vision to read online course materials. For instance, Sarah mentioned that she always needed to use assistive technology such as a screen reader to convert the text materials to audio. Also, other participants mentioned that using a screen reader reduced their challenges when reading online materials, as they did not have to seek assistance in reading the materials. In addition, the finding showed that Word processing was the most helpful assistive technology because of its "Read Aloud" feature. These findings are consistent with the literature that identified text-to-speech assistive technology as the most beneficial to suit the individual needs of students with low vision (e.g., Hersh & Johnson, 2010; Fichton et al., 2009; Nees & Berry, 2013). In addition, this finding is tied to the "action and expression" UDL principle, which asserts that individuals with disabilities should get opportunities for independence through the use of assistive technologies as they help them in overcoming barriers in the educational environment (CAST, 2008).

However, the findings of this study were not consistent with some literature on magnifiers as helpful assistive technology. The participants expressed that they have visual condition abilities to read the original document. Karen mentioned that magnifying or enlarging text were not helpful for her in online courses. Sarah mentioned that she avoids reading and she prefers using speech to text assistive technology to receive information through audio mode. According to this finding, magnifiers as the main method of providing accommodations were less useful than the ability to choose which forms of assistive technology were most beneficial for the online courses. Therefore, the participants needed to hear the information or conversations in online courses, so they did not need to use a magnifier but use speech to text features such as "Read Aloud" or screen reader. This finding evidence that online course designers should provide more accessible types of online materials to allow individuals to choose which type of assistive technology will work best for them such as text-to-speech.

The third finding showed two aspects of design to increase accessibility and to facilitate reading for students with low vision: headings and color contrasting for the online content. The participants indicated that headings is helpful to direct their attention toward key concepts and facilitate navigation; however, the study did not reveal adequate headings styles for students with low vision. This finding is consistent with literature (e.g., Kearns et al., 2013) that recommends online course designers to design online materials with headings and use high-contrast colors, plain backgrounds, and scalable text for low vision or colorblind students as they allow them to skim the page quickly. Headings allow students with low vision to locate the information more easily and grasp the main ideas of the text (e.g. Fichten et.al., 2009; Houston, 2018).

Online materials with low contrast can be difficult to read for students with low vision, making color contrast necessary to improve accessibility (e.g. Houston, 2018). Sarah mentioned that she had difficulty reading the online PowerPoint slides because of the black and gray text font contrasted in a red background. She expressed this background color was not suitable for her visual condition. However, this study did not expand on color contrasted of online materials. Houston (2018) suggests avoiding some color combinations that are not easy to read for students with low vision, such as blue links on black backgrounds, red text on green backgrounds, or other combinations where contrast is not enough. Although, Houston (2018) study did not find a list of color combinations that can assure accessibility for students with low vision, his study suggests that materials in online courses should be presented using a dark font color contrasted with a pale background.

Finally, UDL principles and literature (e.g. Kharade & Peese, 2012; Pittman & Heiselt, 2014) address additional beneficial accessibility aspects for students with low vision, but the findings of this study showed some of these aspects were not applicable in participants' online courses. Aspects that were not present in online courses for most of the participants in this study were closed captions on video media; a transcript of the video or audio presentation; visual analogs to represent emphasis and prosody (e.g., emoticons, symbols, or images); and text descriptors for any relevant image, graph, or chart. However, Sarah mentioned that added description for videos was helpful to understand the video contents. This finding supports UDL representation principle which suggests that presenting information in several formats increase accessibility.

6.2. Wish List for Students with Low Vision in Online Courses

The findings revealed that students with low vision need two additional accessibility design aspects: audio response and instructor video. Students with low vision can benefit from submitting their responses to discussion board as audio files. This would reduce time spent on formatting the answer, such as using a screen reader to double-check response and allow them to focus on content. This finding is consistent with (e.g. Ching & Hsu,2015) that addressed audio discussion modality in online courses; however, the literature does not address the needs of students with low vision.

In addition, the participants expressed the need for videos in which their instructor presents the content. This finding is consistent with the literature (e.g. Choi & Johnson, 2015) that addressed the positive effects that instructor-recorded videos explaining content have on students as they improve students' understanding and engagement with the materials. Relevant literature (Kim et al., 2019) suggests that audio representation of the content helped make curricula more accessible to students with low vision. Therefore, the findings of this study showed the need for inclusion of audio discussion modality and instructor's audio representation of the content to reduce the challenge and enhance the learning of students with low vision.

7. Recommendation, Implication and Conclusion

The findings of this study serve as a foundation for future research on this topic. The literature review presents research on universal design for learning (UDL), especially as it relates to accessibility and assistive technology for students with low vision. This study will help instructors and online designers who might teach online courses or might want to improve online courses. This study could primarily impact those students with low vision take online courses and face challenges, so they will have a better learning experience in online courses. Literature (e.g., Barnard-Brak & Sulak, 2010) found that students with invisible disabilities often are not comfortable disclosing their disabilities. The findings of this study also indicate online instructors should provide audio response to accommodate students with low vision in online courses.

Based on the interpretations of the findings, this study focused on one type of visual impairment; however, a much broader future study can include other visual impairment types. In addition, this case study focused on the fully online courses, so future research can be replicated in blended courses, including face-to-face and online sessions of similar size and student population. The UDL theoretical framework can help future researchers replicate the study by focusing on specific principles of universal designs for learning (UDL) because such factors affect students with low vision engagement in online courses. Other research can expand the case study to examine students' and/or professors' perceptions of the accommodations and assistive technology for engaging students with low vision in online courses. In addition, this study was limited to students with low vision; therefore, future studies can expand this case study to examine instructors' challenges when providing helpful accommodations for students with disabilities in online courses.

The findings for this study showed students with low vision identified a screen reader as the most helpful assistive technology in online courses. Future studies can employ a quantitative approach to compare two groups of students with low vision to examine the effectiveness of using specific assistive technology in online courses. In addition, this study's findings included the students with low vision preference for information delivery methods; future studies can employ quantitative methods to compare groups of students receiving different information delivery methods in online courses to understand the relationship between information delivery method and learning performance.

The overall purpose of this qualitative case study was to explore the most helpful accessibility design and assistive technology for students with low vision in online courses. Individual interviews were conducted to obtain in-depth data. This study found that the most helpful aspects for online content accessibility for students with low vision are headings, color contrasting, and alternative formats for materials, such as Word documents, Rich Text formats (RTF) or Adobe accessible PDF files. Overall, this study reveals that online courses require the inclusion of more accommodations and better implementation of UDL principles to meet the needs of students with low vision. The consideration of the findings of this study may bring about significant understanding and renovation in the online courses design that will guarantee equal learning opportunities for students with low vision. Online designers, instructors and disability resource centers may benefit from this study as the findings can guide their decisions on providing support to students with low vision.

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Appendix A

Semi-Structured Guiding Interview

Part 1:

1. When were you diagnosed with low-vision?
2. In which educational level you did recognize you needed more support and accommodations from the school or teachers/instructors?
3. Do you have other family members who have the same or a similar condition?
4. Do you learn from them? Or did you teach them how to deal with low vision in academic setting?

Part 2:

1. As a student with low-vision, do you prefer online or face-to-face courses?

Face-to-face course
Online course
Hybrid/Blended course
All types of courses

   a. Why do you prefer that type of course?

2. What are the information delivery methods (text such as pdf or word document, audio, video) that you find to be most beneficial with regard to your learning in the past online courses?
   a. How did you use those methods of delivering information to help your personal learning preferences?
   b. What currently unavailable methods of providing the information would you like to become available in the future?

3. How has accessibility and assistive technology helped you to overcome challenges in your online courses? What were these challenges?

4. Which types of accommodations and assistive technologies could contribute better to your engagement, participation and learning of the content of your online courses?

5. According to your experience, what accessibility accommodations in online courses were helpful to you and how were they helpful (to navigate the online courses, to better understand online instruction and/or to complete online activities??

   a. What accessibility design did you need in online courses but did not get to help you understand the material?
   b. What kind of visual information were you looking for in online courses?
   c. What kind of auditory information were you looking for in online courses?

6. What is your wish list regarding accessibility accommodations you'd prefer in an online course? Can you describe a specific experience where you felt like you didn't have access to services or accommodations that you thought would be helpful in your education?

7. Is there anything else you would like the researchers to know about your online course experience regarding your low-vision?

8. What question should I have asked, but didn't?

Using Social Media to Engage Culturally Diverse Parent, Family, Community in Education

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ABSTRACT

Social media plays an important role in the interaction and communication between home, especially culturally diverse families, and schools. This qualitative multiple case study aimed at exploring how international students who are also parents respond to the use of social media in communicating with the school and teachers in the US. Participants responded to the question - How can social media tools (Or new technologies) be used to engage parents, families, and communities in education? Five participants, who were students from a US university at the time of the data collection, volunteered to be interviewed. The participants were from three regions – Asia, North African, and the Middle East. The study found out that digital used by the school to engage culturally diverse parents assisted the parents to familiarize themselves with local cultures. Also, parents who used social media community platforms such as WhatsApp commented that the tool has helped them to build community among parents and suggested that schools should use such mediums to help build a community for parents.

Keywords: parental involvement/engagement, community building, international students /parents, culturally diverse parents/families/communities, social media, education technology, digital tools

INTRODUCTION

Technology has been a powerful tool for transforming social interaction and assisting to strengthen the relationship between teachers and parents (Graham-Clay, 2005; Olmstead, 2013).

Thus, it has helped to affirm and advance relationships between educators, students, and parents. Parents working schedule impacts the number of time parents could visit schools. Some parents have busy working schedules and some also work double shifts (Alzaid, et al. 2020). As a result, technology as a medium can be used by schools to inform parents about students' achievement and behavior, and school activities. In addition to parents' working schedule,-there may also be several unforeseen contingencies that could restrict direct teacher and parents' physical interactions. This warrant the need to explore other avenues to maintain teacher-parent-communication relationship. It, therefore, has become relevant that teachers engage parents through using technology, especially, social media tools.

Parents and family involvement in education has a vital role in children's education (Epstein, 1985; Roekel, 2008). In addition, the community as a whole plays an essential role in the growth and development of youth. School, family, and community partnerships are related to student achievement and school success (Roekel, 2008). Epstein (1992) describes six types of involvement: parenting, communicating, volunteering, learning at home, decision making, and collaborating with the community. This shows the multiple roles parents play in their child's educations. Parents play a vital role in students' learning and such roles are confined to the home. As Epstein indicated, with continuous communication, teachers and parents can better position themselves to understand students' and experience so that they can provide learning experiences that support students' learning.

Cibils (2017, p.55), on the other hand, revealed that "what accounts for parental involvement is unilaterally defined by the school and limited to those behaviors and attitudes which reflect strict alignment with school policies and decisions". There are, therefore, certain cultures that do not conform to the mainstream culture that influences school policies. As a result, such behaviors are mostly sidelined by the school structures either consciously or unconsciously. Therefore, since parental characteristics influence how they interact with the school and among themselves (Civil, Bratton, & Quintos, 2000; Epstein & Salinas, 2004; Erol & Turhan, 2018; Yamamoto, 2015), it becomes relevant to explore how schools promote parental social networking between linguistically diverse parents.

As stakeholders of education are considering the use of social media tools to engage parents (Willis & Exley, 2018), it becomes pertinent for researchers to explore the attitudes and perceptions of parents from different cultures other than the mainstream culture (Alzaid, et al. 2020). Diverse parents' perception of social media adoption for community building between parents and teachers will influence how teachers adopt tools to engage parents. This because the heterogeneity of parents' culture impacts how they interact in every social environment (Gentina, & Singh, 2015). Consequently, teachers' knowledge of parents' attitudes and perceptions will help teachers to assist parents to develop a positive attitude toward social media and use emerging technology to a sense of community. The purpose of this article is to share the results of a qualitative multiple case study aimed at exploring how international students who are also parents respond to the use of social media in communicating with the school and teachers in the US.

LITERATURE REVIEW

This section gives an overview of research on parental involvement and parents to parents to parent interaction. It also highlights how communication technology tools have been used by schools to engage parents and the challenges associated with using communication tools to engage parents.

Parental Involvement, Parent-Teacher Communication and Parent Social Networks Parental involvement occurs in many forms. Parents engage in students' home learning, participate in school events, and volunteer in their children's school. Parents also communicate with teachers about students' learning (Alzaid, et al. 2020; Epstein, 1992, 2011). Hence, parental involvement transcends beyond teachers engaging directly in students' learning at home to include the relationship they maintain with teachers. Communication between parents and teachers has been proven to improve students' academic achievement (Epstein, 2011; Hornby & Blackwell, 2018). In the view of Vijaya (2017), parent-teacher communication is vital in parental involvement. It should not be seen as an ephemeral interaction between teachers and parents about students' performance, but long-lasting relationships teachers and parents create with the view of promoting life-long learning for students.

In addition, research indicates that parents' involvement in their children's education could be strengthened by social networks that are created among parents (Curry & Holter, 2019; Ee, 2017). That is, when opportunities are created for parents to interact among themselves, they can support each other and improve their involvement in students' education both at home and at school. Supporting parent to parent interaction leads to a sense of community for parents (Alzaid, et al. 2020). Parents are capable of supporting each other to promote their involvement in their children's education. Parents discuss among themselves students learning, school activities, and challenges they face engaging in their students' learning. It is against this backdrop that schools should support parents by developing communication tools that bring parents together.

Also, parents 'social networks evolve easily along the lines of parents' demographic characteristics (Leo, 2010). Thus, parents easily build networks with other parents who share the same characteristics and interests. However, bringing parents together can be challenging in elementary schools. Schools lack efficient strategies that could bring linguistically diverse parents together to build a sense of community or parent social networks (Curry & Holter, 2019; Ee, 2017). That is, parents' involvement in their children's learning is strengthened by social networks that are created among parents, however, the creation of these social networks is made possible when schools provide opportunities for parents to interact among themselves (Curry & Holter, 2019).

Using Technology to Improve Teacher-Parents Relationship

Technology has improved communication between parents, communities, and schools in several ways. Graham-Clay (2015) explained that classroom phones and voice mail, video technology, radio announcement, and school websites are ways teachers can utilize to engage parents. Similarly, Hendley (2002) recounted that online communication is effective in improving parent-teacher communication. Analyzing a schools' webpage, Hendley hinted that such that webpages engaged parents in school activities. Bahceci (2019) also realized that the use of a digital tool, Class Dojo, by schools to engage parents increased the rate at which parents inquired about contents their children were studying at school. Thus, using technology, teachers will be able to engage parents in schools' activities. Parents, therefore, need not be in the physical environment of the school; they can still inquire about schools' activities and participate remotely in some school activity. According to Beecher and Buzhardt

(2016), Innovative tools and programs that utilize mobile technology possess the capability of delivering content to parents and teachers. Thus, teachers and parents should be actively engaging with mobile technology to increase their enthusiasm to adopt innovative technology.

Thompson, et al., (2015) noted that the use of smartphones could augment communication through the use of social media to increase the modes of parent-teacher communication. They found that most parents preferred emails since they can reply at their own convenience time. Again, the proliferation of smartphones will enable parents to easily access emails from teachers. They also note that texting also works well for getting quick feedback from parents.

Olmstead (2013) aimed at determining how emerging technologies facilitate efficient parents-teachers communication and parent involvement. The study was conducted through the lenses of social constructivism and the social cognitive theory of self-efficacy. Olmstead used semi-structured interviews to collect the data. The study revealed that technology assists in keeping parents informed about how students are performing. Also, the study revealed that "majority of parents were interested in receiving information about their child through the use of text messaging, but most of the teachers were not willing to use this type of communication p.36." This indicates that there are some constraints in using technology to engage parents. Teachers' willingness to use a particular tool or strategy plays a role.

Challenges to The Use of Technology in Teacher-Parent Relationship

As schools and teachers use technology to improve their communication with parents, they also experience several challenges. Patrikakou (2016) indicated that the digital divide between the higher income and lower-income families seems to close due to the expansion of mobile technology and the declining cost of mobile devices. Also, the call for national broadband technology hints at a future where families could access the internet and social interaction will be continuously be altered. Graham-Clay (2005) reiterated that teachers should be aware of families that may not have access to technology so that they do not marginalize them. For instance, Hendley (2002) also ensured that parents who do not have access to computers were provided with weekly newsletters.

Patrikakou (2016) concluded by stating that everyone needs to be well versed in the use of technology, and schools should be able to assist parents to navigate the use of technology and media to be well equipped to get involved. That is when parents realize the usefulness of mobile devices and acknowledge their ease of use, schools would be able to mitigate barriers parents experience when it comes to getting involved in students' education. This mediating process, in the form of educating parents on technology use, would parent to build resilience. Also, Graham-Clay (2005) presented opportunities that include technologies that are available for teachers to implement to increase parents' involvement in education. Graham-Clay stressed that teachers need to continue the development of their skills to improve their interaction with their parents.

Ho, Hung, and Chen (2013) further showed that teachers' attitude influences their adoption of communication tools. They investigated teachers' attitudes towards adopting mobile phone texts as a medium for parent-teacher communication. They concluded that "perceived usefulness and perceived ease of use have direct positive relationships with attitude, and attitude further influences behavior intention directly" (p.113). The study suggested that attitude should be seen as a mediator between perceived usefulness and behavior intention. Schools should therefore factor in parents' attitude as they design social media tools to engage parents.

THEORETICAL FRAMEWORK

To ascertain the perspectives, beliefs, and strategies ISP who have been using educational technology or digital tools for CB, strengthening PTP and to be involved in their children's education in U.S, the study will use Epstein's six types of parental involvement. According Epstein (1985), schools need to provide opportunity to assist parents in the area of parenting, communicating, volunteering, learning at home, decision making, and collaborating with community. Epstein focused on the need for collaboration between the home, community and school to assist parents in the various types of parental involvement. Therefore as "Technology can decrease the sense of fear that educators and families often experience as they start to think about increasing collaborative activities, or the isolation that some schools feel as they begin to develop a program of partnerships" (Simon et al. 1998, p. 268), the study will use Epstein's six types of parental involvement to examine how educational technology has assisted ISP in parenting, communicating, volunteering, learning at home, decision making, and collaborating with community by exploring their beliefs, perspective and strategies.

RESEARCH DESIGN

The research design for the study was a qualitative multiple case study with the overarching research question - How can social media tools (Or new technologies) be used to engage parents, families, and communities in education? Participants who responded to semi-structured interview questions were international students who couple as parents with their children either in the elementary school or high school in a U.S. Southwest borderland. In all, five (5) international students from North Africa, the Middle East, and Asia participated in this study. The participants were made up of four males and one female.

Data was collected through semi-structured interviews. The semi-structured interview was by the researchers to allow for conversations, between the interviewer and the interviewee, that are impulsive and include in-depth answers (Ryan et. al., 2009). Interview from each case was transcribed and analyzed for relevant themes.

To identify contrasts and possible similarities across the case, this study used comparative analysis (Parra, 2010; Miles & Huberman, 1994). Comparative analysis also aided in deepening researchers' understanding and their interpretation of responses in relation to the research question that was asked. Comparing responses helped the researchers to address validity and reliability of the questions (Miles & Huberman, 1994). Optional member checking was used for the trustworthiness of the study, and participants were sent the case study write-ups to check for accuracy (Guba, 1981; Lincoln, 1995). It must be noted the data was collected before the COVID-19 pandemic. However, the analysis of the data occurred during the pandemic. As a result, the researchers used web conference tools and shared document tools, Zoom, and Microsoft online respectively, to continue working on the research paper as a team. As the researchers were analyzing the data, they also took into consideration the effect of the pandemic on technology/digital use.

FINDINGS

Responding to how social media tools could be used to engage parents, families, and communities in education, all the participants, affirmed that social media tools are effective communication tools schools can employ to assist diverse parents. The study found out that the international students, who have their children in the US elementary and high school, perceive that social media could assist them to build a community among parents and with the school. Also, Social media tools could help them familiarize themselves with the local culture and further make it easier to seek academic support for children from other parents and the school.

Community Building

The study unearthed that social media tools fostered building a community between parents and schools. The results indicated that if parents are put on one platform and encouraged by the schools, they will interact with each other. Most of the participants, who noted that they belong to parents' groups on WhatsApp (not related to school parents' groups), elucidated that the tool assists them to communicate among themselves, and also share information. They recommended that schools could capitalize on the opportunity to bring parents together. Social media tools, therefore, serve as an opportunity for improved parent-teacher communication. These findings align with findings from Bahceci (2019) and Thompson et al. (2015) that the use of digital tools by schools to engage parents increased the rate at which parents communicated with the schools that the use of smartphones could augment communication between parents and the school through the use of social media.

Abdullah from the Middle East, for instance, responded that using social media is helpful though his children’s school was not using it. He stated, *“I think social media has a good advantage to communicate with school society and parents"*. Using social media, Abdullah felt he could communicate with parents, especially parents from his home country he had never met.

He also stated, *“I know there are some Arab parents in school where my son attends but don't know who they are because there's no way to communicate with them*”. Hussain, who is from the Middle East also revealed that he used a tool like WhatsApp with friends for social interactions not for the school. However, though he specified that he does not regularly use WhatsApp for interaction, a social media tool for parents to interact among themselves will be helpful. He stated, *“I don’t have time to interact more with these social media tools...to communicate with parents, sometimes you need [An opportunity for parents to interact among themselves using social will be helpful]*”

Fatima who is from North African recounted that she uses a group chat on the WhatsApp platform with other parents, and it helped them to build a parents’ community. She also noted that it has helped them to make it easier to build a community among themselves to support their children’s education. Similarly, Adnan commented that social media tools are capable of enhancing communication between schools and families. He made this claim in reference to Facebook messenger since he is familiar with this tool. Adnan stated, “*But now it's the time of technology...using just the Messenger group, even if it's not the best communication channel...if you want to enhance that communication, it is helpful*.”

Providing Academic Support to The Children

The study also found-that bringing parents together and using social media could facilitate the provision of academic support for children. Thus, when parents come together, they are able to support each other to find solutions to academic problems.
This demonstrated that the provision of academic support will not be the sole responsibility of the school. Also, as international students, the participants showed that academic support their children is needed if their children are to survive in the US school system. However, with access to digital tools and using social media, it will be easier for parents to build networks and support each other. Similar research also realized that parents, collaborating among themselves to build a network, support themselves and it improve their involvement in the children's education.

Both Abdullah and Fatima expounded that social media tools had helped build a community where parents could acquire academic support for their parents. In Abdullah words when explaining how social media groups could provide support for parents stated:

> Through my experience with using WhatsApp group, our community can share some experience related to academic and they help each other when someone need help in an academic matter like homework, and discussion about some classes and share advice. Always they help each other when they face some problems.

Similar Fatima shared an experience she has with using a WhatsApp group. In Fatima words,

> [We] created WhatsApp group to share some material that help us as parents to help our children. We do not have any experience, so we had to find out by [our] own. We needed to look for resources and buy books for our children's exam. [This is] one-way schools can use technology [to help people] who are planning to take the ACT test. They [schools] can create groups [digital tools] for parents or for students to communicate and share resources and even ideas.

The experienced they shared indicated schools could assist parents to form social networks using social tools. The goal for such an endeavor will be assisting parents to share academic resources among themselves. This will however assist new parents or parents from different cultures to makes inquiries about where they can get educational resources. Also, it will make it easy for diverse parents to seek help not only from the school or teachers but also from other parents. Social media tools will therefore make it easier for parents and teachers to find and share resources.

Familiarizing Parents with The Local Culture

The study also revealed that the participants acknowledge that if schools use social media to engage families and teachers, it will assist parents to get acquainted with local culture and share their culture. Some of the participants indicated that when teachers or schools send in-class activities through digital tools, it helps them to learn about the cultures and traditional celebrations in the United States. Most parents admitted they do not know much about the local culture and celebrations their children participate in while at school. However, when an opportunity was created for teachers to take pictures and video the activities to a school platform, parents were able to find out more about activities in the US. Thus, if schools use social media tools where they can share activities in school with parents, they will be well informed about the event in their new environment.

Amir from Asia shared that using social media tools will assist him to know many cultures. Though he may not physically present in the school environment, the images teacher will post will give him an idea of what is transpiring in the school. Amir explained that most of the things happening in the classroom are based on the local culture and they, are parents, should be able to experience. Amir stated:

> Valentine's Day and so many other cultural things going on in school. What I find interesting is I get to know more about celebration and so many things which I have never, ever heard. One thing gives a lot of local cultural flavor. I've been here for five years but I don't know many cultural things here. But the class Dojo [school adopted communication tool] helped me because they celebrate different cultural events in the classrooms and immediately share for us to see.

Adnan on the other hand noted that the school's communication tools have helped them to know about the local culture and also comprehend the school's environment. Adnan on the other hand noted that the school's communication tools have helped them to know about the local culture and also comprehend the school's environment. He stated*, "They [digital tools] helped us at least. Gather our thoughts and understand the school environment, because, without those communication tools, we wouldn't know really nothing about this [local] culture*".

CONCLUSION

The research study shows that the use of social media networks and modern digital tools will enable parents not only to communicate with teachers and the school but also with other parents' community. Social media communication thereby could help build a community among parents as well as it could expanding parent engagement to include culturally diverse parents which can benefit families, schools, communities, and for the futures of individual children. Also, throughout this study, it was made clear that diverse parents benefited from using social media as it assisted them to learn about the interior cultures, traditions, and annual feasts that are customary in the United States of America. This study also showed that the use of social communication among parents has become a means for parents to solicit academic support for their children. Parents could use social media platforms to communicate among themselves to show solidarity and cooperation to obtain academic support for their children.

Also, earlier indicated, the analyses of the data took place during the COVID-19 pandemic. Researchers further realized the study could be relevant as physical contact between humans has been restricted. Thus, the increase in COVID-19 should serve as a hint to school to find possible means of improving and maintaining teacher-parent communication. A pandemic should not further widen the gap between parents and schools. It is against this that schools need to effectively utilize emerging technology to stay in contact with parents and build a sense of community using social media tools. Schools should also assist parents to realize the usefulness of using communication technology tools to connect with the schools.

This study included only five participants and it will be relevant to include more participants in future studies. Also, the pandemic became an obstacle since the study made provision for only face-to-face interviews as a result, not all targeted participants were accessed by the researcher.

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Engaging Students in Asynchronous Online Courses

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According to the Best Colleges.com (2018) survey of online programs, fully online programs have increased by approximately 31% between 2016 and 2017. Prior to the 2020 Pandemic at least 25% of all Minnesota State University (2019) courses were online system wide. Due to the impact of COVID 19, the move to virtual learning has been quick and often without the professional development and other infrastructure supports historically provided faculty in making the transition to online instruction. This lack of appropriate support has been one of the reasons the past year's instruction has often been referred to "remote learning" as opposed to the traditional terms of "online" or "virtual" learning (Craig, 2020). This practice has helped to accentuate the need for proper pedagogical professional development for instructors to be fully prepared to teach in an online environment. According to Lederman (2019), only about half of professors are comfortable in an online environment. Meanwhile, only 26% of college students are satisfied with an entirely virtual classroom experience (Burke, 2020). During the spring of 2020, in some reported cases, at least 40% of students were not engaged in their remote or virtual courses (Quesada, 2020).

As the potential for remote or virtual learning appears to be pushing into the spring of 2021 (Liesman, 2020; Natanson. & Strauss, 2020), it is essential to ensure instructors have the ability to engage their online students. Students and faculty are both concerned about ensuring adequate engagement within online courses. Therefore, as a project with the scope of a scholarship of teaching and learning grant at a midwestern university, the author and several faculty colleagues looked to determine the impact on student engagement of three key approaches to improving student engagement in online asynchronous graduate courses. The first was the potential impact of providing student choice within the required discussion threads of the course. The second was the impact of requiring students to complete an introductory video for a course. A third was adding a voluntary synchronous study session to an asynchronous online course to engage students more fully.

Research Questions

During the 2019-2020 academic year, several faculty in an online asynchronous graduate program decided to try to determine effective ways to improve student engagement in the courses. There were three primary research questions:

Research Question 1: Did student choice in asynchronous online discussion boards generate more student engagement?

Research Question 2: Did the addition of a video-based introduction requirement increase student engagement?

Research Question 3: Did the inclusion of a voluntary weekly synchronous study session improve student engagement in an otherwise asynchronous course?

This research study was limited to fully online asynchronous courses as part of a graduate program at a midwestern university leading to a degree in either special education or educational administration.

Background

One of the reasons students are concerned about online courses is the lack of personal engagement with the instructor and their peers. At the same time, potential students are worried about the potential lack of quality in online programs and the perceived lack of interaction and community among classmates and with the professor. (Best Colleges, 2018; Burke, 2020). Student engagement remains a significant concern for online instructors.

A secondary factor considered was whether or not students participated in a video introduction with their peers at the beginning of a course. A recent metanalysis (Ma, 2019) considered video introductions as a key determining factor of student engagement. Similarly, the University of Phoenix's College of Doctoral Studies (2020) stated 85% of students felt all online courses should include a welcome video and 95% of students felt an instructor's welcome video encouraged them to reach out to their instructors.

Methodology

This exploratory mixed method study reviewed the impact of three particular instructional practices on student engagement within asynchronous online course discussions, the provision of choice to students within the discussion prompts (RQ1), the use of video introductions within the course (RQ2), and in two courses, the addition of a voluntary synchronous study session (RQ3). The methodology consisted of an ex-post facto analysis of the student responses to weekly discussion prompts in multiple sections of asynchronous online graduate courses and a review of the data available from within the CANVAS LMS system. Some of the discussion prompts provided students choice in what to discuss and others did not provide for student choice. The initial review was an analysis of the number of posts per student and the overall word counts of those responses.

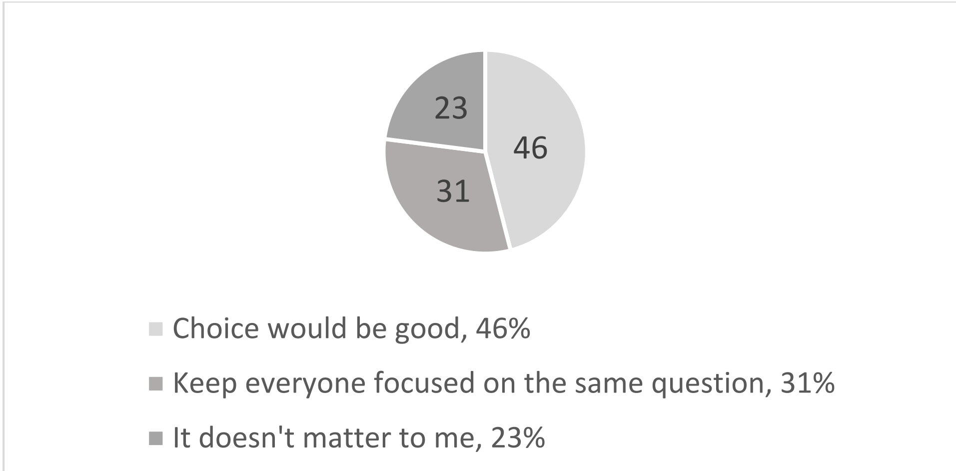
The fact of whether or not students were asked to participate in a video introduction to their classmates was considered as another potential factor in developing student engagement as well in conducting a similar analysis (RQ2). The research then considered the overall grades earned by students for the discussion posts, the length of their posts, and the number of posts the students made. Increases in those areas were considered to be evidence of increased engagement by the student when the requirements within the course was not otherwise modified.

In addressing the third research question, the researcher reviewed the system end of course surveys to identify the potential impact of the synchronous study sessions. Additionally, the students from the Summer 2020 course sessions were provided the opportunity to complete a survey to respond to the impact of the instructional changes intended to increase student engagement in their courses. The non-demographic questions from the survey queried students about:

1. Do you feel you are learning enough in the course at this time?
2. Do you feel the optional Zoom sessions are helpful?
3. Do you think I am participating or moderating the discussion questions?
4. Do you prefer to have a couple of questions to select from in the discussion threads or would you prefer all students to answer the exact same discussion prompts?
5. Do you feel you are getting adequate feedback on your assignments?
6. Do you find the video introductions helpful as a way to get to know each other?
7. If we were able to allow for greater differentiation in the course, by allowing students to choose one or more modules to complete would you be in favor of that approach?
8. What additional things could I do to improve student engagement within my online courses?

Prior to employing the new options for students, students in courses without choice within the discussion prompts were asked if they felt providing choice within the discussion prompts was a good idea. The results were initially split. The question, “Would you prefer to have a couple of questions to select from or continue to have everyone in the class respond to the same questions?” How respondents answered is shown below in Figure 1.

Figure 1
Percentage of students who wanted to implement choice in discussion threads.



The discussion threads were then divided into those offering choice and those without student choice. They were compared by number of student posts, the length of posts, and the overall grades obtained by students for each approach to the discussion section of the course. A similar review was conduced based upon whether or not the course required an introductory video. The survey results were relied upon for the impact of the synchronous study sessions as they were only implemented by one faculty member in two courses. Faculty who had implemented choice or video introductions were asked for feedback as well as to the impact of the new facets of their courses.

Results

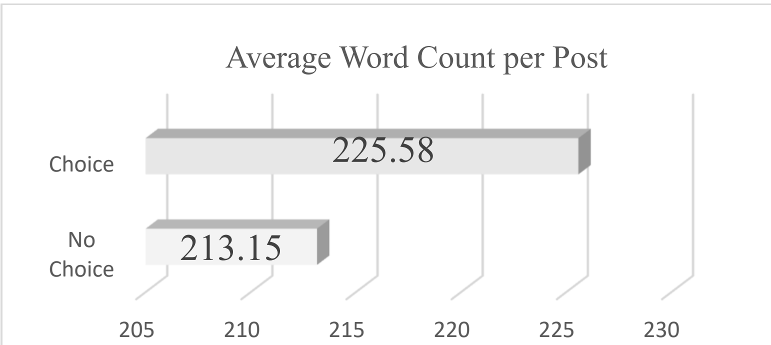
The Impact of Choice within Discussion Threads

The goal of adding choice to the discussion threads was to allow students to have a greater voice in determining the direction of the discussions and therefore encourage student engagement. After the initial pilot survey about choice, one initial course was offered with choice within the discussion threads. At the end of the course, they were given a similar survey as to the one mentioned in Figure 1. At that point, 94% of the students identified that they preferred choice and 6% stated no preference. None of the students wished to return to a system without choice.

Choice was then implemented within approximately half of the course load of the faculty involved. A simple analysis of the discussion threads from the courses showed that students in the courses where they were given choice in their discussion prompts wrote posts that were approximately five percent longer than those without choice. Overall, average student grades for the discussion threads were approximately 96% without choice and 98% when they were offered choice. The specific numbers regarding the length of posts are shown in Figure 2. The basic discussion rubric used in all of the courses involved expected a minimum of 150 words per post.

Figure 2:

Scope of Discussion Prompts with and without Choice



When offered the opportunity to voice their comments about choice in the discussion portion of their courses, 61% percent of the respondents preferred choice. 16% of the respondents would have preferred to have students focus on a single set of questions without choice. The other 22% did not have a preference. This was higher than the percentage of students who wanted choice prior to being exposed to choice within a course. Only one respondent added a specific comment about the discussion threads offering:

To add excitement I think laughter is always good...maybe some "what is your favorite.....to do outside of school?" or "what is your favorite meal to grill outside?" Just to get us talking about something that we could find common ground with. It could build cohesiveness in cohorts.

When reviewing the number of discussion posts in courses with and without choice, there was no effective difference between the number of posts made by students. Faculty felt that the choice encouraged both student engagement and the development of higher-level thinking skills.

The Impact of Requiring Video Introductions

Asking students to post an introductory video appears to have had a major impact on student engagement. Students appear to have responded positively to the implementation of introductory videos. Sixty-nine percent of the respondents felt that the introductory videos were helpful for students get to know each other. The other 31% didn't feel the video introductions were helpful.

Students were provided a prompt to respond to in order to guide their response within the introductory video. An example is below:

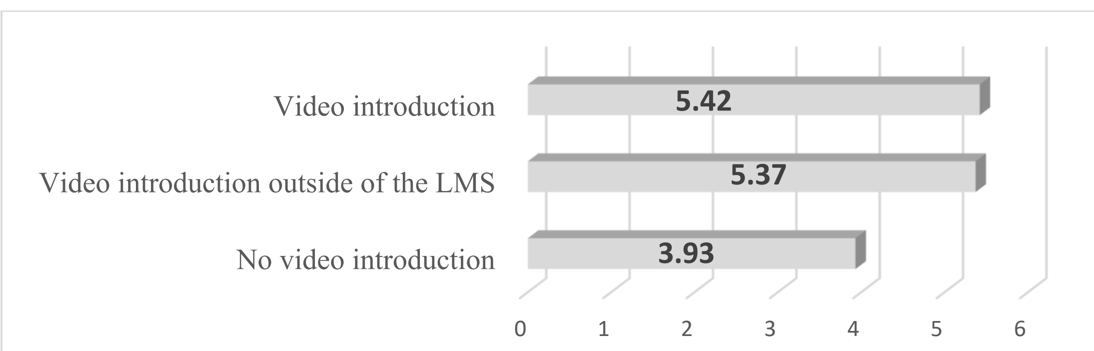
Getting to Know You

- *An important part of learning online is creating a learning community and a sense of interaction with the other members of the class. The introductory video and your profile are a great first step towards that goal.*
- *Create a brief 2-3 minute video introduction that tells the class more about who you are. In your introduction, you could include a little about yourself, your background and work experience, why you are enrolled in this course, and after looking at the syllabus something you are excited about.*

As illustrated in Figure 3, students in courses with a video introduction requirement posted 33% more than students without the requirement. Additionally, the posts were slightly longer on average as well. Initially, several of the course had the introductions completed through FlipGrid, a third-party service. Then all the introductory videos were managed through the CANVAS LMS in order to save students having to set up an additional account or potentially learn another system. It does not appear to have made a difference to student engagement as to whether the videos were managed through FlipGrid or within the CANVAS LMS itself. However, among students who completed the Summer 2020 survey, all respondents rated their technology skills as average or above average (the highest rating), so working with students with lower levels of digital literacy might appreciate not having to learn an additional technology tool.

Figure 3

Number of Posts Per Week Based upon Video Introduction Requirement



Student survey responses were uniformly positive. Some specific comments regarding the introductory videos included:

The video introductions allow more of our personalities to show through.

I, for one, am very much enjoying the video introductions!

I like when we have options to do short video discussion threads. It does make the class more personal.

Faculty responding to a request for insights on using introductory videos stated using helped to engage students and to help the faculty get to know the students as individuals. Some faculty stated they returned to the videos throughout the course as a way to remind themselves of the students' backgrounds and interests.

The Impact of Synchronous Study Session in an Asynchronous Course

Due to the impact of COVID 19, a voluntary study session was added to assist students in coping with the isolation of the pandemic. The session was held in the evening on the same day or the week throughout the course. It was clearly articulated that the sessions were voluntary and the sessions were recorded and the recorded sessions were posted into the LMS for students who wished to review them or who had been unable to attend the live session. One hundred percent of the students exposed to the study sessions responded that they felt they were helpful. In general, at least two-thirds of the students participated in each of the study sessions. Several sessions had 100% attendance. Specific responses about the study sessions included:

These meetings help me connect with you and my classmates. These connections motivate me to extend myself on the discussion board posts. The meetings are also good springboards for the weekly writing assignments.

Although online independent study really fits my career/lifestyle with my family at this time, nothing can replace the face-to-face conversation and thought process you get when talking outloud. I really appreciate these meetings and having them to "add" to what we are discussing, reading, researching, and experiencing.

Very helpful most of the time. Great to connect with others, hear their questions...etc.

I liked the balance of online work and the optional weekly face to face [sic] *meetings.*

This class was the best online learning experience I have had … … [the instructor] offered short weekly Zoom meetings. These were very helpful in guiding my learning and motivating me. They also helped create a sense of community with my peers.

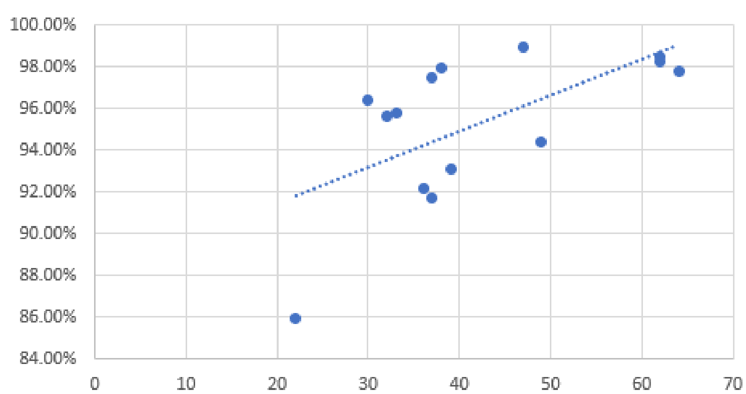
Students who did not have the opportunity to participate in the synchronous study sessions were asked it they would like access to such sessions. Fifty-two percent of the respondents said they would prefer not to have such sessions. That did not align with the fact 78% of the same group of respondents said if the time wasn't convenient to them, they would utilize a recording of the session. A second brief poll of students was conducted in the Fall of 2020 with current students and 93% found the synchronous sessions to be valuable.

Some Additional Insights

During the review of the discussion posts by students and other LMS data, two additional insights were drawn from the LMS data. The first was that there was a moderately strong positive correlation between the number of discussion posts a student made and their final course grade as shown in Figure 4. A second insight was that simple access to the course in the LMS was not enough to improve student performance. The correlation coefficient for page views v. final grade was r = 0.3632 compared to the r = 0.6084 for the number of discussion posts v. final grade. Simply viewing course materials was not as effective in raising student performance as active engagement in the discussion threads.

Figure 4

Final Grade v. No. of Discussion Posts



Conclusions

This study was based upon the review of graduate level education courses delivered in a asynchronous online format .Students were not in cohorts and the course scheduling process generated a range of students within each course from first time graduate students through students in their final course. Courses were identified as either providing for choice in discussion prompts or not allowing choice. Each course was generally structured to include weekly discussion prompts as part of the course design and those discussions accounted for 20% of the student's final grade.

Recommendations for Practitioners

Students tended to perform at a higher level of engagement when they had choice within the discussion threads. The students provided about five percent longer posts when they had choice in which discussion prompts to respond to. The students who had the opportunity for choice lost about half the amount of discussion points that students without choice lost during the length of the course. Therefore, it is recommended to allow students choice in the discussion prompts to which they are asked to respond.

Having students and the instructor create introductory videos at the beginning of the course is another way to improve student engagement. Students in courses requiring videos posted about a third more than students without such a requirement. Open responses similarly show students felt the introductions were helpful in building community and engaging students. Therefore, asking students to complete an introductory video within the LMS, if possible, is a good way to improve student engagement within online courses.

Adding synchronous study sessions is another recommendation after reviewing the responses from students about the impact of the sessions and 100% of the students responded that the sessions were useful. It is important to share with students that active participation in the discussion threads is a positive method for improving student performance. Students sometimes think of the discussion threads as busywork and not a core component of the coursework.

Recommendations for Further Research

This study was conducted among graduate students in educational graduate programs. It would be helpful to replicate the three facets of the study among undergraduate students. Additionally a study utilizing secondary students, who are also experiencing a high level of online instruction and reportedly low levels of engagement in many areas, would be helpful as online learning is likely to remain with a lager presence in that realm of the foreseeable future.

Another way to build on this study would be to complete a content analysis of the discussion posts themselves to confirm that choice does encourage higher levels of thinking skills as defined by Bloom's Taxonomy (Anderson, L. W., & Krathwohl, D. R., 2001).

As the initial study was conducted in a rather homogeneously white rural area of the Midwest, testing the recommendations made in areas with more heterogeneous demographics may potentially provide additional insights.

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Disrupting Students' Learning Micro-Culture in a Graduate Pharmaceutics Course: Perceived Impact of Deep Learning Strategies on Self-Efficacy

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Abstract

In an attempt to break a micro-culture of shallow learning associated with problem-solving, this study describes the impact of two complementary instructional deep-learning strategies, productive failure and instructor-designed concept maps on pharmacy students' perceptions and beliefs. The analysis of a proposed path model indicated that students' perceived impact of the two instructional strategies were significant predictors of self-efficacy. Future research will focus on the impact student-generated concept maps for transfer problems associated productive failure.

Motivation and Objective of the Study

Pharmacy students are expected to assume diverse roles that extend beyond the traditional roles of dispensing medications and medication management for patients. They are increasingly expected to analyze new information and use the conclusions drawn to solve complex problems. Current ACPE pharmacy accreditation standards emphasize problem-solving competencies needed to integrate knowledge from foundational sciences (Medina et al., 2013). The instructional strategy commonly used in fundamental and applied sciences is scaffolding through worked examples (e.g. Jonassen, 2004, 2011). One of the major shortcomings of this strategy is its tendency to prompt learners to focus on the procedural aspects of the problem solving. That is, students are often missing the conceptual integration of foundational knowledge that experts convey as they work though problems (Darabi et al., 2007; van Gog et al., 2015).

This shortcoming become even more critical, especially as pre-pharmacy students create a micro-culture of shallow learning. As these students move into the entry level pharmacy courses, some of their gaps in knowledge pose challenges that could hinder their academic performance. The major objective of this study was to analyze to what degree instructional strategies focused on stimulating deep conceptual understanding through the use of concept mapping integrated with productive failure in-class strategies can alter the above described micro-culture of shallow learning.

Instructional Intervention

"Pharmaceutics I" is a foundation course in the Pharmacy Doctorate (PharmD) program that strives to bridge the foundational chemistry knowledge form pre-pharm curricula and the applicative clinical skills by building strong analytical and problem-solving skills. The instructor found that for some topics for which students consistently performed below expectations and identified as one major reason the fact that students failed to make the required connection between the conceptual aspects of chemical equations and the algebraic equations used to model them.

For a couple of semesters, the instructor worked with an instructional designer to adapt and implement a productive failure instructional strategy (Kapur, 2008, 2010, 2013). Using a design-based research methodology (Cernusca & Ionas, 2014) with two iterative DBR cycles, the researchers found that students in the treatment cohort scored significantly higher on the exam that was the focus of this strategy (Cernusca & Mallik, 2018). However, the instructor observed a lack of consistency in students' ability to analyze the conceptual structure behind the problem information and decide on the nature of the analysis that needs to be performed. To address this gap, during spring 2019 semester the instructor, working with the instructional designer, started to integrate in the instructional process a series of instructor-designed concepts maps associated with the worked examples prior to and part of the productive failure strategy.

Concept mapping is an effective mindtool (Jonassen, 2000) that helps engage learners in critical thinking and deep learning (Bilik et al., 2020; Hay, 2007) and effectively assess learning (Weinerth et al., 2014). While concept mapping was introduced at a larger scale in education during 70's, more current reviews of the literature show the potential impact of this tool across various areas of health professions such as medicine (Daley & Torre, 2010), nursing (Daley et al., 2016) and pharmacy (Hill, 2004; Noble et al., 2011). Finally, concept mapping proved to be an effective tool when integrated with other deep-learning instructional tool and strategies. For example, concept mapping was integrated with the use of a photograph association technique (Byrne & Grace, 2010). While this integration was used to elicit children's ideas about a specific science topic, concept mapping can be useful in pharmacy educational research associated with sensitive topics. For example, adding concept mapping to the use of photovoice strategy (Werremeyer et al., 2017) can enhance the quality of the outcome resulted from the photovoice intervention. At a deeper level, Addae et al., (2012) proposed a modified Problem Based Learning (PBL) strategy where concept mapping was combined with the traditional PBL phases to produce a new 5-phase leaning approach in which three of the phases were designed as identifiable concept mapping tasks. In this strategy the first concept map was developed as a group map focused on the structure of the clinical problem and served as the center of the overall map that was developed in the other two concept mapping tasks.

We decided to integrated concept mapping with the active learning in-class activities with a focus on increasing students' ability to solve problems that were scaffolded with a productive failure strategy previously implemented in this course (Cernusca & Mallik, 2018). While the fully student-generated and partially student-generated concept maps proved to be more effective than the expert-generated concept maps (e.g. Lim et al. 2009) we decided to start this integration process with later type, expert-generated type with the instructor being the expert in this case. From an instructional impact perspective, the inclusion of instructor-designed maps was selected because it is a low-impact strategy that has a main goal to introduce students to the basic structure of the mental models associated with various stages in the problem-solving process. That is, this strategy was not expected to significantly increase the anxiety associated with the changes in the instructional process, reducing therefore the chances to create student resistance to the change.

Examples of topics that were augmented with instructor's concept maps were the identification of functional groups, molecule type identification or compound identification (see Figures 1 to 3).

Figure 1

State of Matter concept map

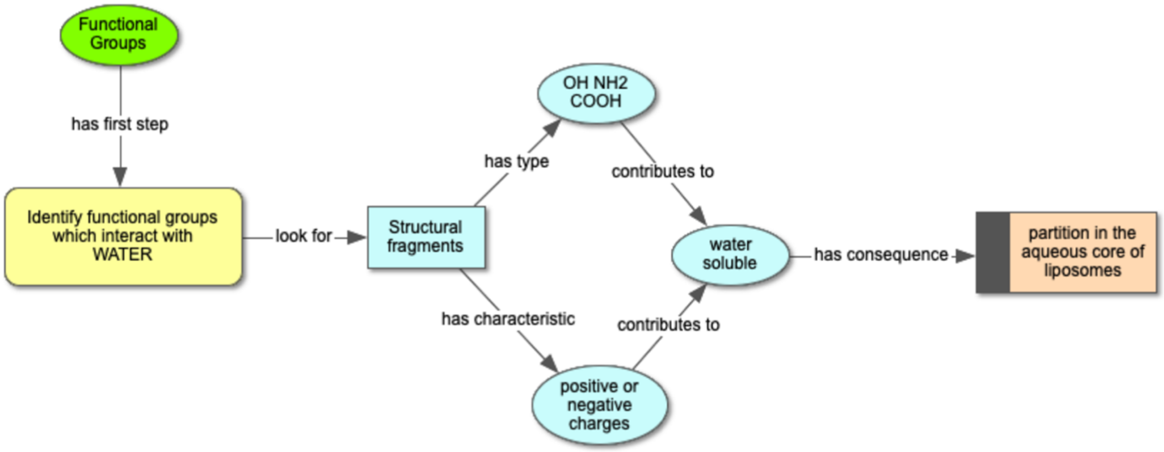


Figure 2

Physical Properties of Molecules concept map

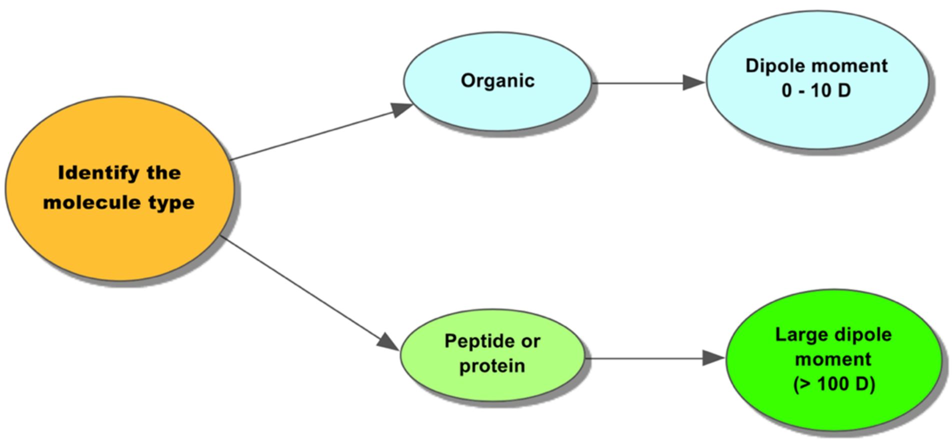
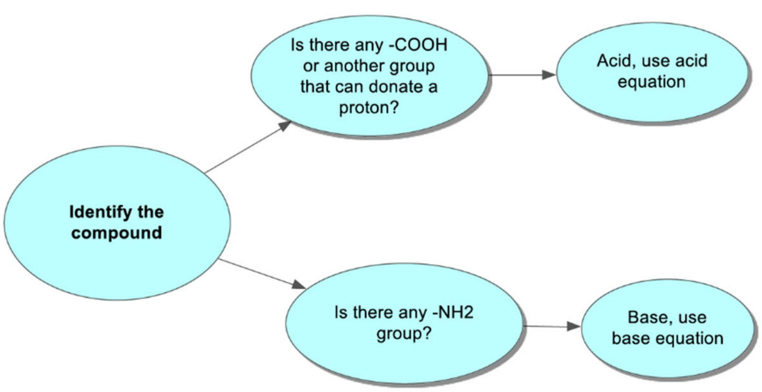


Figure 3

Acid Base concept map



$$pH = -\frac{1}{2}\log(K_a \times [RCOOH]_{total})$$
$$= \frac{1}{2}(pKa - \log[RCOOH]_{total})$$

$$pH = 14 + \frac{1}{2}\,log(K_b[RNH_2]_{total})$$

Because the structure of the instructor-generated concept maps was dependent of the context of the problem to be solved, the instructor encouraged students to try to adapt his maps for the problem that was solved during the classroom activities or as part of the assigned homework.

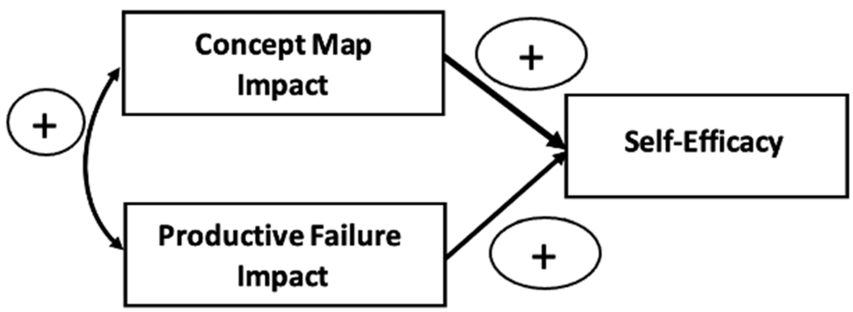
Research Focus and Methodology

Due to the relatively low impact of the use of instructor-driven concept maps, the major goal of this study was to explore the perceived impact of the integration of productive failure and concept mapping on pharmacy students' self-efficacy (used as a proxy for students' future performance).

Research Design

An exploratory quantitative design research was used to analyze if perceived impact of concept mapping and productive failure were significant predictors of student perceived self-efficacy. The proposed structural model is presented in Figure 4.

Figure 4
Proposed conceptual model related to the implemented instructional intervention



As shown in Figure 1, the expectation is that both the perceived impact of concept mapping and productive failure tasks on own learning increase student self-efficacy beliefs while the two types of strategies perceptions will interact with each other.

Participants

The course used for this study had an enrollment of 84 students in their first year of the Doctor of Pharmacy program. A convenience sampling strategy was used, all students in the course being invited to participate in the study. A number of 56 (67%) students volunteered to participate in this study.

Data Collection

The instructor collaborated with an instructional designer to administer, using Qualtrics®, an online an end-of-course survey with items adapted for three constructs validated in the literature.

The perceived impact of productive failure on own learning and the perceived impact of concept maps on own learning were implemented from Grasman & Cernusca (2015) with minor changes related to the course name and focal topic to customize them for this study (Appendix 1). The self-efficacy construct was adapted from Cernusca & Price (2013). All three constructs used a 9-point Likert evaluation scale ranging from 1 for Strongly Disagree to 9 for Strongly Agree. Scores for each construct were computes as the average of the scores of its individual questions, resulting in a continuous score ranging from 1 to 9. The online survey was administered during the last two weeks of the course and students had 10 days to complete the survey. No bonus points were given for those that participated in this research study. This study was approved by the local Institutional Review Board and the informed consent form was posted at the onset of the survey indicating the voluntary participation in the study and the alternative task available for those interested in earning the bonus points but not participate in this study.

Data Analysis

Data collected were analyzed for basic statistics and correlations among proposed variables using SPSS v25. Analysis of raw data did not reveal outliers and the analysis of z-scores (< +/-2.5), skewness and kurtosis (< +/- 0.5) indicated an accepted level for the normality of the dataset. All three constructs adapted from the literature showed a very strong internal reliability with Cronbach's Alpha values of 0.99 for perceived *impact of productive failure* on own learning and 0.95 for *self-efficacy* and *impact of concept mapping* on own learning. A path analysis model for the three proposed variables, perceived impact of productive failure on own learning, perceived impact of concept mapping on own learning and self-efficacy was tested using IBM SPSS Amos v25 software.

Findings

Table 1 presents the basic statistics for each of the measured continuous variable at the exit point in the course. As shown in Table 1, the proposed conceptual model was supported by the statistically significant ($p<0.001$) correlations among these variables with a moderate to high strength ranging from 0.58 to 0.64.

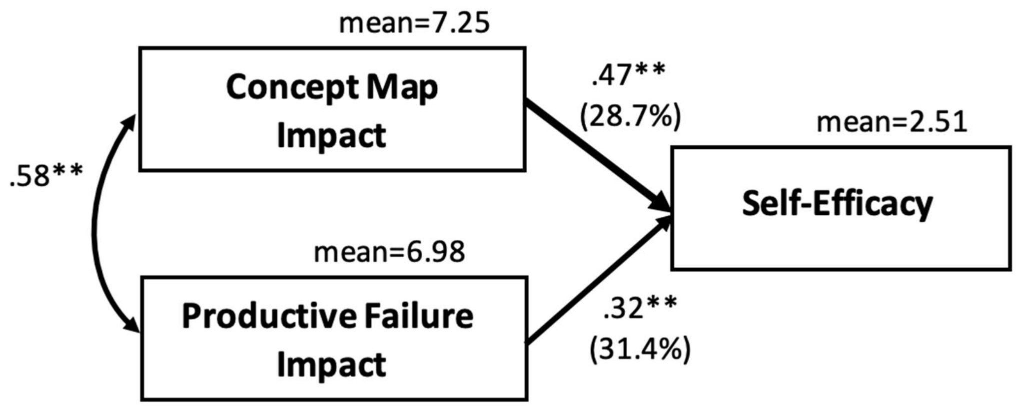
Table 1
Means, Standard Deviations, and Pearson Correlations for continuous variables (N=53)

	M	SD	1	2	3
1. Perceived impact of concept maps	7.24	1.69	-	.58**	.64**
2. Perceived impact of productive failure	6.98	1.79		-	.59**
3. Self-efficacy	7.04	1.44			-

Note: **p < 0.01 (2-tailed)

The results of the path analysis as resulted from the data generated with AMOS are summarized in Figure 5.

Figure 5
Results for the proposed path analysis model



The path analysis indicated that both perception variables were significant predictors of self-efficacy, with perceived impact of productive failure standardized coefficient of $\beta=0.32$, $p<0.01$ and perceived impact of concept maps standardized coefficient of $\beta=0.47$, $p<0.001$. The covariance between the perception variables had a standardized coefficient of $\beta=0.58$, $p<0.001$. The overall model had a good fit (NFI=0.99; CFI=0.99) and the two perception variables explained 49% of the variance in students' self-efficacy, an acceptable level considering the low-impact nature of the concept mapping instructional intervention.

Because the exams in this course are open-notes, anecdotal data based on instructor's observation during the exams indicated that students used the instructor-developed concept maps when they worked on the problems during the exam.

Discussions and Further Research

The results of this study indicate that the combination of the two strategies, productive failure and instructor-designed concept maps has the potential to significantly impact students' perceptions and beliefs on own ability to perform well in the course. The acceptance of the two strategies is also a potential indicator of students' willingness to move toward the use of deep learning problem-solving strategies as part of this course.

Considering the piloting nature of this study, the research team intends to further explore the identified trends by expanding the use of instructor-driven concept maps and introduction of instructional tasks that will require students to generate their own concept maps for transfer problems associated with the worked examples integrated in the productive failure activities.

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Appendix 1

Instructional engagement constructs

The use of Concept Maps in PSCI 368 helped me to…	Strongly Disagree				Strongly Agree
…better retain **the material taught in lectures**	1	2 …	5	…8	9
…better prepare **for the exams**	1	2 …	5	…8	9
…develop a better understanding **of the concepts introduced in lectures**	1	2 …	5	…8	9
...feel more confident **in my ability to learn the material introduced in the lectures**	1	2 …	5	…8	9
…make the time studying **for exams and quizzes more effective**	1	2 …	5	…8	9

The use of Productive Failure in PSCI 368 helped me to…	Strongly Disagree				Strongly Agree
…better retain **the material taught in Buffered Solution lectures**	1	2 …	5	…8	9
…better prepare **for Exam 2**	1	2 …	5	…8	9
…develop a better understanding **of the concepts introduced in Buffered Solution lectures**	1	2 …	5	…8	9
...feel more confident **in my ability to learn the material for Buffered Solutions**	1	2 …	5	…8	9
…make the time studying **for Buffered Solutions exam more effective**	1	2 …	5	…8	9

Exploratory Steps to Stimulate a Deep Learning Micro-Culture. Introducing Concept Mapping Strategies into a Pharmacy Curriculum.

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Abstract

To create a culture of deep learning needed to prepare pharmacy students for their roles involving patient care and team-based clinical decision-making concept mapping strategies were integrated in an entry-level and advanced-level pharmacy doctorate courses. Findings indicated that concept mapping strategies can help students build and represent complex conceptual models and that this strategy can be successfully adapted to match the level of skills and knowledge. Concept mapping also revealed areas where students need improvement in the organization and depiction of their knowledge.

Background and Objective of the Study

Pharmacists are continuosly expanding their role in health professions beyond the traditional roles of dispensing medications and medication management for patients. They are increasingly expected to be able analyze new information, draw valid conclusions and use them to solve complex problems in individual and population-level patient care. To prepare pharmacy students for these new professional roles, instructors need to integrate in the instructional process strategies that promote conceptual integration skills across various topics covered in their courses. In addition, current pharmacy accreditation standards emphasize problem-solving and creative thinking competencies which aligned with the new professional roles of pharmacists (Medina et al., 2013).

Concept maps and concept mapping strategies are mindtools that have been shown to be effective in engaging students in the process of building complex mental models, similar to what is required in real-world problem solving situations and generating creative solutions to known challenges (e.g. Balaid et al., 2016; Bilik et al., 2020; Jonassen, 2000). While concept mapping was introduced at a larger scale in education during the 1970's, more current reviews of the literature show the potential impact of this tool across various areas of health professions such as medicine (Daley & Torre, 2010), nursing (Daley et al., 2016; Garwood et al., 2018) and pharmacy (Carr-Lopez et al., 2004; Noble et al., 2011).

Concept mapping proved to be an effective tool when integrated with other active learning instructional tool and strategies. For example, Addae et al., (2012) proposed a modified Problem Based Learning (PBL) strategy where concept mapping was combined with the traditional PBL phases to produce a new 5-phase learning approach in which three of the phases were designed as identifiable concept mapping tasks. In this strategy the first concept map was developed as a group map focused on the structure of the clinical problem and served as the center of the overall map that was developed in the other two concept mapping tasks. From an assessment perspective, concept maps proved to be very effective tools to measure both surface and deep-learning outcomes (Hay, 2007).

Finally, concept mapping proved to be an effective strategy not only for individual students but also for group instructional tasks (Mukherjee et al., 2018), as were implemented in the research being reported in this paper.

Despite the many benefits of using concept mapping to increase depth of learning, concept mapping is a type of open-ended instructional strategy that can pose challenges to both instructors and students and therefore potentially create resistance to its use in the current pharmacy classroom. Lim and colleagues (2009) examined the effect of different concept mapping generativity level that ranged from expert-generated maps to partially learner-generated maps and to fully learner-generated maps. They found that while the students in the fully learner-generated concept maps outperformed the other two groups, those students with high self-regulating skills significantly outperformed those with low self-regulating skills. Therefore, staging the introduction of concepts maps starting with the lowest generative level, expert-generated maps and increasing the engagement with the next levels of generativity can help decrease the gap between various level of self-regulating skills specific for a student cohort, especially in large courses. The major objective of this study was to explore to what degree concept mapping strategies can be integrated in both entry-level and advanced pharmacy courses as part of a pharmacy doctorate curriculum.

Instructional Design Interventions

During the Fall 2018 semester, an instructional designer worked with two instructors to implement concept mapping strategies in two courses across a pharmacy doctorate (PharmD) curriculum. The first course was Public Health for Pharmacists, an advanced-level course for the third year (P3) PharmD students and the second was Pathophysiology, an entry-level clinical course for first year (P1) PharmD students.

Because of the advanced level of the course and its structure with a lecture module and an active learning module, the concept mapping intervention in the P3 course was integrated in two stages. At a first stage, in the lecture part of the course the instructor developed a complex concept map that synthesized the main elements related to the role of pharmacists in ensuring population health, the focus of the course (Fig.1). However, due to its complexity the concept map was not presented in the beginning of the course in its totality but rather was integrated as sub-maps throughout the lectures. Figure 2 shows a partial map presented and discussed with students as the semester progressed. The goal of the partial concept map integration into the lecture was two-fold. First, the instructor introduced students to concept mapping strategies by providing example of maps ranging from simple to complex. Second, the instructor used the concept maps to both emphasize the interconnectivity and complexity of the course topic and to generate class-wide discussions about the course topics. These discussions had the additional outcome of making edits and ultimately, completion of the partial and the final concept maps.

As a second step, in the active learning part of the class the instructor used one of the major team-based case studies addressing the analysis of the burden of Hepatitis C (Hep C) on the population health system as the context for a student-generated concept mapping task. Student teams were tasked with the development of a concept map that reflected strategies that pharmacists can use to help in reducing the Hep C burden and improve population health. The major goal of this activity was to engage students in course-related tasks that were beyond the traditional role of a pharmacist and consequently to increase students' beliefs in the usefulness of the skills they built in this course.

The active learning part of the course was held in a technology-rich classroom that had a SCALE-UP design with round tables that host groups of up to 9 students. Each team used post-it notes provided by the instructor to write the major concepts on and had access to a whiteboard or a big empty post-it-note to build their concept map (see Figure 3).

Figure 1

Pharmacists' role in ensuring population health. Instructor-developed concept map.

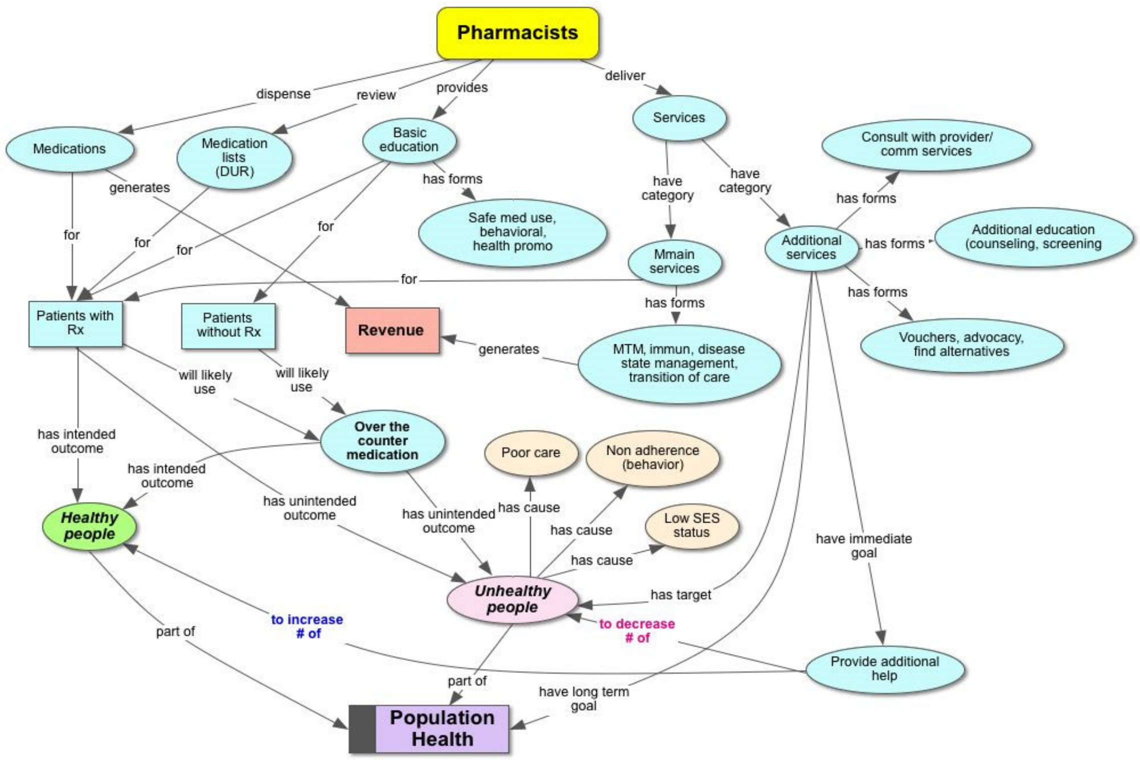
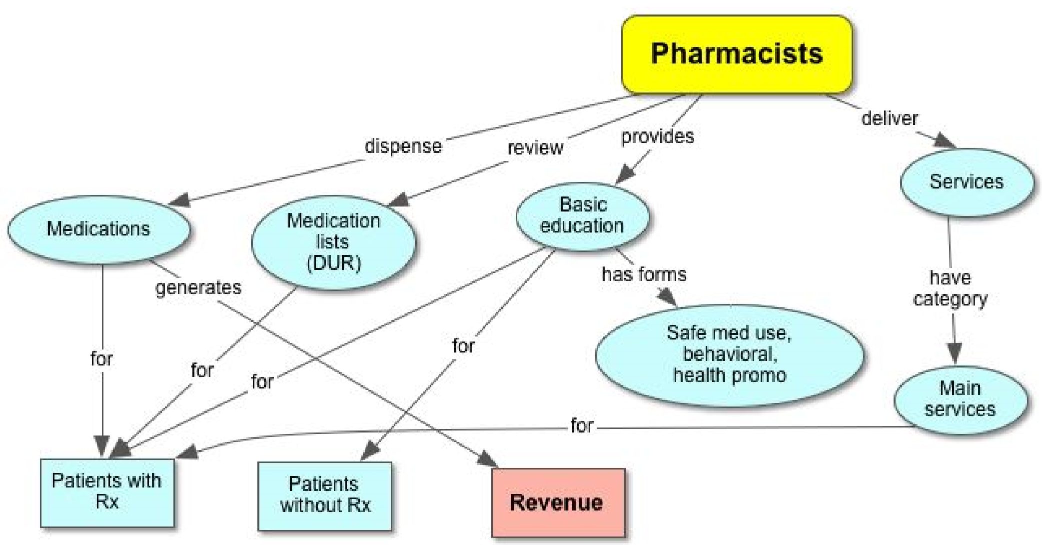


Figure 2

Pharmacists' role in ensuring population health. Partial concept map integrated in lectures.



As shown in Figure 3, each group found the best strategy to collaborate on integrating the knowledge built during the lecture and from the analysis of the Hep C case study into their own concept map.

Figure 3
Concept mapping activity. Working as groups to build HepC concept maps.

At the end of the activity, one representative from each group presented their group's concept map to the entire class (Fig.4).

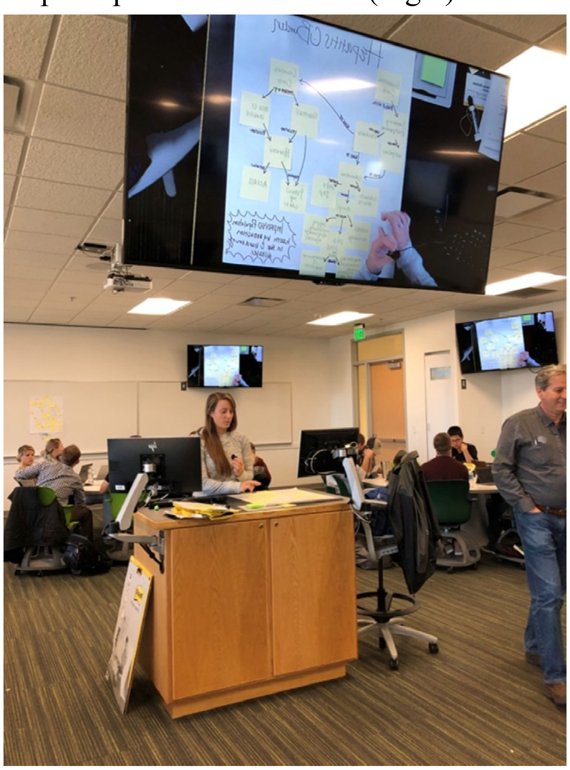


Figure 4
Concept map presentation for the entire class

Finally, the instructor showed his own concept map and used it to generate discussion about the topic that was the focus of the in-class concept mapping activity. Because of the relative novelty pf the concept mapping strategy, the resulted concept maps were not included in the course assessment strategy.

For the entry-level P1 course, the opportunity to test the potential of the concept mapping activity occurred toward the end of the semester. The timing of this activity was considered optimal because most students were enrolled simultaneously in both the immunology and the pathophysiology courses.

Therefore, the topic of the lecture integrated a significant amount of instructional material that was already covered in the immunology course. Consequently, the implementation of concept mapping activity was less structured than in the previous course. To build their concept maps, students were required to focus on the major relationships between immunology and pathophysiology through the perspective of the role of the pharmacist by integrating these two areas of study. Students were able to actively refresh immunology concepts while attempting to link them with pathophysiology concepts. Compared to a standard lecture, students were expected to be a significantly more engaged in the topic as a result of overlap of topics and courses. During the first half of the class period, teams of students engaged in building the concept maps with a minimum introduction by the instructor of what a concept map is. White boards were used to provide a space for each team to collaborate in the development of their concept map. In the second half of the class period, the instructor built on the concept mapping activity to expand, emphasize, and reinforce the major relationships between immunology and pathophysiology concepts from a pharmacist's practice perspective. The resulted concept maps were not included in the grading scheme of the course.

Research Focus and Methodology

Due to the relatively low impact of the use of concept mapping activities in the two courses, the major goal of this study was to evaluate the potential impact of the concept mapping on students' ability to represent the dept of their learning at various levels across the curriculum.

Participants

A convenience sampling was used for this study. For the P1, entry-level course, the class size was 78 students and all of them volunteered to participate in the study. For the P3 course, the class size was 89 and 87 (98%) students volunteered to participate in the study.

Data Collection and Analysis

All group concept maps were captured by the instructor as a photograph at the end of the activity. There were 18 groups for the P1, entry-level course, and 11 groups in the P3, advanced-level course. Considering the exploratory nature of this intervention and the span of knowledge and skills of the two groups, to evaluate the overall quality of the concept maps, an evaluation rubric was developed with three assessment dimensions adapted from the literature (e.g. Jonassen, 2000): accuracy of instances (concept-link-concept) used in the concept map, depth of the map structure, and connectedness of the map structure. Each dimension was defined and scored ranging from 1 (low) to 5 (high) as shown in Table 1 below. To determine the final map score, the three scores were summed and computed as percentage of the total potential score.

In addition, to check if the course-related activities could impact the overall development of the concept maps, students' course self-efficacy was measured using items adapted from constructs validated in the literature. The self-efficacy construct was adapted from Cernusca & Price (2013). The self-efficacy construct used a 5-point Likert evaluation scale. Scores for each construct were computed as the average of the scores of its individual questions, resulting in a continuous score ranging from 1 to 5.

This construct was part of an exit online survey administered in Qualtrics® during the last week of the course. Self-efficacy data and cohort analysis were performed with SPSS v25®.

Table 1
Concept map scoring rubric

Accuracy of instances (concept-link-concept)
5 – at least half of the instances (concept-link-concept) have both the concepts and links labeled correctly as single term node or link significant for the topic at hand
3 – one third or more of the instances (concept-link-concept) have both the concepts and links labeled correctly as single term node or link significant for the topic at hand
1 – less than one third or more of the instances (concept-link-concept) have both the concepts and links labeled correctly as single term node or link significant for the topic at hand
Depth – the level of hierarchical links
5 – at least half of concepts are linked in 2 or more hierarchical levels (from general to specific)
3 – one third to about half of the concepts are linked in 1 or 2 hierarchical levels
1 – less than one third of the concepts are linked in two hierarchical levels
Connectedness – ratio to dead-end to multiple-linked nodes
5 –high ratio of multiple-linked to dead-end nodes indicating a good understanding of the complexity of the topic
3 - dead-end nodes are same or slightly more than multiple-linked nodes indicating a fair understanding of the complexity of the topic
1 –dead-end nodes are significantly more than multiple-linked nodes indicating poor understanding of the complexity of the topic

Findings

The qualitative evaluation of the student-team concept maps indicated that, relative to the complexity of the task for each course, the maps had a relatively high complexity and correctly represented the conceptual models associated with the focal topic. As expected, due to the differences in the academic level of the two groups and the complexity of the concept map integration in the instructional process the scores of the P3 cohort (67% to 93%) were overall higher than the one for the P1 group (27% to 87%). The main evaluation dimension that differentiated the two groups was the accuracy of the instances in the map structure. Most of the concept maps built by the P1 student groups had correctly labeled nodes with individual concepts but the links between the nodes were not labeled and often were not directional. However, two of the P1 groups scored 4 and 5 on the accuracy dimension.

On the other hand, the connectedness of the maps for the P1group was much closer to the P3 group with more than two thirds of the connectedness scores for P1 concept maps being at or above 3, the average of the evaluation score for this dimension. Figure 5 shows the concept map developed by the group that earned the highest score. As a comparison, Figure 6 shows a P1 map with a low score, while Figure 7 shows the highest scored concept map developed by a P3 group.

Figure 5
P1 concept map that had the higher score in their cohort

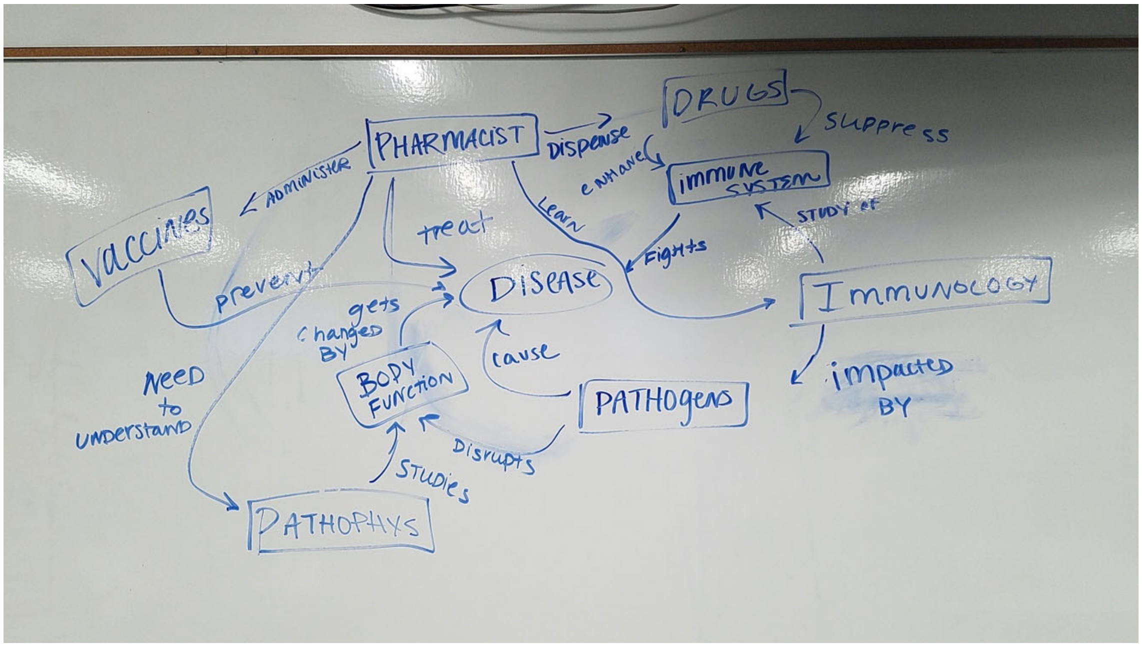


Figure 6
P1 concept map that had one of the lowest scores in their cohort

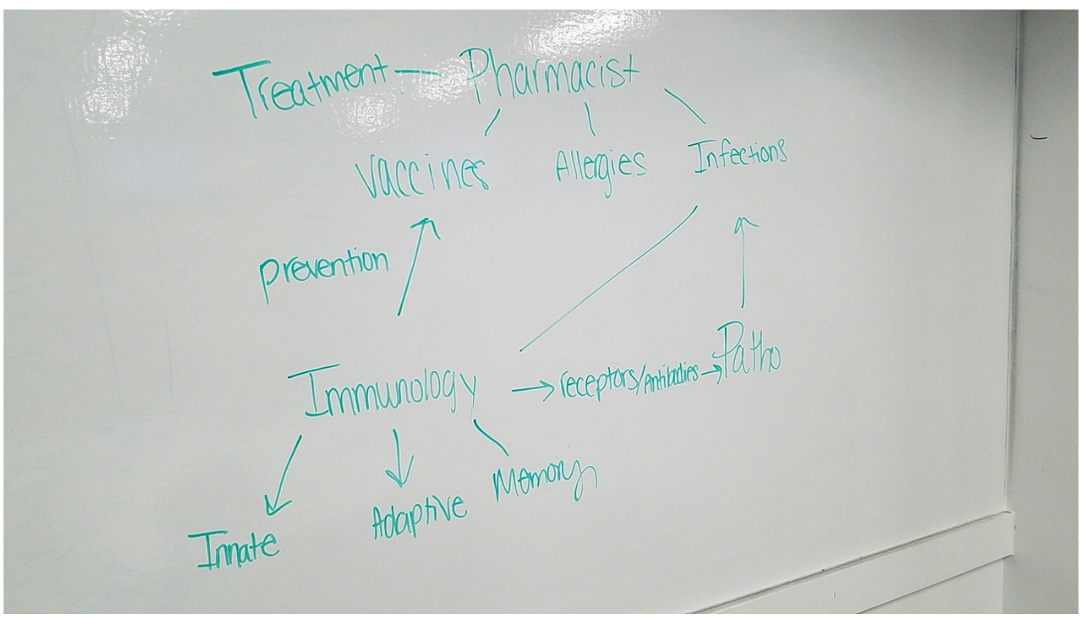
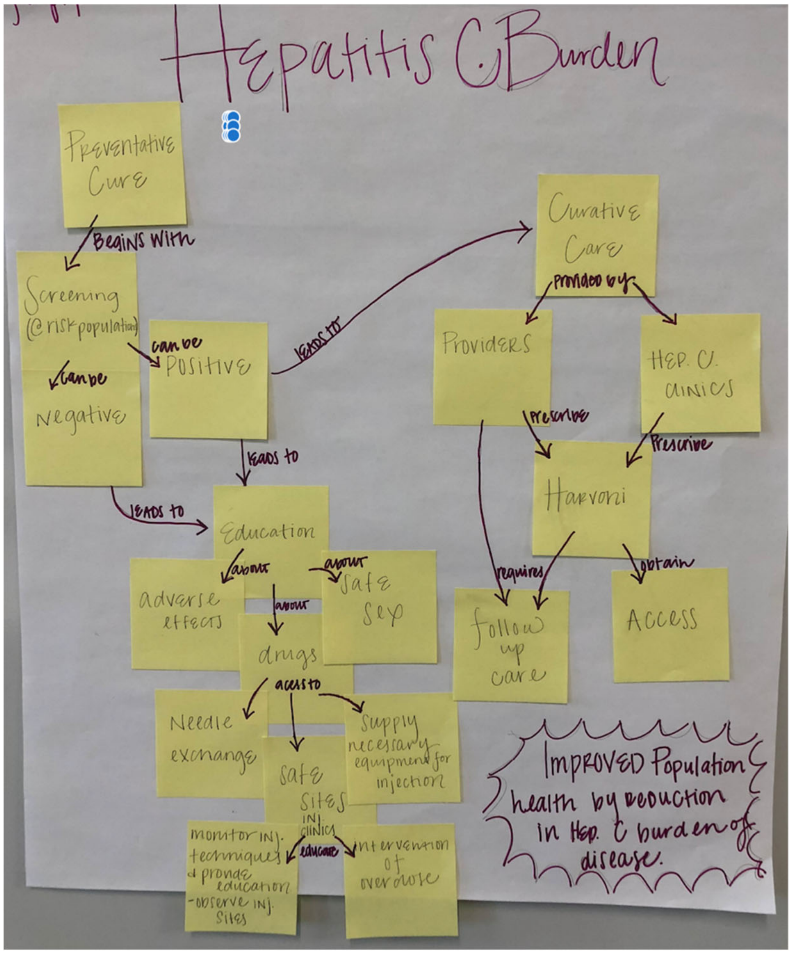


Figure 7
P3 concept map that had the higher score in their cohort



These findings show that while clearly the quality of the concept maps are higher when the concept mapping strategy is integrated in the instructional process and the task is part of an active learning activity, as was the case with the P3 group, where students were able to represent with concept mapping the complexity of their knowledge even when this strategy was introduced as an ad-hoc task in the instructional process.

For the self-efficacy data, the construct used had weak internal reliability for P1 cohort with Cronbach's alpha of 0.42, but a very high internal reliability for the P3 course with Cronbach's alpha of 0.93. Both cohorts reported above the mean to high self-efficacy levels, with P1 students having an average score of 3.87 (SD=.46) and P3 students an average score of 4.03 (SD=.62), on a 1 – low to 5 – high self-efficacy evaluation scale. An independent sample t-test showed no statistically significant difference was found between the mean self-efficacy scores of the two cohorts, $t(163)=-.189$, $p = .06$. Also, a one-sample t-test indicated that both cohorts reported self-efficacy scores statistically significantly higher ($p < .001$) than the mean (3) of the evaluation scale. This suggests that both courses provided students with similar engagement and feedback opportunity to increase their beliefs in the ability to learn in their course.

Conclusion

The finding of this exploratory study indicated that concept mapping strategies can help students build and represent complex conceptual models relating complex roles of pharmacists that go beyond the traditional medication dispensing roles. This strategy can be successfully adapted to match the level of skills and knowledge for both entry and advanced-level pharmacy students. Future research will focus on the concept mapping to provide instructors with a clearer picture of areas that need improvement to further help pharmacy students prepare for their professional journey, especially for advanced-level courses.

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Using Important-Performance Analysis to Guide Instructional Design Decisions for E-Service Learning

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Abstract
Designing experiential learning activities requires an instructor to think about learning outcomes. Using importance-performance analysis can assist with the instructional design of the activities. This study used IPA in a fully online asynchronous graduate class. The primary goal of this article is to demonstrate the use of IPA to guide the instructional design process of e-service learning activities.

Keywords: e-service learning, online course design, experiential learning, importance-performance analysis

Introduction

Service-learning has been a proven learning strategy from the days of Dewy and is often intertwined with other forms of experiential learning such as practicums and work-related learning. Caspersz and Olaru (2015) define service-learning as a "process of reflective education in which students learn civic or social responsibility through a scholarship of community engagement that embodies the principle of reciprocity" (p. 19). In practice, service-learning integrates academic rigor with real-world projects that students undertake with community groups and thus creates a reciprocal learning relationship between the students and their community groups. Typically, community-engaged pedagogies such as service-learning require facilitative expertise that educators develop and refine through scholarly teaching that integrates experience and reflective teaching (Strait, Turk, & Nordyke, 2015; Waldner, 2015).

Service-learning is often integrated into face-to-face environments but with the number of online courses and programs, creating high-impact practices for online service-learning is imperative. E-service learning occurs when the instructional, service, or both components are conducted online. For example, students in an online history class may assist a museum with digital archives. Dailey-Herbt and colleagues (2008) described e-service learning as a pedagogy that engages learners through technology. Previously, it was not easy to engage the community from a distance, but technology development, connecting students from a distance with community-based practices, is seamless.

Designing for Online Service Learning

With the increase of online education, many studies focus on transitioning from traditional service-learning to e-service learning. Often educators find the online environment as a barrier for effectively implementing service-learning. Frameworks have been proposed for implementing e-service learning, yet there is no "one size fits all" due to the diverse needs of projects. Researchers hope that the design and development of e-service learning will help future educators make informed decisions and plan the best implementation for their respective projects. E-service learning challenges educators to make full use of technology rather than replacing instructors with technology. The focus should be on the design of the course and project.

Although there is a plethora of research regarding service-learning benefits, research on online service-learning is lacking. Marcus and colleagues (2020) conducted a systematic review of e-service learning literature and found only eleven studies that focused on the design and development of service-learning for online courses. Many of the studies offer suggestions for designing e-service learning for various disciplines. Strait and Sauer (2004) offered suggestions for beginners such as starting small with one course, introducing learners to the purpose, providing explicit communication channels for both the learners and community partners and ensuring flexibility. Bangert (2004) focused on the reflective portion of service-learning, stating discussions should be carefully crafted to create stimulating discourse and groups monitored to ensure equal participation. Helms and colleagues (2015) also focused on group communication. They recommended creating a group charter for students to develop a plan for working together, including developing a communication plan. Students may have to identify community partners or clients since many students may live outside the school area they are attending; it was also suggested to provide a list of criteria the project must meet. Students should submit a proposal early in the semester with the organization and explain why this organization meets the criteria.

Overall, the best practices suggested by researchers are also best practices for online course design and development, as suggested by Quality Matters (QM) ™. QM ™ is a faculty-oriented, process-centered, peer review process developed from research based on instructional design principles to assure quality design in online and blended courses. Many of the suggestions offered for designing e-service learning courses are incorporated within QM rubric's best practices. For example, introducing the learners to the purpose is covered in specific standard 1.2. Creating engaging and meaningful discussions is covered in specific standard 5.1. Specific standard 5.4 addresses communication among learners. Although researchers have offered some specific examples, such as the use of a group charter (Helms et al., 2015), designing a course to meet QM standards, can significantly assist an instructor in any discipline with designing and developing a course to support e-service learning.

This study analyzed student perceptions of an e-service learning project to inform future course design.

Methods

This quasi-experimental study explored students' perceptions regarding online experiential learning in terms of what they perceived to be important and how they performed. This study utilized an importance-performance analysis (IPA) method. Additionally, students were required to complete a reflection at the end of the semester. The reflections were analyzed to garner additional information about the students' experience with service learning in an online asynchronous class.

Participants

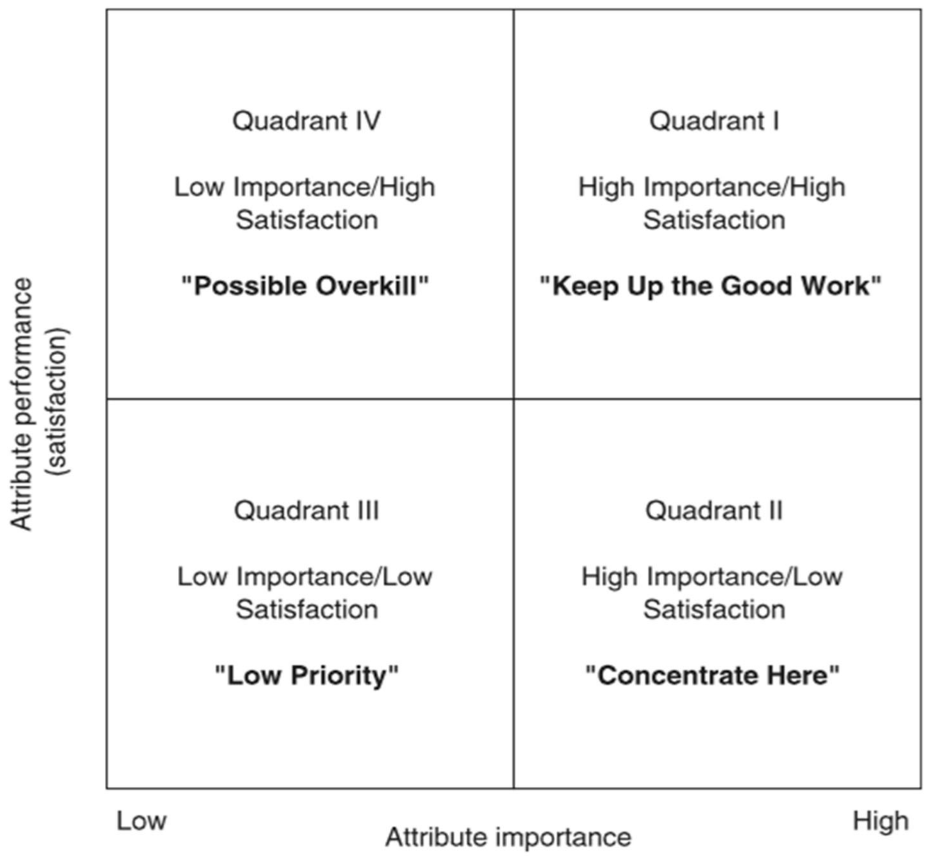
This study used a graduate course in an Instructional Technology program delivered in Spring 2020 during a fifteen-week semester. The online asynchronous course had 14 students. Students were recruited to participate in this study voluntarily at the beginning of the semester. Students who chose to participate in the study were assigned a random identification number, which allowed the researcher to match survey data anonymously. Twelve students completed both the importance and performance survey, with an 85% response rate. This response rate falls in line with the recommended response rate for online surveys (Baruch & Holtom, 2008).

Importance-Performance SELEB Survey

Importance Performance analysis has been used primarily in marketing and tourism yet has found a place in higher education for student evaluation of teaching and course design (Anderson, Hsu, & Kinney, 2016; Caspersz & Olaru, 2015; Huybers, 2014). Alberty and Mihalik (1989) also stated that Importance-Performance analysis has an important place in adult education. Important-Performance surveys allow students to evaluate both constructs of various teaching attributes (see Figure 1). Specifically, the importance-performance model identifies the relative importance of factors influencing student preference (importance component) and indicates the degree to which a particular instructor or setting possesses these factors (performance component).

Figure 1

Importance-performance analysis (IPA)



The SELEB (Service-Learning Benefits) survey developed by Toncar and colleagues (2003) was used to gauge student perceptions of the service-learning with minor word changes to terminology (Caspersz & Olaru, 2017). The SELEB scale consists of fifteen items that fall under four main factors: practical skills, interpersonal skills, citizenship, and personal responsibility. The Importance SELEB scale was given to the students at the beginning of the semester. The scale is 1 – 5, with one being extremely important and five being not at all important. The Performance SELEB was deployed at the end of the semester upon completion of the experiential learning activity. Table 1 displays the survey items and how each is associated with each main factor. There are four factors associated with the fifteen variables.

Table 1

Factors and Associated Variables of the SELEB Scale

Practical Skills	Interpersonal Skills	Citizenship	Personal Responsibility

Apply information learned in the classroom and apply it to real-life scenarios	Experience personal growth	Gain a greater understanding of cultural and racial differences	View social issues from a variety of perspectives
Apply problem-solving techniques	Enhance my leadership skills	Develop social responsibility and citizenship skills	Demonstrate my trustworthiness to others
Build my self-confidence	Further develop my oral and written communication skills	Be involved with the community	View social issues from a variety of perspectives
Learn practical workplace skills		Make a difference in the community	
Develop organizational skills			

Service-Learning Project Description

The project was implemented in a fully online asynchronous graduate instructional technology course on change management. The course was designed to align with the QM Rubric and was informally reviewed by a certified QM Peer Reviewer. Throughout the semester, students were asked to reflect on their experience every three weeks with a cumulative reflection at the end of the course. The students were also expected to complete a service-learning project for a local non-profit organization.

The class teamed up with a local non-profit to assist with implementing a technology change within the organization. The instructor chose the community partner, and students formed teams to tackle the problem collaboratively. Students were required to attend a kickoff meeting (synchronously) with the administrative staff from the non-profit organization to review the organizational needs. Since the entire class was working with one client, it was determined that all communication, including questions, would go through the instructor, and questions would be sent to the client once a week on Thursdays with an expected response time on the following Tuesday. Throughout the semester, the students were required to submit various checkpoints for their final Change Management Plan.

Results

IPA was used to analyze student perceptions and Performance. This data was used to construct a two-dimensional matrix. Importance is depicted on the y-axis, and Performance is depicted on the x-axis. The IPA graphs' gridlines are determined by the overall mean of Importance (4.40) and Performance (4.23).

A paired-samples t-test was conducted to evaluate the impact of the experiential learning assignment using the importance-performance scale. There was no significant difference between importance and Performance for all associated variables. Table 2 displays the mean scores for the four main factors of the SELEB survey. There was a decrease in the mean from importance to Performance in interpersonal skills and citizenship and an increase in personal responsibility.

Table 2
Mean comparison of the SELEB factors

Factors	Importance	Performance
Practical Skills	4.58	4.58
Interpersonal Skills	4.52	4.33
Citizenship	3.83	3.81

Personal Responsibility	3.89	4.22

A paired-samples t-test was conducted to analyze the four main factors comparing the importance to the performance. Practical skills remained the same from importance (*M* = 4.58, *SD* = .452) to performance (*M* = 4.58, *SD* = .452), *t* (9) = .000, *p* = .1.000 (two-tailed). The mean decrease in the practical skills scores was -1.293 with a 95% confidence interval ranging from .458 to 2.112. The eta squared statistic (0) indicated a small effect size. Interpersonal skills resulted in a decrease from importance (*M* = 4.52, *SD* = .444) to performance (*M* = 4.33, *SD* = .577), *t* (9) = 1.644, *p* = .139 (two-tailed). The eta squared statistic (.37) indicated a moderate effect size. Citizenship skills resulted in a minor decrease from importance (*M* = 3.83, *SD* = .750) to performance (*M* = 3.80, SD = .933), *t* (9) = .096, *p* = .926 (two-tailed). The eta squared statistic (.035) indicated a small effect size. Personal responsibility skills resulted in an increase from importance (*M* = 3.89, *SD* = .943) to performance (*M* = 4.22, *SD* = .687), *t* (9) = -1.664, *p* = .135 (two-tailed). The eta squared statistic (.40) indicated a small effect size. (see Table 3)

Table 3
Paired t-test important-performance of SELEB factors

Factor	*t*	Sig. (2-tailed)	Eta Squared
Practical Skills	0.00	1.00	0
Interpersonal Skills	1.64	.139	.37
Citizenship	.096	.926	.035
Personal Responsibility	-1.66	.135	.40

Table 4 depicts the analysis of the two-tailed t-test for the variables of the four main factors. Each item is labeled which is depicted in Figure 2 on the IPA quadrant. There is a decrease in the mean scores from importance to performance.

Table 4
t-test importance-performance of SELEB items. Letters correspond with Figure 2

SELEB Items	Mean Importance	Mean Performance	t	Sig. (2-tailed)	Eta squared

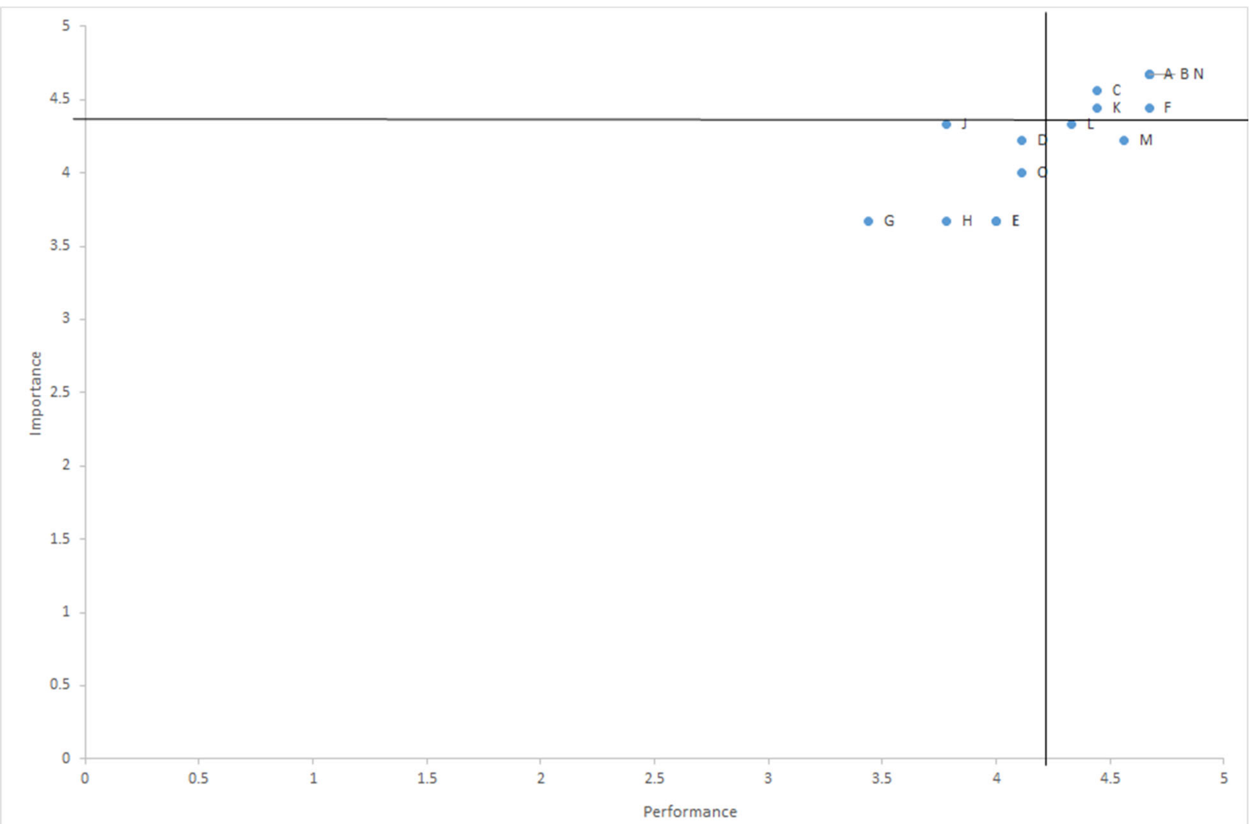
A	Apply information learned in the classroom and apply it to real-life scenarios	4.67	4.67	0.00	1.00	.939
B	Learn practical workplace skills	4.67	4.67	0.00	1.00	.939
C	Develop organizational skills	4.44	4.56	-1.00	.347	.909
D	Gain a greater understanding of cultural and racial difference	4.11	4.22	-.426	.681	.819
E	Develop social responsibility and citizenship skills	4.00	3.67	-.426	.681	.786
F	Experience personal growth	4.67	4.44	.800	.447	1.023
G	Be involved with the community	3.44	3.67	-.686	.512	.798

H	Make a difference in the community	3.78	3.67	.359	.729	.879
I	Develop social responsibility and citizenship skills	4.00	3.67	.632	.545	.515
J	View social issues from a variety of perspectives	3.78	4.33	-1.89	.095	.665
K	Build my self-confidence	4.44	4.44	0.00	1.00	.931
L	Enhance my leadership skills	4.33	4.33	.000	1.00	.867
M	Further develop my oral and written communication skills	4.56	4.22	2.00	.081	1.06
N	Apply problem solving techniques	4.67	4.67	0.00	1.00	.939
O	Demonstrate my trustworthiness to others	4.11	4.00	.359	.729	.411

*p < .05, two-tailed [LP1]

Figure 2 illustrates the associated variables from the importance and performance SELEB scale on an importance-performance quadrant. The *x* and *y* axis are determined by determining the overall mean score for both importance and performance (Huybers, 2014). The overall importance mean was 4.40 and overall performance was 4.23. Applying real world skills (A), practical workplace skills (B), organizational skills (C), personal growth (F), self-confidence (K), and problem solving techniques (N) landed in the upper right quadrant, which suggests that this activity met both the importance and performance for students. Leadership (L) and development of oral and written skills (M) fell in the lower right (concentrate here) quadrant. Greater understanding of culture and racial differences (D), social responsibility (E), community involvement (G), make a difference in the community (H), view social issues from a variety of perspectives (J), and demonstrate trustworthiness to others (O) fell in the lower left (low priority) quadrant.

Figure 2.
Results from the importance-performance means



Discussion

There are many reasons for implementing service-learning to enhance student learning outcomes and various other skills, such as the development of social responsibility. Within the online environment, service-learning can prove challenging. Incorporating Importance-Performance analysis can assist the course designer/instructor with design suggestions focusing on specific skill development. For example, leadership and oral and written communication skills were an area that needs concentration. The course designer can take this information to enhance student learning in these areas. Each student was in a team for this course; therefore, many of the students should indirectly be working on both leadership skills within the group and the client and their oral and written communication. The course designer will revisit these areas to develop more concrete examples of the expectations of working with a team of peers and how to interact with a client to ensure the students stretch their knowledge and improve already existing skills. With the areas that fell into the 'low priority' quadrant, the course designer/instructor needs to analyze the skills and determine if they are pertinent to the course/program goals. An instructor can focus on specific areas for student development through IPA and build those specific concepts into the course design.

Limitations

There were a few limitations with this initial study. First, it was a small class but as Strait and Sauer (2004) stated, it is important to start small then apply appropriate design to new courses. Next, during the middle of the semester the COVID-19 pandemic put additional stress on many of the students either due to adding homeschooling to their daily activities along with graduate schoolwork and full-time employment. During the last half of the semester, many students focused their reflections on venting about COVID-19 and the undue stress that came with it. Some of the COVID-19 stress/fatigue affected group dynamics. Finally, the class was given a project to work on rather than choose their own project. This could have influenced the degree the students felt invested in the project and with the client.

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Social eBooks with game-like conversations with characters, small-group discussions and Natural Language Processing, as read/played by Slovenian fourth graders

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Abstract

We investigated how: (a) anonymous versus identified online discussions, in elementary school, compared for task relevance of postings, and (b) how game-like conversations with story characters affected task relevance of postings. We conducted three similar studies involving fourth graders reading short web-based eBooks with small group online discussions and game-like conversations with characters. All discussion postings were qualitatively coded for discussion relevance. Students in name-identified discussions were significantly more on task, than those in anonymous discussions. Students who could participate in game-like conversations with story characters were also significantly more on task, than those who did not. In times of social isolation, when school is increasingly conducted remotely online, the effective design of small group online discussion is vital.

Key words: online discussion, elementary school, online education, distance education

Introduction

Reading is on the decline in the Western world, including in USA and Slovenia (OECD, 2010; Mol and Bus, 2011). Children's literacy skills in the USA have stagnated from 2000 to 2020 (PISA, 2019). Children's recreational reading, the most important factor in developing literacy skills, is on the decline (Mol & Bus, 2011). Meanwhile, the popularity of computer games and social media has soared among children. How can we reinvent the book technology to tap into children's digital recreational interests, to increase motivation to read and literary skills? Computer games provide a mindset that allows children be more persistent with higher level cognitive challenges (Gee, 2005). Therefore, incorporating games and game-like interaction into web-based eBooks has potential to motivate children to read. Reading is often individual, one person curled up on a couch with a book, escaping into imagined worlds (Zwaan, 1999). However, reading is also social, for instance conversations over coffee about books. For the younger generation, much conversation is digital, SMS (Short Message Service) or social media. To stimulate children's recreational reading, we invented a new form of book, adding games and social interaction into web-based eBooks. Students read pages of text, come to a game that can only be won by comprehending the previous text, then read on. Recently, we added social interactions to these eBooks, via small group texting discussions.

Research questions

We focus on these questions about interactive eBooks: (a) how do different forms of interaction (individual and social) influence each other, i.e., "How does individual game-like interaction influence social small-group discussions?" and (b) "How do staging factors influence the quality of small group online discussions?"

Method

The first author received a Fulbright Scholarship to conduct research in Slovenia on web-based eBooks. In 2019, he conducted two studies in Slovenia, where students read and interacted with very short eBooks based on stories from the fourth-grade textbooks used in schools. In each classroom, the intervention lasted two class periods in a single session. First, we conducted two pilot studies (total of four classrooms), in Slovenia, investigating how fourth grade students, reading web-based eBook stories, interacted individually and socially within the eBooks. In each of three stories, students (a) engaged in game-like conversations with characters, and (b) answered open-ended questions, and (c) interacted socially with each other in small group online discussions within eBooks. Each eBook had both individual and social elements. Students took a pre- and post-test on reading motivation.

Secondly, we conducted a full study in 19 Slovenian classes. The full study included three treatment groups: (a) individual interaction only (game-like conversations with characters and open-ended questions), versus (b) social interaction only, versus (c) text-only. In the full study, students also received real-time feedback to open-ended questions using Natural Language Processing (NLP). We developed NLP algorithms first in English, using questions and answers in English. We then successfully transferred the NLP algorithms to Slovenian, to provide feedback to students answers to Slovenian questions.

Results

We report the quantitative results, briefly at the conference. However, we focus on qualitative results: (a) coding of the small-group discussions, (b) how effectively the NLP was used to provide feedback to open-ended questions.

Small-group discussions: More than 3,000 postings from small group discussions were qualitatively coded along three dimensions: (a) book relevance – whether the posting related to the story, (b) type - whether the posting is written is a question, an answer or a statement, and (c) category - a very simplified "descriptive" of what the text was about.

There were dramatic differences between the first pilot study and the full study. In the first pilot study, 68.8% of discussion postings were coded as book relevant; 31.2% were NOT book relevant. By contrast in the full study, 34.5% of discussion postings were book relevant, 65.5% were NOT book relevant. Similar dramatic differences were found between pilot one and full study in type and category.

Discussion

There are two differences between pilot study one and the full study, and thus two possible causes for dramatic differences: (1) in the pilot studies, each student experienced all forms of interaction, both individual and social, within all three stories: game-like conversations with characters, answered open-ended questions, and small group online discussions, and (2) in pilot study one, the student usernames for logging in to the eBook system were their first and last names; while in the full study, because IRB requirements, usernames were anonymous.

Two possible causes in more detail:

(1) Classroom observations in pilot study one suggest students were excited by the content-related challenges of game-like conversations with characters and open-ended questions. This excitement carried over into the small group online discussions where students discussed in lively manner. In the full study, there were three different treatment conditions: (a) individual interaction only (game-like conversations with characters and open-ended questions), versus (b) social/online discussions only, versus (c) text-only. Thus, students in the discussion condition, read the almost the entire story in text-only form and, towards the end of the story, engaged in the online small group discussions. Classroom observation suggest there was no excitement while reading the story in text-only form, and thus no challenge/excitement that carried over into small-group online discussions.

(2) In the full study, because of anonymous usernames, students either: (a) first spent time, asking who others were, before discussing the story, or (b) assumed that anonymity freed them from texting in a socially acceptable manner. In these cases, the moderating influence of the researchers or teachers, sometimes brought the students back on track.

In pilot study two, students had anonymous user names, but each student experienced all forms of interaction, both individual and social, within each of the three stories. Thus, the coded discussion postings from pilot study two may shed light on which of the two causes is more probable. As of this writing, that analysis has not yet been done. However, these, and other results, will be revealed at the presentation.

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MOOCs Participants' Expectations and Recommendations for Improvement

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Abstract

Human beings' desire to learn and improve their life standards without any time and place dependence has resulted in the spread of MOOC applications. MOOCs have become one of the mainstream lifelong learning opportunities for students, adults and anyone who wish to improve herself. Increasing interest in MOOCs necessitates examining of their quality. So, this study intended to investigate the learners' experiences in MOOCs and the future course recommendations. The learners' experiences in MOOCs was grouped under three categories: content and design, course site and media, and instructor behavior. Some of the most satisfying experiences of the learners were variety of the course topics, interactive contents, easy access to the content and flexibility, personalized feedback from the real instructors and their expertice in the content areas. Meanwhile they like to see more courses on technology related topics, such as coding, information technologies, and some Adobe products.

Introduction

Advances in information technologies have effected the way we teach and learn, and consequently new learning environments and implementations have emerged. Massive Open Online Courses (MOOCs) is one those emerged learning environments. MOOCs, which can be considered as an implementation of connectivist learning theory (Siemens, 2013) and have a wide repercussion around the world, offer learners from all over the world the opportunity to learn through free, online and open courses (Kaplan & Haenlein, 2016). Today, we see that MOOC applications are becoming widespread in order to put more information into circulation and to make the courses at universities accessible and flexible for more people. Latest figures reveal that currently there are more than 8000 MOOC offerings from more than 800 institutions to around 60 million users globally. As a reflection of this global movement, several MOOCs platforms have launched in Turkey. For instance, AKADEMA, a MOOCs platform was launched by Anadolu University in June 2014 (Mutlu at al., 2014). Based-on long history of the open and distance learning experience, Anadolu has been designing and offering a number of online courses to anybody who wish to learn without any prerequisites and fees. The courses, unlike many other MOOC platforms, are facilitated by the real university instructors and the learners need to interact with them as well as other learners to be able to complete the course activities. So, a big majority of the courses employed a guided-study approach except couple self-paced ones. Currently, 121 courses are being offered in AKADEMA, almost all are in Turkish expect two new ones in English. Anadolu University considers AKADEMA as a social responsibility project to share its knowledge to the society.

MOOCs are getting more interest due to the fact that traditional education systems are falling short on meeting the needs of the learners and institutions (Koutropoulos et al., 2012). This increasing interest of learners has also grasped the researchers' attention. Since the beginning of 2010, we have seen more research studies examining the effects of MOOCs on learning processes (Gasevic, et al., 2014; Sa'don, Alias, & Ohshime, 2014; Sangra, et al., 2015; Loizzo & Ertmer, 2016). In those studies, self-regulation, social learning, learner-to-learner interaction, learner motivation, completion, learner characteristics, cultural differences, diversity, learning in social networks, MOOC design, learning design, and similar topics are the ones often investigated. However, as it was mentioned in the literature in order to understand a phenomenon, we need to examine it under different settings and circumstances. Therefore, this study proposes to learn more from the actual learners' experiences in MOOCs offered in AKADEMA platform to be able to improve the learning processes in these courses.

Purpose and Method

This study intended to investigate the learners' experiences in MOOCs offered in the AKADEMA platform of Anadolu University and their future course recommendations, or the topics they are interested in learning through MOOCs. So, the research questions were formulated as following:

1. What are the components and characteristics of MOOCs in AKADEMA that the learners satisfied the most?
2. What kinds of topics would the participants like to learn in AKADEMA MOOCs?

A descriptive content analysis approach was conducted in the study. Content analysis is to gather similar data within the framework of certain concepts and themes and to interpret them in a way that the reader can understand (Yıldırım & Şimşek, 2006). In other words, content analysis can be defined as a systematic, repeatable technique in which some words of a text such as book, book chapter, article, thesis, letter, historical documents, newspaper titles and articles are summarized with smaller content categories with coding based on certain rules. Content analysis can be used in both qualitative and quantitative research. The steps followed in the research process and the way the data are collected reveal whether the study is suitable for quantitative or qualitative method. In this study, the quantitative method was used because a series of descriptive statistics was used during the analysis.

An online survey with two major open-ended questions was used to collect data. One of the questions asked the learners indicate their perceptions regarding the most and the least satisfactory characteristics of the MOOCs. The second question allowed the participants to state the topics they are interested in learning. The data collected during May 2018 with voluntarily participation of learners in AKADEMA MOOCs. Total 719 participants responded these two questions and included into the analysis. After data collection, the data was transformed into a script and then two coders separately analyzed. Two coders, first, created a code schema and then with the participation of a third expert (one of the authors of this paper) compared and synthetized. Then themes were derived from the codes (Figure 1).

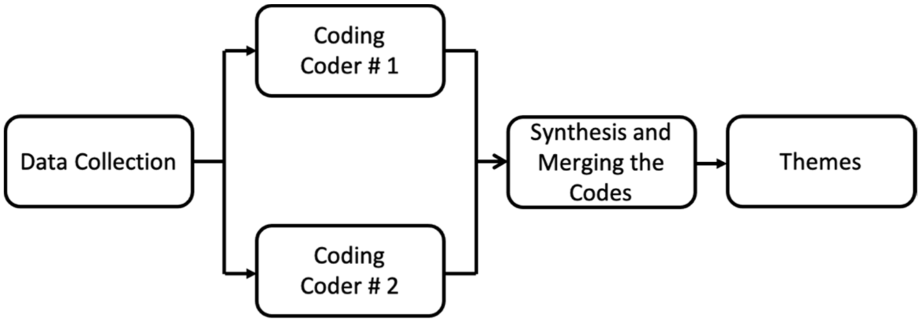

Figure 1. Data analysis process

Findings

The reporting of the findings was organized according to the research questions. Figure 2, first of all, was related to the question about to what extent the courses met the learners' expectations. As can be observed from the figure, quite a number of participants (66 percent) indicated that their expectations were met in the AKADEMA courses while still one fifth of them (20 percent) were not happy about the courses. A higher percent of the learners also stated that they did not have any problem or experience any issue during the learning processes.

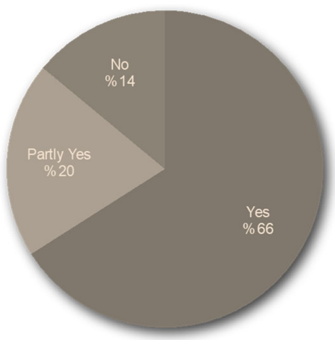

Figure 2. To what extent the courses met the participants' expectations

Table 1, on the other hand, summarizes the most satisfied components or characteristics of the courses the participants took and completed.

Table 1. The most satisfied components and characteristics of MOOCs in AKADEMA

Theme	F
1. Content and Design	
Variety and up-to-dateness of the contents	52
Interactivity in the contents	38
Appealing of the contents	25
Fruitfulness of the content for learning	21
Fun in courses	22
Facilitation of the personalized development	12
2. Course Site and Media	
Accessibility	32
Flexibility to reach the course site and resources	26

Interactive videos	22
Group interaction	20
Sense of classroom community	12
Providing discussion opportunities	10
3. *Instructor Behaviors*	
Personalized feedback	18
Content expertise	12
Accessibility	10
Teaching presence	5

As can be observed in Table 1, the participants' responses to this question was classified under three major themes: content and design, course site and media, instructor behaviors. According to the results, a majority of the participants satisfied with the variety and up-to-dateness of the content in the courses (f=52). Interactive design of the courses (f=38) and attention-grabbing characteristic of the content (f=31) were also other satisfying features of the MOOCs. In terms of course site and instructional media or materials provided to the learners, the most satisfying characteristics of the courses listed as accessibility (f=32), flexibility to reach the course site and resources (f=26), interactive videos provided (f=22), promoting small group interaction (f=20), and sense of classroom community (f=12), and finally discussion opportunities provided throughout the course (f=10). The final theme was about the instructors' actions or behaviors during the courses. Under this theme, four characteristics stepped forward in the learners' answers. A number of learners (f=18) indicated their satisfaction with the instructors' personalized feedback for their learning progresses. Similarly, the learners also pointed out their satisfaction with the instructors' expertise in their fields (f=12). They also felt high level of sense of teaching presence in the courses and satisfied with this feeling.

The following table (Table 2) presents the topics and courses the participants would like to learn or take as MOOCs in the AKADEMA platform.

Table 2. Topics and courses the participants would like to learn in AKADEMA

Theme	**F**
1. *Technology*	
Adobe Products	22
Coding	15
Introduction to Computing	12
2. *Social Sciences*	
Psychology	18
Law	13
Movies	6
3. *Languages*	
English	13
Arabic	9
French	7
4. *Personal Development*	
Diction	4
Charming	4
Poetry	3

5. Health	
First Aid	3
Medicinal and Aromatic Plants	3
Patient Care (Schizophrene - Autism - Alzheimer)	2

Answers of the question regarding the topics and courses of interest were also classified under five categories: technology, social sciences, languages, personal development and health. The table revealed that technology related topics and some of the fields in social sciences were pointed out by the participants more often than others. Adobe Products, coding and basic technology skills were the ones came to the fore than others in the technology category, while psychology and law were in social sciences. Unremarkably, learning English was another topic the participants were interested in learning.

Conclusions and Recommendations

MOOCs have been one of the hot topics over the last decade. Learners' satisfaction and needs are very important to provide quality learning experience in MOOCs. This study focused on these two variables in the scope of Anadolu University's MOOCs platform, AKADEMA. More precisely, the study intended to explore the learners' satisfaction with different characteristics and components of the MOOCs and also their preferences of the topics they would like to learn in MOOCs.

The study also investigated to what extent the courses met the learners' expectations. The results have revealed that the courses in AKADEMA have met significant percent of the learners' expectations, and a larger percent did not come across any problem during their study. From the data, it can be inferred that the participants had positive attitudes toward learning in MOOCs.

The learners' experiences in MOOCs was grouped under three categories: content and design, course site and media, and instructor behavior. The prominent characteristics or components of the AKADEMA MOOCs in terms of content and design were identified as the variety and up-to-dateness of the content in the courses, interactive learning design, as well as attention-grabbing characteristic of the content. Conole (2015) stated that one of the major motives for participating MOOCs is about personal development for self-fulfillment. The variety of courses may help them improve their skills or acquire new skills. This professional development opportunity as well as the certificate of completion they receive at the end might support for career development or switching to a new career. On the other hand, Vrasidas (2000) expressed the importance of content-to-learner interaction in any learning setting, while Tsang et al. (2014) and Zimmerman (2012) noted that this type of interaction may boost the motivation of the learners, reduce the drop-out rates and increase the chance of achieving the learning objectives in online learning. The current study uncovered a similar result that the participants indicated the interactive content of the courses as one of the satisfying components of the MOOCs. Another often indicated characteristics of the courses the participants liked was about appeal of the course contents. There were a number of studies in the literature (Aybek, 2017; Jacobs, 2013; Kirschner, 2012; Martin, 2012; Zutshi, O'Hare & Rodafinos, 2013) emphasized the appealing of the course content among learners as one of the factors effecting the learners' engagement and persistence. So, this study also supported the literature; namely the more appealing content we provide, the more learners engage with it and persist to complete the courses.

In terms of the course site and design theme, flexibility to reach the course site and resources, and the interactive videos provided to the learners were stepped forward as the most cited characteristics that the learners liked in the AKADEMA MOOCs. Since the leaners were in general lifelong learners whose major goals are related to personal development, it was important to access the course site and resources with different means, especially through mobile devices, and ways, including no login requirement. Flexibility, anyway, was considered as the key term for open education (Aydin, 2019; Cooke, 2018; Veletsianos & Houlden, 2019). Veletsinaos and Houlden (2019) analyzed the articles in the Journal of Distance Education and came up with six themes about flexibility in open and distance learning: the qualities of flexibility as affording "anytime, anyplace" learning; flexibility as pedagogy; liberatory or service-oriented aspects of flexibility; limitations of flexibility, especially in terms of technology, the constraints of time and space, as well as cultural differences; flexibility as a quality needed by instructors and instructional designers themselves; and critiques of flexibility as a concept. The current study considered the flexibility in terms of the first three themes of the Veletsinaos and Hounden's study, namely the qualities of flexibility as affording "anytime, anyplace" learning; liberatory or service-oriented aspects of flexibility. The analyses have shown that the participants enjoyed the flexibility of learning anytime and anyplace accessing the learning environment and learning activities.

Another important component of the AKADEMA MOOCs related to the course site and design theme was the interactivity required while watching the videos prepared by the instructors in-house to help learners acquire the competencies targeted. By looking at popular MOOCs in different platforms, one can easily infer that videos have come back big especially with the xMOOCs. Along with the practice, we have come across more and more studies on effective use of video as instructional material. So, literature provided beneficial insight about role of video in online learning and effective ways of producing as well as integrating them. For instance, studies (Bezerra & Silva, 2017; Clow, 2013; Wilkowski et al., 2014) shown that quality videos increased the learners' motivation, and the exact opposite, poor quality videos caused loss of interest and motivation. Moreover, the studies in Turkey (Aybek, 2017; Horzum, 2016) revealed that only text-based content, which does not include videos, negatively affects participants' MOOC experiences and is even shown as a reason for dropping a course. The AKKADEMA courses have been providing interactive videos and also requiring some extra activities to turn the learners active watchers rather than passive receivers, such as asking questions and requiring the learners find their answers in the videos, or demanding the learners generate examples similar to those given in the videos, etc. It sounded like that the promotion of interactivity motivated the learners and supported their learning.

Under the theme related to the 'instructors', the learners expressed their satisfaction with the instructors' willingness and efforts to provide personalized feedback about their progress and their high level of subject-matter expertise. Previous studies, such as Horzum et al., (2016), have uncovered that insufficient feedback was listed as one of the reasons of dropping the MOOCs. Similarly, Bocchi et al., (2004), and Ivankova and Stick (2007) pointed out the significance of providing timely and sufficient feedback in open and distance learning, and how feedback help boosting the retention. In another study, Li et al. (2016) have also shown that instructors' feedback supported the learners' active engagement to the learning process and keep their focus on the learning activities. The MOOCs in AKADEMA platform required the instructors provide timely feedback. An automated messaging system was also built into the platform that informs the instructors about new and unanswered postings as well as some statistics about their actions in the course site via email. The instructors found it very beneficial for them to keep track of learners' progress and their tasks in the courses. Furthermore, getting sufficient and timely feedback from real instructors (not computer-generated interaction) possibly helped the learners develop a positive attitude about the instructors' subject-matter expertise. A previous research finding indicated that instructor credibility has a significant positive effect on content area knowledge (Carr, Zube, & Dickens, 2013). In another study the researcher also found a significant relationship between learners' perception of instructor credibility and the degree of their acquisition of learning outcomes in online learning (Vallade & Kaufmann, 2020). Our study also supported the literature about the relationship between learners' perceptions with the credibility of instructors and their satisfaction from the courses. In the light of these, one can easily infer that personalized feedback and learners' perception of instructors' subject-matter expertise might be effective on the learners' satisfaction and their retention in MOOCs.

Another findings of the study supported the literature was about the learners' preferences of the course topics for further learning: a big majority indicated technology related topics including some of the well-known productivity, such as Adobe Photoshop, Adobe Premier, and coding software. Since some of the learners attended the MOOCs for professional development and for new career opportunities, and technology skills definitely help individuals more forward in their career or get better jobs, this preference can be considered as acceptable and understandable. Meanwhile, one might find the finding related to the participants' interest in psychology as extraordinary, but the field of psychology has recently been one of the top fields of study by the undergraduate candidates in Turkey (YOK, 2020) too. So, this finding also reflected the demand for psychology and related fields. Moreover, learning English language has always been one of the hot topics for decades in Turkey and most probably all around the world. So that, it was not a surprise to see this kind of a preference for AKADEMA.

Overall, it was very remarkable to observe that the learners in MOOCs expressed their interest in different types of interactions, including peer, instructor and content. Literature on online learning (e.g.; Anderson, 2003; Moore, 2013; Miyazoe & Anderson, 2011; Rodriguez & Armellini 2015) is full of studies express the importance and role of interaction on learning, retention, motivation, and etc. Similar relationship between interaction and learning is also documented for MOOCs too (e.g.; Cisel, 2018; Kasch, Van Rosmalen, & Kalz, 2020; Stracke, et al., 2018). However, one can easily claim that we need more studies on the different types and contexts of interaction especially in MOOCs to understand the phenomenon and provide better learning opportunities to all who wish to; and as Kasch et al (2020) stated in MOOCs we see thought-provoking examples of interaction but at the same time literature needs to elaborate interactions in MOOCs in order to improve their educational value and quality. This study provided a perspective in this sense about AKADEMA MOOCs and the participants' preferences and satisfaction. On the other hand, the study should be conducted with the participation of more learners and also diverse data (qualitative and qualitative) on each components of the MOOCs should be collected to understand the interaction preferences as well as the most beneficial interaction types and activities.

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Strategies and Methodologies on Online Language Teaching

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Introduction

Virtual technologies such as computer-assisted language learning (CALL), now available to most students, are ubiquitous in everyday life and are becoming increasingly essential to either online, or hybrid classes -in which students attend a traditional class twice a week but complete their homework virtually in an online platform. Particularly in universities in the United States, virtual platforms are increasingly used for teaching Spanish as a foreign language to students with varying backgrounds. As such, this research project proposes an approach to teaching grammar in an asynchronous setting, while considering common communicative goals that are established in a language course. Likewise, the proposed methods and strategies aim to offer an attractive language course that allows students to remotely learn and practice a language, while enhancing student engagement through interactive activities.

Therefore, after reviewing several literature sources, methodologies for efficiently teaching a language online will be determined and shared in this research project. On one hand, the goal will be to demonstrate how effective certain strategies and tools can be, in order to design an interactive online course, which will allow all students to learn a language. On the other hand, challenges to consider while teaching a language online will also be discussed and analyzed.

Although the efficiency of online language teaching is still questioned and at its infancy as could be noted in O'Dowd (2010) and Uschi (2003)'s articles, this research project will also provide with some data taken from Elementary Spanish courses that were taught at Stanly Community College. Data will support the grade increase that was noted in online and hybrid Spanish courses, after implementing new tools to increase student attention and engagement, and updating the design of Spanish courses according to the Quality Matters Standards. The research question that will be answered is the following: how can online language instructors design a Spanish course that fulfills all communicative and grammatical goals using certain tools and considering both design and student learning outcomes?

Rationale and Purpose

This project will discuss the way languages can be virtually taught efficiently to online students if certain factors and tools are implemented consistently and purposefully. For an online language course such as Spanish, tools have to be selected based on the three American Council on the Teaching of Foreign Languages (ACTFL) model standards (Cutshall, 2012), which include:

- Interpersonal communication through speaking, writing, and listening activities,
- Interpretive communication through listening, reading, interpreting and analyzing activities,

- Presentational communication through narrating, informing and explaining information through a variety of activities using the target language.

Research regarding online language learning and the abilities for technology tools and CALL are showing evidence on how opinions can diverge regarding their efficiency to teach grammar and communication skills to the learners. Some articles from the reviewed literature show that an online language class can allow learners to study a language at their own pace and practice with both teachers and students at flexible times, if the teacher chooses the correct tools to implement in the course (Sun, 2014).

On the other hand, teaching an online language course appears to be a controversial topic, as some authors such as Uschi (2003) still believe that technology has yet to prove to assess the full efficiency of successfully passing on knowledge and grammar concepts to learners, while others are fervent supporters of the quality of teaching through virtual platforms. In a higher education setting, three groups of agents must be considered when establishing online courses: the administrators, the teachers and the students. Administrators believe that online courses allow them to save money, staff and classroom space, while teachers are focused on the quality of teaching, whereas students may resent taking online courses (Uschi, 2003). Therefore, in this article, the purpose will be to discuss the fact that adopting certain strategies, in order to improve the selection of content and tools to include in virtual courses, can help language instructors have successful outcomes at the end of each semester.

However, it is important for instructors to keep certain considerations in mind. Depending on the learners' background and abilities, certain tools and strategies may be more appropriate than others in order to teach grammar outside of the traditional classroom. As both students and instructors may not have the opportunity to interact with each other as often as in a traditional classroom, presenting a variety of virtual activities will help students to stay engaged and understand the goals of language learning (Levy, Wang & Chen, 2009). Acquiring the grammar is an important component that cannot be neglected, as it is the foundation of language learning. Students can often forget that component as they already have established certain objectives upon completion of their Spanish courses. Motivations can vary, but in the majority of the introductory videos that students created at the beginning of the fall semester of 2019, they mentioned are professionally-oriented or grade-oriented. The goal for the instructor is to accept these motivations and objectives and make students work towards them. However, in order to efficiently do so, they have to show them that in this particular case, Spanish grammar is the base for any communicative goal, and learning a language is paramount to achieve their professional careers.

Therefore, how can instructors successfully design a Spanish course that fulfills all communicative and grammatical goals, using certain tools and methodologies, and considering both design and student learning outcomes?

Literature Review

Colpaert (2006) reviews pedagogical implications based on a research study that demonstrates the increase of online interactivity with online language programs. The content delivery, role of teacher and pedagogy are discussed. First, the technology-driven approach attempts to be a pedagogy based on innovative tools. Then, the attribute-based approach analyzes the capabilities of this medium to potentially impact learning. The affordance-based approach evaluates its potential to enhance the language learning and teaching processes. Finally, the pedagogy-based approach more strictly details the needed technology for teaching and learning. However, there is still a gap between language pedagogy and CALL tools. To bridge that gap, working with language instructors, instructional designers and other multidisciplinary individuals could be potential solutions.

A variety of online tools can be used in order to train language instructors in order for them to be proficient and ready to teach online courses. As Levy, Wang, and Chen (2009) show, in order to train two language tutors, several online tools, platforms and a synchronous learning management system developed by the National Sun Yat-Sen University of Taiwan can be used to teach languages online efficiently. The implementations of the models used to train online tutors include the following learning concepts: learning as behavior, learning as construction of knowledge and meaning, and learning as a social practice, which are concepts that are paramount to then be able to facilitate the students' learning approaches. The training integrated a variety of synchronous and asynchronous tools that allowed all professors from China and Australia to become more familiar with the tools before starting to teach the students. In addition, using any new material before class is highly recommended to ensure that it works accordingly.

Through this training, it was noticed that learners should first feel confident by practicing using every feature of the learning management system (LMS) or any of the recommended tools by trying them out, assessing the language proficiency level in each class, in order to build familiarity and confidence among the learners. Through self-reflection and monitoring reports, learners were also able to interact with peers and share suggestions to the facilitator when needed.

Additionally, in order to foster interaction among online language learners, O'Dowd (2010) showed that in Spain, programs of online language learning through a system of e-tandem exchanges between some European institutions, who would write and correct each other (it was referred to as "telecollaboration") was seen as efficient. In some cases, teachers had played the role of facilitators, by monitoring between the students' exchanges. Communications can take the form of videos, photos and messages. Online intercultural exchange with students from around the world is greatly increasing as it seems to be a great preparation before studying abroad. However, this practice involves both face-to-face and online interactions which, according to the author, are best in order to foster learning. Due to communication cultural differences, it may lack of authenticity without face-to-face interaction.

In both face-to-face and online format, teachers change roles according to the constantly changing classroom settings. Nowadays through the Web 2.0, knowledge is now accessible to all learners and teachers (Senior, 2010). Based on the constructivist theory, knowledge is acquired socially through experience rather than discovered. In the case of language instructors, they have to be ready to teach and adopt different pedagogy as opposed to only focusing on constructivism or connectivity. Their teaching methods will be a blend of all theories.

Within the classroom, teachers must ensure a sense of community and connectedness among the students. The instructor also has to build a relationship with students, no matter the grade. Establishing rapport can be done in a different class setting but is paramount to build a social environment, which will give the students a sense of comfort and engage them to work on the material in group for instance. LMS are great tools to allow students to remotely connect and the teachers play an important role as facilitators of these connections among students. Although traditional classes allow for more interaction, online courses can also be used as a social space if the instructor promotes collective group and learning.

In order to go from a virtual classroom to building an online learning community, learner behaviors are currently changing and will impact the way instructors teach (Sun, 2014). Depending on the level of expertise for online language teachers, not only technology skills must be taught to them but also pedagogy. For a novice online language instructor, these include strategies for online community building, socializing, facilitating communication competence, language learning theories and online language assessment. For an expert, they consist of creativity in using and adopting materials to create more materials to facilitate communicative competence and online interaction, facilitating online socialization and community building, and intuitive integration of assessments (Compton, 2009). Assessing and evaluating progress is an essential part of education and can be done by using the ACTFL guidelines. However, insufficient opportunities for students to speak the language through online tools makes it difficult to correctly assess oral language practice (Lin & Warschauer, 2015).

Wang and Chen (2009) determined that synchronous meetings have been challenging as students cannot meet at the same time, or need to troubleshoot to fix technical issues at first. A traditional class cannot truly be replaced. Nonetheless, a virtual drop-in option has seemed to be more successful in one of their Elementary Chinese I class, as students could log in and practice with the teacher at any time. Learner participation in online language classes is always a priority as language learning is a skill-based rather than a content-based process. Constant synchronous interaction is needed to help learners practice with other peers.

Nowadays, online learning is attracting a variety of students and in this article, Blake (2011) aims to show how the field of CALL and other computer-mediated communications can really facilitate online language learning (OLL). In this study, Blake chose to focus on web-facilitated, hybrid or blended, or fully virtual or online course.

Often times, some concerns exist about OLL educational quality compared to traditional face-to-face courses. However, it is important to remember that traditional courses quality of teaching may also vary depending on the techniques and methods that are used, class sizes, and individual student attention. In fact, Grgurovic (2007) conducted a study that shows that students who took all their classes online performed better than their peers who took traditional courses due to the amount of time spent on them. Regarding CALL design, two areas have flourished in OLL: tutorial CALL, and social computing or computer-mediated communication (CMC). Often used to give grammar activities, there are also other tools recommended by Blake (2011), such as Quia and Hot Potato. However apart from grammar, focusing on lexicon and vocabulary through reading and listening comprehension assignments is also paramount. Nowadays, new tools are emerging rapidly due to the popularity of online courses. CALL such as Livemocha or Mango are constantly improving content delivering to better serve the students and increase language practice (Lee, 2016).

On one hand, Intelligence CALL are used to provide feedback to students' responses, and allow interactions through keeping track of their work and giving them suggestions. Such programs already exist for German, Portuguese and Japanese. Additionally, the use of asynchronous tools in an online course allows students to develop cognitive engagement, as they have more time to elaborate their responses, engage in the language which contributes to reduce anxiety (Lee, 2016).

On the other hand, Social Computing CALL is another system that is learner-centered and allow both students and instructors to have both synchronous and asynchronous conversation. Social media means allow stimulation for students, however it awakens certain concerns as personal and academic networks can be mixed together and the purpose could be lost.

Mobile apps are also increasing as cellphones are popularly used and aim to help learners memorize vocabulary and sentences (Hockly, 2015). Apps like Duolingo for instance identify learners' needs to progress in the language learning process based on computer-generated algorithms. After completing an activity for instance, learners will use points each day if they do not go back to practice it again. This is based on cognitive learning, as the brain will slowly forget certain information after not being used for an extended period of time.

Additionally, studies have shown that videos appear to be as successful for students learning in a traditional face-to-face class, and students prefer to use the chat message in order to react about the content than a microphone. However, through the use of Visu, Guichon (2010) determined the limitations or catachreses than can exist for teachers while hosting a videoconference, such as the navigation between webpage, chat, Word pages, and images shared during the videoconference. Additionally, teachers must establish the time needed for each session, so they can evaluate and assess students efficiently. Both technological and pedagogical objectives have to be considered jointly, and not successively prior to hosting a session. Anticipating possible difficulties can save teachers and students time and energy, as visual materials can be provided before the session in one page so students can follow along easily without losing focus.

Games are another way to stimulate language learning, as it has the potential to combine tutorial CALL with the attractive affordances of social computing. Certain videogames such as World of Warcraft allow different users from all over the world to interact and communicate while pursuing different quests. There are three different types of game: multiplayer, two-players, or single-player games. They have design experiences, which allow the game to be interactive and playful but this will be the main criteria for a learner/player to continue using it.

Role-playing is another way to stimulate students' attention by adopting a new identity while playing, which is what language instructors except the students to do when learning a foreign language. Students turn off their original language and culture in order to fully embrace the target language and its cultures. Blake (2011) mentions a variety of games can be used for language learning and have captivated students from the new generation as it has been documented. Ultimately, games and technology can be leveraged to connect traditional students as well so that their interests for the language does not fade away.

Chun, Smith, and Kern (2016) talk about how technology and media influence context and forms of expression and communication. They intent to empower the learners so they can use the technology tools at their full potential. Often times, teachers encounter the following dilemma: technology can either be seen as extremely powerful to enhance intellectual capacity and creativity. On the other hand, there is the concern for some that technology could be detrimental to language learning. Tuoven (2000), as cited in Lee (2016), states that the lack of face-to-face communication or interaction and the isolation of students if learning alone with the computer can increase anxiety and decrease student learning process and productivity.

Nonetheless, technology automatically influence on communicative purposes, which therefore can be used in order to learn and teach languages. Multimedia tools such as Camtasia that allows video capture to increase student engagement and interactions, collaborative and social tools such as social media are synchronous and asynchronous tools that can be used for communicative and semiotic purposes. They are designed as CMC. Games and applications are also available to students, teachers and researchers. To some extent, even online translators such as Google Translate can be used effectively if the teachers offer guidance to students on how to use them, through literacy and creation of digital stories for instance.

Colpaert (2006) conducted a research project based on the ADDIE model (analysis, design, development, implementation and evaluation), which helped demonstrate that often times in online language courses, conceptualization is the issue, not technology. Conceptualization is defined as the creation of a concept as an answer or solution to requirements. For instance, an interactive textbook, an adventure game, or a treasure hunt. Teachers should set the pedagogical goals before they pick their language methods and technology tools. They also have the roles of designers when it comes to planning, and contributors when it comes to assisting students.

In a case study, Guichon (2010) talks about how the development of a desktop videoconferencing platform allow students to move from being novice in both language and technology and their difficulties in adapting, as well as the strategies they later developed. Desktop Videoconferencing (DVC) was used in this study to develop methodologies and strategies for online language learners. Both DVC and CALL allow for speaking assessment through synchronous and virtual meetings. Guichon (2009) identified three types of skills: socio-affective (that takes into account individual learning styles and intercultural differences, as well as the ability to establish a relationship with the learner), pedagogical (designing engaging task for online communication), and multimedia skills (which operates the appropriate tools and manages interactions through them). Hosting an online session also requires a planning time prior to the start of the meeting, as well as a reviewing phase after it has ended.

Son (2011) points out the large variety of CALL as well as Internet tools and how they benefit online language learning. Several examples are given depending on the purpose attempted to be achieved in the class, such as communicative, resource sharing, learning management systems, web exercise creation, dictionaries and concorders, presentations and so forth. In order to pick the correct tool, instructors have to ask themselves who will use it, when, where, why and how will the CALL tool will be used.

Nonetheless, Garrett (2009) points out that instructors must include guidelines for the learners to use it efficiently, so they can benefit from them. No assumption can be made and follow-up assignments should exist in order to assess the students. Therefore, the language instructor itself has to be skillful and knowledgeable regarding the new tool. Evaluating the choice of the tools and justify them in and outside of the classroom.

Lund (2006) presents innovative communicative opportunities that emerged from teaching a language online, such as English in a Norwegian secondary school. Using the LMS, the study examines how social factors more than pedagogical ones influence his students' interactions in order to favor communicative language practice. Not only language acquisition can be done in the classroom, but also in a social context such as in the community. Several practices that were noted in online courses as new opportunities have emerged through technology, and can be connected to didactics so that teachers can adapt their courses while following this cultural trend.

In order to build meaningful activities for the learners, it is important to consider not only how, why and to whom we are building the activities but also where and when, whether it is synchronous or asynchronous. Didactics must take context into account. Between standardization and pluralism, between homogeneity and heterogeneity there is a third space where English as a Foreign Language didactics can emerge as a boundary object translating between different social worlds and discourses while maintaining consistency in the form of a shared goal (Star &

Griesemer, 1989). Although student participation and interaction are important, teachers also need to interact with them in order to remind students of their role as experts and referents.

Online language practices can emerge from different contexts and settings. Therefore, it is the teacher's role to insure "didacticizing" new virtual spaces, by taking into account historical and cultural contexts as well, and not restrain time and space to the classroom only.

Harrison and Thomas (2009) have found that students presented with different tools will choose the ones that they find most appropriate for their goals, learning methods and style. This learner-centered approach helps foster learners' creativity and will allow instructors to re-think their roles and teaching methods.

Nonetheless, a challenge that exists in online language teaching is to set some rules for students to be able to communicate and respond to each other. For instance, Nunan (2002) compares the challenges and rewards of teaching online to Japanese and other international students as an L2 at a graduate level. A balance has to be found between teaching and facilitating, as well as including learner-centered activities to allow students to take control of their learning. Online language instructors also have to ensure that all students are participating actively, as some may be new to online learning and more reluctant to participate. In addition, it is paramount to ensure that students are familiar with the technology used in this classroom.

Although in the study, Nunan (2002) underlines the convenience of the course as being able to be taken in different parts of the world, the student evaluations feedback reveals that students would prefer taking face-to-face classes than distance learning. On the other hand, the convenience for both teachers and students to be able to access the course from anywhere in the world was seen as an advantage. In fact, the creation of an online global community was also seen as a reward, as they had the opportunity to socialize, network and exchange tips.

In this study, language instructors that were interviewed show that although they had great technological support by their institution, the pedagogical training to teaching online and hosting synchronous or asynchronous sessions were problematic. Teachers were eager to learn more about telecollaboration and integrating the online component to their classrooms. However as technical support does not seem to be available to support their project, teachers as very much laggard and would rather adopt this new teaching component after some improvement is ensured, and that their international peers who would be participating would agree in adopting this new teaching method as well.

Another unclear aspect would be how to assess students in these online activities. For their normalization, informal feedback does not suffice in order to give a grade to a student. Therefore, a lot of skepticism still exists among European faculty as to integration of technology within the foreign language classroom. The normalization of an activity still needs to be developed in order to be fully integrated into the course curriculum and the syllabus. Partnership between the European institutions for telecollaboration also has to be settled first through exchange programs for instance such as Erasmus after online language instructors are trained accordingly.

In online language classes, learners have to be emotionally and cognitively engaged by the instructors, who will provide personalized feedback according to the learners' needs. A variety of synchronous and asynchronous tools to assess listening, reading, writing and speaking should be included in an online learning community. However, it is important to remember that interactions among students is also paramount for an online language course.

Therefore, controversies in online language teaching still exist among instructor, administrator and student standpoints (Uschi, 2003), as they state that technology cannot replace a traditional language class.

In higher education, online teaching has been favored as administrators are interested in saving costs, time, staff and classroom space. However, this format shift may affect the quality of teaching, and students are often more skeptical about taking an online course. According to Noble (2001), education is an interpersonal affair and the use of technology interrupts it.

For language teachers, at first, adding an online component led them to transfer part of the knowledge such as grammar and vocabulary to the online platform and dedicate more time for communicative activities in the classroom. Students appreciated the flexibility of doing homework online and at their own pace. On the other hand, administrators in higher education institutions decided to add online learning to the curriculum due to scarce resources, but without taking into consideration the possible impact on quality of teaching. Several teachers still lack expertise and support for online teaching.

In addition, as new technology quickly appear and evolve, staying up-to-date and exploiting the tools at their full potential is a challenge and learners should be the priority as they will be the direct people to experience it. Adding technology to the language classroom has yet to improve the quality of interpersonal communication and include meaningful gap activities. Therefore, administrators do not save time or staff as students are more reluctant to taking online classes.

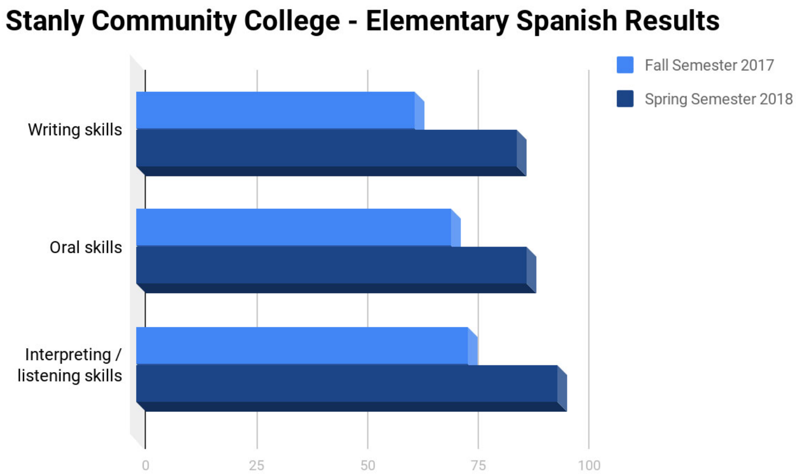
Conclusion

Despite the cost cutting that technology allows administrators and students to take advantage of whether it is classroom space, faculty stipend or tuition fees, online language teaching has yet to prove how effective completing online work is in order to become fully integrated in the curriculum. The pedagogy must be revisited by language instructors in order to maintain the quality of teaching that already exist in traditional language classes in order for their learners to feel a sense of community and allow communicative interactions.

As Chun, Smith, and Kern (2016) showed in their study, the inclusion of technology in language courses will ultimately be subjective to each instructor. The tools that are implemented and their uses should align with the learning outcomes, as well as the learners' interests, abilities, the available resources to each instructor and the culture of each institution.

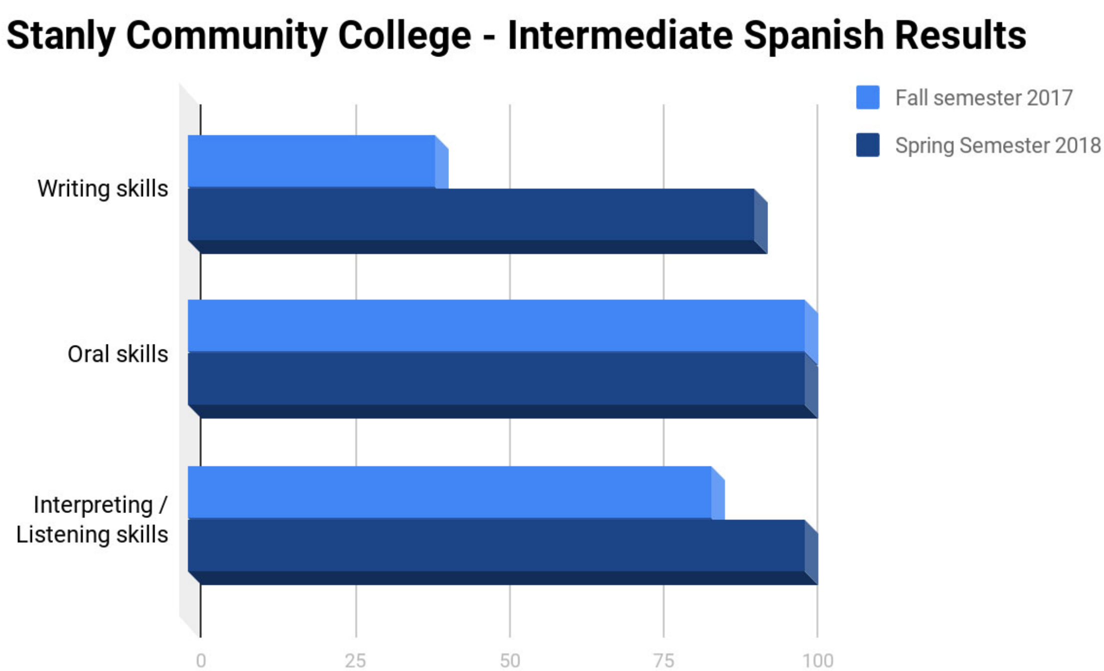
However, to support the efficiency of teaching a foreign language online, data was collected from beginning and intermediate classes at Stanly Community College. Previous to fall semester 2017, students did not yet have access to virtual tools in language classrooms. Between fall semester 2017 and fall semester 2018, online students began having access to more virtual tools with which they could interact orally, auditively, and in written form. Software we have discussed such as Zoom, Screen-Cast-O-Matic and Adobe Connect became available for instructors and students. This interactive use of technology has benefited students with the same quality of teaching students would get in a traditional classroom. Therefore, that can in part justify the growing curve that has been observed in specific language skills.

Table 1. Stanly Community College - Elementary Spanish



Nevertheless, one limitation in presenting the data is that the percentage is calculated by the number of students in each class. This number can vary every semester depending on the demand. It is also important to note that every semester, students who register at the beginning level have a diverse profile. Some come with no previous knowledge of Spanish while others may already have some knowledge of the language from high school or from growing up in a bilingual climate.

Table 2. Stanly Community College - Intermediate Spanish Results



As to the results taken from the intermediate class online, it is to consider that the majority was already familiar with the online format, as they had previously taken the elementary level with the same instructor. That could possibly justify the reason for which all students from the fall 2017 and spring 2018 semesters had above average results in their oral skills, given that oral evaluations previously had a similar format. However, an increased curve between fall 2017 and spring 2018 was also observed in student's writing, interpreting, and listening skills after implementing more virtual and interactive tools in the class. As a result, we are able to establish that even though a class is online, it is always important to show that a professor is present and available for students. The simple reality of being able to show one's face through video creates more personal contact between students and their instructor. This leads to greater confidence between them, and the student's autonomy and interest begin to grow.

Although until now, few researches have been conducted on the efficiency of online language learning when integrated correctly, technology tools appear to be beneficial to OLL when they allow students to improve their listening, reading, writing and speaking skills and when instructors are able to assess their progress by providing substantial feedback and interaction (Blake, 2011).

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Exploring Student Perceptions of Teaching Presence in BlendFlex Instruction as Compared to Face-to-Face and Online Instructions

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Abstract

This study was to investigate student perceptions of teaching presence in BlendFlex instruction as compared to face-to-face and online instructions. BlendFlex instruction offers additional flexibility for students to choose between delivery methods based on their needs and change it at any time. Selected items from the College Student Opinion Survey were used for measurement. The results revealed that student perceptions of teaching presence were significantly higher in BlendFlex instruction and face-to-face instruction than online instruction.

Keywords: BlendFlex Instruction, Blended Instruction, Face-to-Face Instruction, Online Instruction, Teaching Presence

Introduction

Blended instruction has the advantages of both face-to-face and online instructions. In blended instruction, instructors provide content via a combination of face-to-face and online instructions, delivering between 30 percent and 79 percent of the course content online, with the remaining contact delivered through face-to-face or other non-Internet mediums (Gomes, 2014). Therefore, students can have face-to-face contact with their instructor and peers and also work in a self-paced mode that accommodates other scheduling needs (Currie, 2017).

BlendFlex, a form of blended instruction that was pioneered predominantly by a technical college in Georgia, was provided to serve students who would not have local access to the instructional content but might not be comfortable with the self-paced format and demands of online instruction (Central Georgia Technical College, n.d.; Durso, 2017; Lieberman, 2018; Quinn & Lee, 2016). BlendFlex instruction melds the face-to-face, online, and telepresence methods into a single methodology. Rather than being restricted to only one delivery method for the duration of a course, students registered for BlendFlex courses can, at any time, participate in as many, or as few, of the delivery methods as they wish. Instructors can assist students through multiple delivery methods in BlendFlex instruction.

According to the Community of Inquiry (CoI) framework, three core elements are essential to creating a meaningful educational experience: cognitive presence, social presence, and teaching presence (Garrison et al., 1999). Cognitive presence refers to one's ability to construct meaning through interactions. Social presence relates to one's ability to communicate directly and develop relationships based on the personality. Teaching presence is defined by the design, facilitation, and direction of both the social and cognitive aspects of instruction to provide meaningful learning in the course (Akyol et al., 2009). Sustained communication is important for achieving a cognitive presence in an instructional setting and can be difficult in face-to-face instruction, and proves to be even more difficult in online instruction. Learners in an instructional setting must be able to project their personalities into the community. Without the ability to project their personalities, learners in the online community may not view others as real people and therefore are unable to contribute to forming the core basis of a community where learners interact and build upon the knowledge and experience of others. To support the development of both cognitive and social presence, the function of teaching presence must be emphasized because it helps involve everyone in the community and produce a meaningful educational experience in a course (Garrison et al., 1999, 2010). Therefore, it is critical to investigate if BlendFlex instruction helps promote teaching presence as compared to face-to-face and online instructions.

The Current Study

BlendFlex instruction was pioneered predominantly by a technical college in Georgia (Central Georgia Technical College, n.d.; Durso, 2017; Lieberman, 2018; Quinn & Lee, 2016). It started on September 25, 2013, to provide students multiple delivery methods for healthcare training. Since its inception, BlendFlex instruction has expanded from healthcare-related courses to credit courses in other programs, non-credit adult education programs, and preparation classes for the GED® high school-equivalency test. This study focused on a math course due to the high number of sections offered by the college and the diverse student population registered for the course.

To measure student perceptions of teaching presence, 10 items were selected from the College Student Opinion Survey. The selected items focused on student perceptions of the instructor's strategies related to "design and organization," "facilitation," "direct instruction," and "others" teaching presence related measures. The reliability of the selected items was calculated using 107 students' responses from MATH XXXX courses in the fall semester of 2016 with a Cronbach's Alpha of .97. From fall 2016 to spring 2019, 2,996 students actively registered for MATH XXXX that was offered in three different formats, BlendFlex, face-to-face, and online instructions. At the end of the course, students were invited to complete the survey. In total, 666 students responded to the survey. The survey response rate was 22.23 %. One-way ANOVA and Games-Howell Post Hoc tests were used to analyze the survey results.

Results

Data gathered from the College Student Opinion Survey consisted of responses from academic year (AY) 16-17 (fall 2016, spring 2017, and summer 2017), AY 17-18 (fall 2017, spring 2018, and summer 2018), AY 18-19 (fall 2018 and spring 2019 only). A total of 666 responses were collected from students taking MATH 1012 courses during the defined timeline. Of those responses, 37 responses resulted from students participating in BlendFlex instruction, 386 were attributed to students in face-to-face instruction, and 243 students in online instruction participated in the survey during the various terms (see Table 1).

Table 1. Survey Responses by Academic Years

Instruction / Years Covered	BlendFlex	Face-to-Face	Online
AY 16-17 (Fall 2016, Spr 2017 and Smr 2017)	18	178	103
AY 17-18 (Fall 2017, Spr 2018 and Smr 2018)	15	123	76
AY 18-19 (Fall 2018 & Spring 2019)	4	85	64
Subtotal	37	386	143

Descriptive Statistics

Based on the CoI framework laid out by Akyol et al. (2009), teaching presence data were gathered via the ten selected items from the student opinion survey and divided into four categories: “design and organization,” “facilitation,” “direct instruction,” and “others.” Table 2 shows the descriptive statistics for the survey results. Student responses of *Strongly Agree* were coded as 5 points, *Agree* coded as 4 points, *No Opinion* received a coding of 3 points, *Disagree* coded with 2 points, and *Strongly Disagree* was coded as 1 point.

Table 2. Descriptive Statistics for Survey Results

No.	Question Item	BlendFlex *M* (*SD*)	FTF *M* (*SD*)	Online *M* (*SD*)
Design & Organization		4.77 (.71)	4.67 (.60)	4.48 (.81)
1.	The instructor provided/presented a course syllabus outlining course requirements, course objectives, attendance/make-up work policies, and grading procedures.	4.76 (.76)	4.74 (.59)	4.55 (.84)
2.	The instructor taught the course objectives as listed in the course syllabus.	4.78 (.71)	4.66 (.69)	4.46 (.88)
3.	The instructor followed the course schedule or gave notice of any changes to the course schedule.	4.78 (.71)	4.68 (.65)	4.49 (.89)
4.	The instructor presented the material in a clear and organized manner.	4.76 (.72)	4.63 (.78)	4.43 (.91)
Facilitation		4.73 (.74)	4.61 (.73)	4.27 (.94)
5.	The instructor encouraged students to ask questions and/or participate in class discussions.	4.70 (.78)	4.63 (.76)	4.18 (1.07)

6.	The instructor related course material to practical application.	4.76 (.72)	4.60 (.78)	4.37 (.93)
Direct Instruction		4.70 (.72)	4.55 (.80)	4.22 (1.04)
7.	The instructor provided suggestions on how to be successful in the course.	4.65 (.82)	4.55 (.86)	4.19 (1.09)
8.	The instructor provided timely feedback on assignments and exams.	4.76 (.72)	4.55 (.82)	4.25 (1.08)
Others		4.73 (.73)	4.56 (.73)	4.27 (.97)
9.	Adequate instructional time was given (in class or online) to cover the required material.	4.78 (.71)	4.60 (.79)	4.37 (1.02)
10.	The instructor was available to assist me after class hours (on-campus, electronically, and/or by phone).	4.68 (.78)	4.53 (.79)	4.17 (1.07)

Note. The highlighted value is the highest mean between groups.

The category of "design and organization" contained four questions (Q1, Q2, Q3, and Q4) and focused on information provided at the beginning of the course, the effectiveness of the course syllabus, the schedule of the course, and how well the instructor followed the initial information presented or provided a notice when changes were made. This category also evaluated the presentation of course materials.

Students participating in BlendFlex instruction showed the highest perception score of teaching presence related to "design and organization" with a mean of 4.77 points (*SD* = .71). Face-to-face instruction-based courses scored slightly lower with a mean of 4.67 points (*SD* = .60). Students using online instruction indicated the lowest perception score of teaching presence (*M* = 4.48, *SD* = .81).

"Facilitation" was the second categorical grouping used and consisted of two questions (Q5 and Q6) related to the instructor's encouragement of queries from students, class participation, and relating the subject matter of the course to real-world examples. As with "design and organization," students using BlendFlex instruction showed the highest perception score of teaching presence (*M* = 4.73, *SD* = .74). Face-to-face instruction scored slightly lower (*M* = 4.61, *SD* = .73) while online instruction showed the lowest perceived level of "facilitation" (*M* = 4.27, *SD* = .936).

The "direct instruction" category consisted of two questions (Q7 and Q8) related to suggestions on how to be successful in the course and timely feedback on assignments and exams. Students in BlendFlex instruction courses once again indicated the highest level of perceived teacher presence (*M* = 4.70, *SD* = .721). Face-to-face instruction scored lower (*M* = 4.55, *SD* = .80), while online instruction scored the lowest (*M* = 4.22, *SD* = 1.04).

The last category, "others," focused on the time allotted for instruction during class and the availability of the instructor outside of class. Once again, questions related to the "others" category revealed that classes taught using BlendFlex instruction had the highest perception score of teaching presence (*M* = 4.73, *SD* = .73). Face-to-face based instruction was in the middle (*M* = 4.56, *SD* = .726) while online instruction had the lowest perception score of teaching presence (*M* = 4.27, *SD* = .967).

Students had the highest perception score of teaching presence in BlendFlex instruction in all categories and for every question. Some of the individual mean scores were not very far apart. For example, when asked about the presentation of a course syllabus containing course requirements, course objectives, attendance/make-up work policies, and grading procedures, students in BlendFlex instruction courses (M = 4.76, SD = .76) responded similarly to those in face-to-face instruction (M = 4.74, SD = .59). Other questions had considerable differences in the level of teaching presence perception. For example, BlendFlex instruction (M = 4.70, SD = .78) had a higher level of teaching presence according to respondents than online instruction (M = 4.18, SD = 1.07) when asked about the instructor encouraging questions and class participation.

One-Way ANOVA Test Results

A one-way ANOVA test was used to test the impact of the instructional delivery method on student perceptions of teaching presence. As outlined in the descriptive analytics above, 10 selected questions were divided into four categories: "design and organization," "facilitation," "direct instruction," and "others." "Design and organization" continued to focus on the initial presentation of information, following the presented course outline and schedule, communication of any changes, and material delivery throughout the course. "Facilitation" included questions related to encouraging questions, class participation, and relating the material to real-world examples. "Direct instruction" consisted of two questions related to the instructor providing suggestions on how to be successful in the course and providing feedback on assignments and tests. The "others" category was made up of two questions related to instructional time and instructor access outside of regular class hours.

Questions 1 through 4 were categorized for "design and organization" as part of the CoI framework. Specifically, these questions related to instructional delivery and relaying of course content. Q1 related to whether or not students perceived that their instructor provided a course syllabus outlining course objectives, attendance policies, makeup policies, and grading procedures, $F(2, 663) = 5.73$, $p = .003 < .05$. Q2 illustrated students' perceptions of whether or not the instructor taught the course objectives outlined in the syllabus, $F(2, 663) = 6.49$, $p = .002 < .05$. Q3 asked students if their instructor followed the schedule provided at the beginning of the term and whether or not the class was notified of any deviations from the originally presented schedule, $F(2, 663) = 5.38$, $p = .005 < .05$. Q4 examined whether or not students perceived a difference in teaching presence when asked if their instructors provided material in a clear and organized manner, $F(2, 663) = 5.44$, $p = .005 < .05$. As indicated by the data, there was a significant difference in student perceptions for questions 1, 2, 3, and 4 in the "design and organization" category (see Table 3).

Question 5 and question 6 were grouped in the "facilitation" category. Q5 asked whether or not the instructor encouraged questions and engaged in-class participation, $F(2, 663) = 20.48$, $p = .000 < .05$. Q6 asked students if instructors related class material to real-world examples, $F(2, 663) = 7.31$, $p = .001 < .05$. Both questions 5 and 6 illustrated significant differences in student perceptions of teaching presence between instructional delivery methods. Therefore, data showed a significant difference in student perceptions related to the "facilitation" category for the CoI framework (see Table 3).

Question 7 and question 8 were grouped for the "direct instruction" category. Q7 related to whether or not instructors provided suggestions on how to be successful in the course, $F(2, 663) = 11.92$, $p = .000 < .05$. Q8 examined whether or not instructors provided timely feedback to assignments and tests, $F(2, 663) = 10.29$, $p = .000 < .05$. Question 7 and question 8 both showed significant differences in student perceptions of teaching presence between instructional delivery methods (see Table 3).

The last category of "others" consisted of two questions (Q9 and Q10) related to the time allowed for course material delivery and access to the instructor outside of class times. When asked about the time allowed for course material delivery, students indicated a perceived difference based on instructional delivery with $F(2, 663) = 6.75$, $p = .001 < .05$. Students also showed a difference in their perception of teaching presence using different instructional delivery methods with a result of $F(2, 663) = 13.80$, $p = .000 < .05$ (see Table 3). The "others" category represented the fourth and final piece to the CoI framework.

Table 3. One-Way ANOVA Test Results

No.	Question Item	Results
Design & Organization		
1.	The instructor provided/presented a course syllabus outlining course requirements, course objectives, attendance/make-up work policies, and grading procedures.	$F(2, 663) = 5.73$, $p = .003 < .05$
2.	The instructor taught the course objectives as listed in the course syllabus.	$F(2, 663) = 6.49$, $p = .002 < .05$
3.	The instructor followed the course schedule or gave notice of any changes to the course schedule.	$F(2, 663) = 5.38$, $p = .005 < .05$
4.	The instructor presented the material in a clear and organized manner.	$F(2, 663) = 5.44$, $p = .005 < .05$
Facilitation		
5.	The instructor encouraged students to ask questions and/or participate in class discussions.	$F(2, 663) = 20.48$, $p = .000 < .05$
6.	The instructor related course material to practical application.	$F(2, 663) = 7.31$, $p = .001 < .05$
Direct Instruction		
7.	The instructor provided suggestions on how to be successful in the course.	$F(2, 663) = 11.92$, $p = .000 < .05$
8.	The instructor provided timely feedback on assignments and exams.	$F(2, 663) = 10.29$, $p = .000 < .05$
Others		
9.	Adequate instructional time was given (in class or online) to cover the required material.	$F(2, 663) = 6.75$, $p = .001 < .05$
10.	The instructor was available to assist me after class hours (on-campus, electronically, and/or by phone).	$F(2, 663) = 13.80$, $p = .000 < .05$

Games-Howell Post Hoc Test Results

Games-Howell post hoc tests are used when data differ in sample sizes and there are not equal variances in each group (Starkweather, 2010). Since the College Student Opinion Survey resulted in differing sample sizes for students participating in courses using BlendFlex instruction ($N = 37$), face-to-face ($N = 386$), and online instruction ($N = 243$), Games-Howell post hoc tests were performed. Table 4 illustrates the full results from the Games-Howell post hoc tests.

Games-Howell post hoc tests revealed that there were significant differences in perceived teaching presence in the "design and organization" category. All associated questions (Q1, Q2, Q3, and Q4) found significant differences in face-to-face instruction and online instruction. The student perception score of teaching presence related to "design and organization" was significantly higher in face-to-face instruction than online instruction. The tests also revealed significances in questions relating to teaching the course objectives (Q2) and material presentation (Q4) between BlendFlex instruction and online instruction. For these two items (course objectives and material presentation), the student perception score of teaching presence was significantly higher in BlendFlex instruction than online instruction.

"Facilitation" related questions (Q5 and Q6) showed a significance in perceived teaching presence between instructional delivery methods. When asked about instructors encouraging students to ask questions and participate in class discussions, there was a difference in responses for BlendFlex instruction and online instruction ($p = .002$), and between face-to-face instruction and online instruction ($p = .000$). The student perception score of teaching presence was significantly higher in both BlendFlex instruction and face-to-face instruction than in online instruction. When asked about instructors relating course material to practical application, there was a difference in BlendFlex instruction and online instruction ($p = .013$), and between face-to-face instruction and online instruction ($p = .004$). The student perception score of teaching presence related to facilitation was significantly higher in both BlendFlex instruction and face-to-face instruction than online instruction.

"Direct instruction" related questions (Q7 and Q8) showed similar results with differences in BlendFlex instruction and online instruction, with additional significance in face-to-face instruction and online instruction. Q7 related to instructors providing suggestions on how to be successful in the course. There were significant differences between BlendFlex instruction and online instruction ($p = .011$), and between face-to-face instruction and online instruction ($p = .000$). Q8 related to timely feedback received on assignments and exams. The result showed significant differences between BlendFlex instruction and online instruction ($p = .001$), and between face-to-face instruction and online instruction ($p = .001$). The student perception score of teaching presence related to direct instruction was significantly higher in both BlendFlex instruction and face-to-face instruction than in online instruction.

The last category of teaching presence, "others," had similar results with each question indicating the significant differences in instructional delivery methods on perceived teaching presence. The adequate instructional time between BlendFlex instruction and online instruction showed the same significance as face-to-face instruction and online instruction with $p = .009$. When asked about access to the instructor outside of regular class hours, there was a significant difference between BlendFlex instruction and online instruction ($p = .003$). There was also a significant difference between student perception scores of teaching presence between face-to-face instruction and online instruction ($p = .000$).

Table 4. Games-Howell Post Hoc Tests Results

No.	Question Item	Results
Design & Organization		
1.	The instructor provided/presented a course syllabus outlining course requirements,	1) Significant difference between face-to-face instruction and online instruction ($p = .007$), $M_{face\text{-}to\text{-}face} > M_{online}$

	course objectives, attendance/make-up work policies, and grading procedures.	
2.	The instructor taught the course objectives as listed in the course syllabus.	1) Significant difference between BlendFlex instruction and online instruction (p = .039), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .006), $M_{face\text{-}to\text{-}face} > M_{online}$
3.	The instructor followed the course schedule or gave notice of any changes to the course schedule.	1) Significant difference between face-to-face instruction and online instruction (p = .017), $M_{face\text{-}to\text{-}face} > M_{online}$
4.	The instructor presented the material in a clear and organized manner.	1) Significant difference between BlendFlex instruction and online instruction (p = .042), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .014), $M_{face\text{-}to\text{-}face} > M_{online}$
Facilitation		
5.	The instructor encouraged students to ask questions and/or participate in class discussions.	1) Significant difference between BlendFlex instruction and online instruction (p = .002), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .000), $M_{face\text{-}to\text{-}face} > M_{online}$
6.	The instructor related course material to practical application.	1) Significant difference between BlendFlex instruction and online instruction (p = .013), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .004), $M_{face\text{-}to\text{-}face} > M_{online}$
Direct Instruction		
7.	The instructor provided suggestions on how to be successful in the course.	1) Significant difference between BlendFlex instruction and online instruction (p = .011), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .000), $M_{face\text{-}to\text{-}face} > M_{online}$
8.	The instructor provided timely feedback on assignments and exams.	1) Significant difference between BlendFlex instruction and online instruction (p = .001), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .001), $M_{face\text{-}to\text{-}face} > M_{online}$
Continued on next page *Others (Continued)*		
9.	Adequate instructional time was given (in class or online) to cover the required material.	1) Significant difference between BlendFlex instruction and online instruction (p = .009), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .009), $M_{face\text{-}to\text{-}face} > M_{online}$
10.	The instructor was available to assist me after class hours (on-campus, electronically,	1) Significant difference between BlendFlex instruction and online instruction (p = .003), $M_{BlendFlex} > M_{online}$ 2) Significant difference between face-to-face instruction and online instruction (p = .000), $M_{face\text{-}to\text{-}face} > M_{online}$

	and/or by phone).	

Discussion

The results showed that the student perception scores of teaching presence were significantly higher in face-to-face instruction than online instruction for all survey questions. Except for survey questions one and three, the student perception scores of teaching presence were significantly higher in BlendFlex instruction than online instruction. The results proved the success of BlendFlex and, similarly, face-to-face instruction. Vaughan et al. (2013) stated, "teaching presence is enhanced when participants become more metacognitively aware and are encouraged to assume increasing responsibility and control of their learning" (p.13). Anderson et al. (2001) found that teaching in an online environment is influenced by the lack of non-verbal communication cues that exist in face-to-face instruction. BlendFlex instruction provides the immediate non-verbal cues that help to increase the perception of teaching presence but also allows students to take more control of their learning by providing multiple ways to consume course content. This could help explain why BlendFlex instruction consistently rated higher in perceived teaching presence than online instruction.

Conclusions

The purpose of this study was to examine student perceptions of teaching presence in BlendFlex instruction when compared to face-to-face instruction and online instruction. BlendFlex instruction incorporates the benefits of both face-to-face and online instructions, which helps engage students in a meaningful educational experience. The results of this study proved the success of BlendFlex and, similarly, face-to-face instruction. BlendFlex instruction seems to be a legitimate, and ultimately worthwhile, methodology for producing better results in improved perception of teaching presence among students than solely online instruction. To achieve a successful implementation of this new instruction, institutions must be willing to invest in technology, training, and other resources to establish best practices for ensuring both faculty and students are prepared to get the most benefit out of the BlendFlex instruction. Students will need considerable support, both before and after instruction begins, to understand how they can best utilize this instruction to achieve their educational goals.

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An Exploratory Study of Learner Characteristics, Learning Behavior and Learning Outcomes in MicroMasters MOOC Programs

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Abstract

Massive Open Online Courses (MOOCs) have been a popular venue for people to learn new knowledge, craft a new skill, or expand their professional profile (Pheatt, 2017; Hew & Cheung, 2014). To date, very few studies have considered credential-based MOOCs. This exploratory study of eight MOOCs representing 31 course runs investigated learner behavior within both open-enrollment and credential-based tracks to identify and correlate any learning patterns or trends. Findings suggest that the verified-track learners (n=5,117) have higher participation and passing rates than the audit-track learners (n=544,868). Based on a survival analysis, about 50% of the verified track persisted for 11 to 12 weeks. Using a multiple regression approach, persistence, gender and enrollment time period were the strongest predictors of the total grade. Finally, the study provides insights into student performance and identifies opportunities to better support learners through future research and course design in MOOCs.

Keyword: MOOC, MicroMasters, Online learning, credential-based MOOC, behavioral data

Introduction

A Massive Open Online Course (MOOC) is an online course with the option of free, open registration and unlimited participation (McAuley et al., 2010). Anyone with internet access can enroll in a MOOC class to learn a new topic and grow their professional profile (Pheatt, 2017). According to a Class Central report in 2018, there were 101 million learners signed up for MOOCs, and over 900 universities were offering 11,400 MOOCs (Shah, 2018). Given their rapid expansion, educators and researchers are still skeptical of the effectiveness of MOOCs for the following reasons: 1. Low completion rate (3%-10%): MOOCs have a high dropout rate because learners have various learning goals, prior knowledge, skills and interests (McAuley et al., 2010); thus, not everyone aims to finish the course or earn a certificate (Pheatt, 2017). 2. Lack of personalized feedback: current MOOC platforms utilize text-based discussion forums which are available for everyone. That makes it difficult to provide customized feedback for individual or small groups of learners (Yousef et al., 2014). Another reason for lacking individual feedback could be resulting from the large numbers of student enrollment and only a small amount of course staff is available to reply to questions (Daradoumis et al., 2013).
3. Limited collaboration and social interaction with peers: unlike traditional classroom, the primary communication approach in MOOC is through text-based discussion forum (Onah, Sinclair & Boyatt, 2014). However, since students are not required to participate in the forum, only a small portion of students would post questions, share learning tips, or answer other students' questions. The high dropout rate and open enrollment also result in a smaller number of students using the forum. With open enrollment, students could start the coursework at different times and that makes it hard for learners at different stages to engage in dynamic and spontaneous conversations with each other. Additionally, the graded assessments are usually designed as individual tasks, which further limits the opportunities for peer interaction (Gamage,

Fernando & Perera, 2015). 4. One-way delivery: a MOOC usually features a guided curriculum and pre-recorded video lectures. When students have a question during a lecture, they could not raise their hands to ask questions or have a theoretical debate like being in a traditional classroom. Instead, he or she could only rewatch the video again and again, with the hope that he or she could figure out the concepts eventually. If still confused, a student could post questions on the discussion forum and hopefully to get a reply from the course staff or classmates from a couple hours to a few days. In short, the one-way delivery style limits opportunities for students to interact with instructors (Gamage et al., 2015).

Although educators and researchers have many concerns around MOOCs' pedagogy design, technology resources and social dynamic, MOOCs continue to grow and expand rapidly. MOOC providers such as Coursera and edX began developing a new business model based on microcredentials because previous research suggested that learners are more willing to pay if they can earn a certificate upon completion (Eckstein, 2019; Young, 2013). A microcredential, defined by the National Education Association (n.d.), is a type of digital competency-based certification used in formal or informal professional learning programs. By the end of 2018, 630 microcredentials in MOOCs are created, mostly offered by Coursera's Specialization and edX's Professional Certificate (Shah, 2019).

What is a MicroMasters Program?

A MicroMasters program is a type of credential-based MOOC offered by edX. Compared to open MOOCs, MicroMasters MOOCs require higher tuition fee, ID-verification, completion of graded assessments and a proctored final exam. The common topics of MicroMasters Programs include Business Management and Computer Science (Caudill, 2017). MicroMasters programs are often designed as a pathway to enroll in a University. For example, the Supply Chain Management MicroMasters Program offered by the Massachusetts Institute of Technology (MIT) allows students who successfully earn the credentials to enroll in a residential master's degree program or convert credits to 20 other affiliated institutes (Kiers, 2016; MIT, n.d.).

In the wide array of MOOC profiles, the credential-based MOOC is becoming a popular option for learners to pursue because the credentials are assessed and endorsed by a university certificate, so the credentials are more recognizable by potential employers (Terras and Ramsay, 2016). However, little is known about the credential-based MOOCs, due to the following reasons: (1) not all universities have the resources to conduct learning analytics analyses (2) learner data is not easily accessible to researchers due to confidentiality (Almeda et al., 2018). Therefore, this study aims to explore learner characteristics and behaviors in eight credential-based MOOCs with an intention to identify learner behavioral pattern(s) within and between open MOOCs and credential-MOOCs.

Literature Review

Extensive MOOC research investigated learner dropout because it is a proxy for course completion (Reich, 2014). Machine learning (ML) algorithms are often utilized to conduct dropout modeling (Borrella, Caballero-Caballero, & Ponce-Cueto, 2019). The common ML algorithms are logistic regression, decision trees, random forests, support vector machines, neural networks and survival analysis; however, most of the literature suggests that these models have "similar predictive power" (Borrella et al., 2019, p3). Reich (2014) utilized Kaplan-Meier's survival analysis to model learners' attrition rates from nine HarvardX MOOCs. The survival analysis model considered learner persistence as a function based on the total number of days students remained active in the course and dropout value. With the same perspective, this study also adopts Kaplan-Meier's survival analysis to explore learners' persistence and attrition rates.

Learner's gender, education levels, social-economic status, and proficiency in English are reported potential barriers to people's understanding and accessing online information (Livingstone, Couvering, and Thumin, 2005). Since MOOCs attract learners with a variety of reasons ranging from preparation (Hew & Cheung, 2014), learner demographics and motivations could affect their behavior and level of participation (Rieber, 2017). This study was informed by the prior study to consider the demographic variables for the model analysis.

Research Question

This analysis aims to explore learner participation, behavior and characteristics in relationship to their learning performance between open-enrollment (audit track) versus paid-enrollment (verified track) in credential-based MOOCs. The research questions are listed as follows:

RQ1: Do students in the verified track have higher participation rates for graded assignments (quizzes and projects) compared to their audit track peers?
RQ2: Do students in the verified track have higher passing rates for graded assignments (total grade reports from quizzes, projects, and final exams) compared to their audit track peers?
RQ3: What is the learner attrition rate for the verified track?
RQ4: What factors predict learner grades for the verified track?

The first two questions uncover differences or similarities between levels of interaction and academic performance between the audit and the verified tracks. The third and fourth questions illuminate the underlying mechanisms of learning patterns associated with academic performance. These findings should support future research design and identify opportunities to better engage learners in future MOOCs.

Research Methods

Data collection

This study used data collected from two MicroMasters Program MOOCs, each consisting of four courses offered by an Ivy League school delivered through edX during 2017-2018. These courses were computer-science (CS) and business analytics(BA) related topics. Each course was 12-week with an additional week for the final proctored exam, except one course was shorter (10-week). Learners could enroll in the audit track for free as an Open MOOC or pay to be in the verified track. The criteria to earn a course certificate included: paying a course fee, verifying identification, taking a final proctored exam, and achieving a total grade of 60% or above.

The audit track learners received the same curriculum, such as lecture videos, and assessments, but the final exam was simplified. Specifically, the final exam for the audit track was similar to the weekly quizzes, while the final exam for the verified track MOOC was an online proctored comprehensive assessment.

There were a total of 410,780 learners in the CS MicroMasters Program from 20 course runs and the BA MicroMasters Program had a total of 139,205 learners from 11 course runs(see table 1). No participants were recruited solely for the purpose of data collection. The learners' gender breakdown in the CS MicroMasters Program were 65.9% male and 13.1% female. The BA MicroMasters Program had 56% male and 21 % female.

Methods

For research questions 1 and 2, I compared the results between the audit and verified track learners using the Welch T-test. Due to the low participation and passing rates (less than 10% and less than 5% respectively) of the audit track found in RQ1 and RQ2, I decided to review only the verified track data for the later questions.

To examine the RQ3 on learner attrition, a nonparametric estimator of the survival function (Kaplan Meier method) is utilized to estimate and graph survival probabilities as a function of time (Min et al., 2011). Rstudio and the survival and survminer packages were used for analysis. Learner persistence was calculated based on learner's first day of learning activity to the last day of learning activity (within the course beginning and end dates). Any activities beyond the course end date were not included in the analysis.

For RQ4, multiple regression was conducted to investigate which factors were strong predictors of the total grade. The independent variables included: (1) student persistence (2) gender (3) educational levels (4) enrollment time period: early enrollment, (W1-W4), mid-enrollment (W5-W8), and late enrollment (W9-W12). Table 2 shows the descriptive data of the variables on the total grade.

Results

RQ1: Participation rate

A weighted average of participation rate was calculated to produce accumulated results for the CS (CS101-104) MOOCs as well as the BA (BA101-104) MOOCs. Figure 1 shows the weighted learner participation rate in graded assignments (quizzes and projects) for the audit track and verified track respectively. In the CS MOOCs, the participation rate for the verified track in quizzes started at 70% and decreased to 35% by the end of the course. The participation rate for projects began at 40% but dropped to 11 % by the end of the course. Verified track learners in BA MOOCs followed a similar trend, with quiz participation rate starting at 70% but decreasing to 39%, and project participation rate falling from 61% to 28%. Conversely, the audit track exhibited a much lower participation rate. Figure 1 shows that their participation rate started from roughly 10%, then decreased to less than 1%. A Welch t-test analysis confirmed that verified track learner participation in quizzes and projects in both MicroMasters programs was significantly higher than those of the audit track ($p<0.01$).

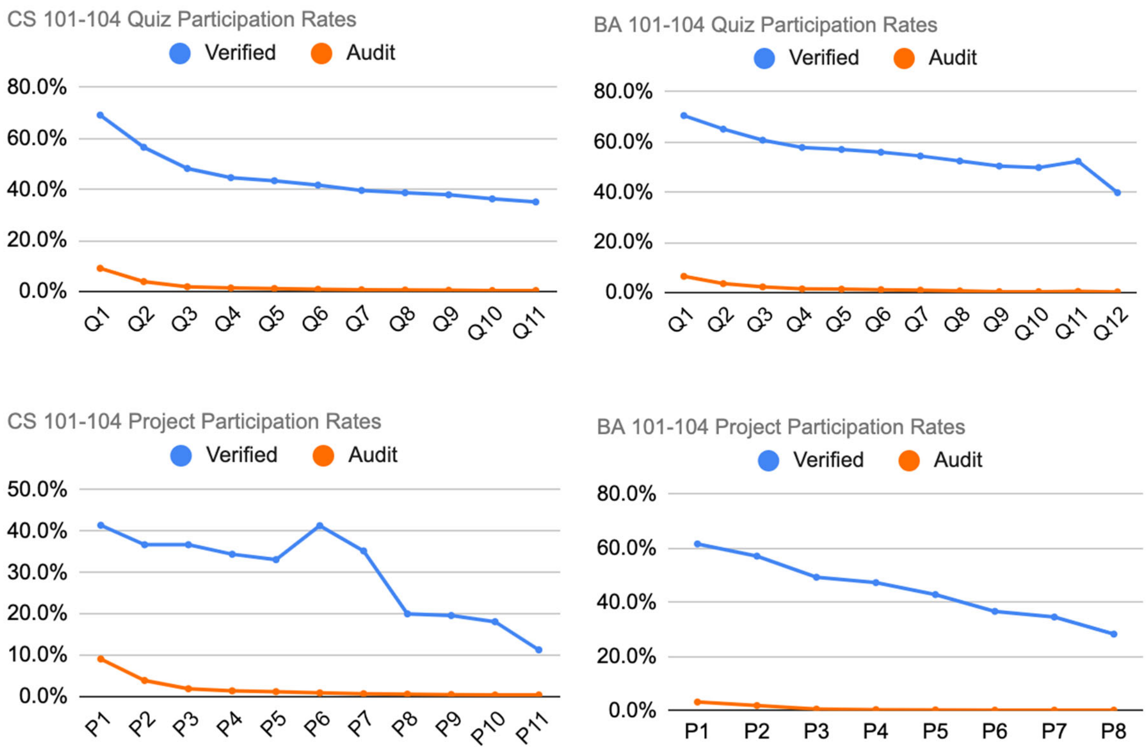

Figure 1 Weighted participation rate for quizzes and projects based on enrollment type in CS and BA MicroMasters Programs

RQ2: Learner passing rate

Table 1 shows that the passing rate for the verified track in the CS MicroMasters MOOCs was 33.9%, while the passing rate for the audit track was 0.14%. BA MicroMasters MOOCs, however, had a higher passing rate of 43.72% for the verified track, with a passing rate of 0.19% for audit track learners. On average, the audit track passing rate across eight MOOCs was 0.17% compared to verified track 38.81%. Based on Welch t-test results, it is concluded that the verified track passing rate is significantly higher from that of audit track ($p<0.01$).

Table 1 Enrollment and Passing learners of CS and BA MOOCs 2017-2018

	Enrollment			Passing Learners		
	Total	Verified	Audit	Total	Verified	Audit
CS MOOCs	410,780	3,994	406,786	1,935	1,354	581
(n=20 runs)		(0.1%)	(92.4%)		(33.90%)	(0.14%)
BA MOOCs	139,205	1,123	138,082	752	491	261
(n=11 runs)		(0.8%)	(99.2%)		(43.72%)	(0.19%)

RQ3: Attrition rate as learner persistence

Attrition rate, as measured by a Kaplan-Meier survival analysis, was utilized to measure student dropout and academic persistence (Ascend Learning, 2012). Figures 2 and 3 showed the Kaplan-Meier survivor functions of CS MOOCs and BA MOOCs using learner active days in the course (academic persistence). Both CS and BA MOOC data showed a sharp rate of dropping out in the first few days, with attrition increasing steadily as the course continued. In CS MOOCs, about 50% of verified track learners dropped out by day 76, which was slightly less than 11 weeks. For BA MOOCs, 50% of verified track learners persisted up to day 85. Considering the total length of the course (13 weeks), the study results showed that about half of the verified track learners in the CS MOOCs persisted for 11 weeks; whereas 50% of the verified track in the BA MOOCs did not drop out.

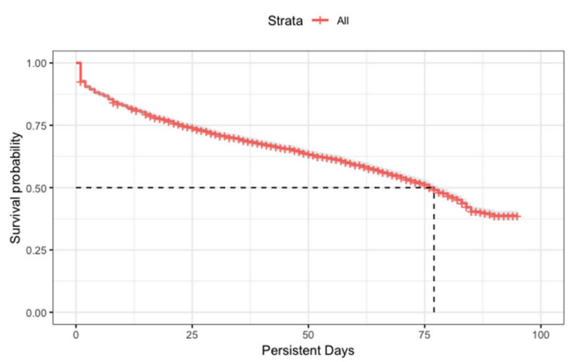	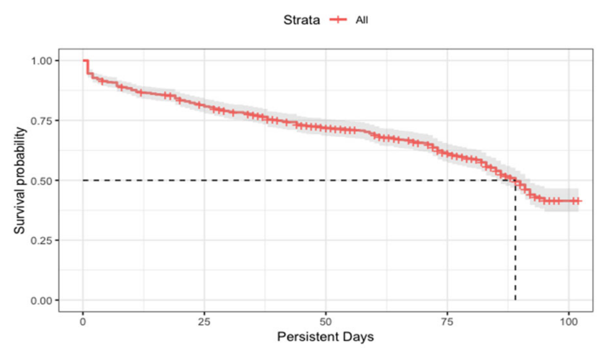
Figure 2 Kaplan-Meier survivor functions for CS MOOCs verified track learners (n=3,258)	**Figure 3** Kaplan-Meier survivor functions for BA MOOCs verified track learners (n=665)

RQ4: Regression analysis of predictors of learner grades

A multiple linear regression analysis was applied to model the predictors of total grade. Table 2 included the independent variables such as learner persistence, gender, educational level and enrollment time period. After examining the standard residual diagnostics, I determined that a quadratic specification of learner persistence was most appropriate for the analysis.

Table 2: Descriptive Statistics of Independent Variables on Total Grades

Independent Variables		N	M	SD
Learner Persistence (1~108 days)		3,643	42	39
Gender				
	Female	372	36	37
	Male	2,441	62	39
	Other	834	34	39
Educational Level				
	Post graduate	1,125	46	39
	Undergraduate	1,203	44	39
	High school	264	39	38
Enrollment Time Period				
	Early enrolled	3,137	43	39
	Mid enrolled	350	39	39
	Late enrolled	158	38	38

Note: M and *SD* are used to represent the mean and standard deviation of the total grade (scaled from 0 to 100), respectively.

Table 3 displayed the coefficient and nested F-tests of the taxonomy of four fitted multiple regression models. Model 1 had a predictor (learner persistence) with numeric value, while the other variables added into models 2, 3 and 4 represented vectors of dichotomous predictor variables. Because of this, their estimates reflected the difference between the observed variables and the reference categories. I interpreted the results of a nested F-test(ANOVA) to determine if including information about these categories improved model fit. I determine the effects of individual predictors by interpreting the magnitude and direction of the estimated coefficients, reported both in their native values and as effect sizes (Cohen's d).

Model 4 was chosen as the final model for the multiple regression analysis and its results indicated that, on average, controlling all other variables, students who persisted for 10 days longer will have final grade 4 points higher (d=0.10). In comparison to female students, a male student on average, holding other variables constant, will perform 5.27 points better (d=0.14). In terms of student enrollment time period, the model suggested that students who joined the course during the middle of the course (between week 4 to week 8) (d=0.62) and late (between week 9 to week 12) (d=0.7) performed better than those who enrolled early.

In conclusion, learner persistence, gender and enrollment time were statistically significant in predicting total grade. Specifically, learner persistence was the strongest predictor in the study, followed by enrollment time period and then gender.

Table 3. Multiple Regression of total grade on learner persistence, gender, educational level and enrollment time period.

	Model			
Variable	M1 (n=3644)	M2 (n=3642)	M3 (n=3640)	M4 (n=3638)
(Intercept)	1.84 (1.48)	-1.26*** (1.61)	-1.27*** (1.65)	-9.79*** (1.63)
Learner persistence	0.34*** (0.07)	0.33*** (0.07)	0.34*** (0.07)	0.3*** (0.07)
$Learner\ persistence^2$	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.00)
Male		5.27*** (1.06)	5.24*** (1.22)	5.27*** (1.16)
Post graduate			0.26 (1.36)	0.55 (1.3)
Undergraduate			-0.18 (1.32)	-0.7 (1.25)
Mid enrolled				24.19.*** (1.71.)
Late enrolled				38.15*** (2.44)
R^2	0.41	0.41	0.41	0.47
General Linear Hypothesis (GLH) Test on Model (1, 2), Model (2,3) and Model (3, 4)				
H_0	$\beta_{persistence}$=0	β_{male}=0	$\beta_{undergrad}$=0 $\beta_{post\_graduate}$=0	$\beta_{mid\_enrolled}$=0 $\beta_{late\_enrolled}$=0
Change in F-statistic	1270	24.89	0.06	195.79
df	2	1	2	2
p-value	<0.001	<0.001	0.94	<0.001
Decision	Reject H_0	Reject H_0	Do not Reject H_0	Reject H_0

Notes: *p < .05; ** p < .01; *** p < .001, cells are estimates (standard error).

Discussion

This study analyzed eight credential-based MOOCs with a total of 31 course runs over 2 years of dataset. The results suggested that the verified track learners had, on average, a 40-60% participation rate in graded assignments (quizzes and projects), while the audit track learners had less than 10%. The verified track learners also had a roughly 40% passing rate (completing the course with a cumulative grade of 60% or higher), whereas the audit track learners had 17%. This data corresponded with previous MOOC studies recommending learners who paid to enroll in MOOCs had a stronger intention to complete the course and earn certificates (Reich, 2014; Koller, Ng & Chen, 2013). However, the passing rates of the verified track students in MOOCs was still extremely low compared to for-credit online learning environments (Almeda et al., 2018), revealing serious deficiencies in MOOC learning environments. The study also found that about 50% of the verified track of the CS MOOCs dropped out by the 11th week (of 13); in the BA MOOCs, approximately 50% of learners did not not drop out. These mid- or late dropouts demonstrated greater interest and effort in completing their courses than early dropouts, but challenges such as difficult course content or personal factors (i.e. psychological issues, work or family obligations) may have prevented them from continuing. It is recommended that future research and course designers focus initially on investigating the causes of mid- or late dropouts over early dropouts, because those who left the course early may have just been browsing the course content.

The preliminary descriptive data suggested that mid- and late- enrolled students had, on average, lower grades than early enrollers. However, the results of the multiple regression model showed that late enrollers actually performed better than early enrollers when controlling other variables. Intuitively, this relationship seemed contradictory. However, one reason could be that linear regression oversimplifies the intercorrelation between learner educational level, the enrollment time period, and total grades. For future research analysis, it is suggested to utilize more complex models (e.g., multi-level path analysis) and feature engineering of the variables to shed light on the relationship of these variables to grades.

In addition to analyzing the strongest predictors of student grade, it is equally important to consider what can be done to support student success in MOOCs. Prior online learning literature asserts that utilizing self-regulatory learning (SRL) strategies in online learning environments has a positive effect on academic performance (Azevedo, 2005; Broadbent and Poon, 2015; Winters, Green, & Costich, 2008). Providing more scaffolding and feedback and assisting learners with developing self-regulatory strategies can increase learners' motivation and learning performance (Schunk & Zimmerman, 1998). Lastly, social support such as increased peer interaction and smaller study groups could provide both cognitive and psychological support by providing a learning community (Effeney, Carroll & Bahr, 2013; Kellogg, Booth & Oliver, 2014). Unfortunately, the MOOCs included in this study provided only a small number of SRL supports on the discussion forums; there was no comprehensive and purposeful design to facilitate or teach SRL strategies. Although there are extensive studies regarding SRL in online learning, there have not been many experimental SRL studies conducted in the credential-based MOOC environment (AI-Freih, 2017; Almeda, 2018; Wong et al., 2019). With the global MOOC market size growing exponentially from USD 3.9 billion in 2018 to USD 20.8 billion by 2023 (Researchandmarket, 2019) more attention from researchers and educators is required in order to address shortcomings in current MOOC design. The purpose of this study is to present emerging learning challenges in credential-based MOOCs and provide recommendations for future research and improved instructional design.

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An Exploratory Cross-Sectional Study:
FlipQuiz as a Digital Tool for Learning English Vocabulary in Language Classroom

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Abstract

The study was conducted to investigate the impact of a digital review tool had on students' grades, learning motivation, and engagement. An exploratory cross-sectional study was performed with two groups of students. The Experimental Group was taught using the digital tool FlipQuiz whereas the Control Group was taught with the conventional method. Pretests, posttests, and surveys on the students' learning motivation and engagement toward gamification in language learning were the instruments used in this study. The data of Posttests of both groups were analyzed using Paired Sample *t* test. The results revealed no statistically significant differences with regard to FlipQuiz on English vocabulary exam scores. The data of two surveys were analyzed using descriptive analysis, parametric data analysis, and nonparametric data analysis. Findings indicated that there was a strong relationship among students in both groups regarding the importance of including technology in the classroom as well as the overall experience of utilizing FlipQuiz in learning English vocabulary.

Introduction

Students need to learn to use the tools as they are mandatory in today's digital world. Having an effective classroom with needed equipment such as digital tools and recourses, internet, and computers will make their learning process more attractive, engaging, and meaningful. Hence, students align with their teachers in terms of having access to this new technological world. Teachers in this point must be prepared to organize the new approaches of learning that will allow students to have equal access of using the technological resources. Students then will understand and retain more when their learning is relevant, engaging, and meaningful to their lives. Students may realize that integrating technology in their learning process will make them live in a multitasking, technology-driven, various, and energetic world, which might impact on their lives positively as today's innovative world requires people with enough awareness of using technology.

Purpose of the Study

The researcher examined the online gameshow-style test review tool for the classroom called FlipQuiz, which teachers can employ in order to motivate their students and summarize the positive effects of reviewing learning content. Unlike other learning tools, FlipQuiz demonstrated its effectiveness in the learning process, which FlipQuiz requires verbal participation. FlipQuiz is a web application in which questions are reflected via projection device, verbal responses are received from students, feedback and evaluation is done online (Solmaz & Çetin, 2017). The study addressed the question of how FlipQuiz is applicable to learning English as a second language, especially with learning English vocabulary. The researcher also examined the students' point of view toward the use of FlipQuiz in classroom.

The study aimed to investigate the effects of FlipQuiz on students' English vocabulary test scores as well as their learning motivation and engagement. The engagement focuses on their learning development in vocabulary knowledge while motivation demonstrates enthusiasm in learning (Wichadee & Pattanapichet, 2018). The study focused also at encouraging students' engagement and boosting their motivation by using digital games such as FlipQuiz rather than the passive methods use in traditional classrooms, which is a teacher-directed style.

Supporting Literature and Research Question

Gamification in Learning

In education, schools, universities, and educational organizations have become active users of technology. This leads the researcher to extend the use of technology tools in education, especially in teaching and learning English as a second/foreign language. Gamification is a learning method that attracts students' attention in order to enhance their learning performance, motivation, and engagement. Solmaz and Çetin (2017) defined gamification as the use of game elements and methods in educational environments. The concept of game-based learning in education was formed based on gamification concept that was created from the positive contributions of elements in the games, for example, competition, challenge, points, leaderboard, nicknames, avatars etc. (Solmaz & Çetin, 2017).

Despite the importance of gamification in education today, there are still disagreements on the effectiveness of gamification on student learning. However, many researchers have studied the gamification and its effectiveness for learning and education and found a positive correlation between gamification and expected outcomes. One of the most important outcomes in learning and education is learning achievements (Kim S., Song K., Lockee B., Burton J., 2018). Many researchers indicated that gamification for learning can develop achievement of the learners. In the study by Kim and others (2018), higher order thinking skills, declarative knowledge and procedural knowledge, and test performance in the schools were improved by gamification. Psychological and behavioral changes, in addition, were noticed in other research findings. Hence, students' and learners' motivation and engagement were fostered through gamified learning environments, Kumar and Khurana (2012).

Solmaz and Çetin (2017) indicated that students had positive attitudes toward gamification. Students points of view showed that gamification activities improved motivation, learning and fun and decreased test anxiety. Students showed a positive attitude when they engaged in a game-based learning environment. Hanus and Fox (2015) supported this argument by stating that utilizing games in education have advantages. Many game design mechanics illustrated success in educational environments, such as play again and recoverable errors. Students' engagement made them study and interact without fear. Hence, playing and integrating online digital learning tools or platforms led to the positive effect on students' performance. For example, an online digital platform called Kahoot improved students' motivation and satisfaction positively (Medina & Hurtado, 2017).

Students' motivation and engagement are the main reasons for applying technology tools in learning process. Many studies indicated that games helped motivate students to learn (Hanus & Fox, 2015; Heaslip, Donovan, & Cullen, 2014; Medina & Hurtade, 2017; Solmaz & Çetin, 2017; Wichadee & Pattanapichet, 2018). The lack of students' performance with learning English vocabulary allowed the researcher to investigate this problem with the use of a game-review digital tool called FlipQuiz. Similar digital tools such as Kahoot, Socrative, Quizlet etc. showed positive results in respect to students' motivation, engagement, and academic performance (Solmaz & Çetin, 2017).

Research Question

Does the use of FlipQuiz impact vocabulary test scores of 7th grade students in a Saudi Arabia English learning classroom?

Research Design and Methodology

Participants were selected from one of Saudi middle public schools with students enrolled in an English class. All participants were enrolled in the same English course. The aimed grade for the study is 7th grade that has two classrooms with almost equal number of students in each class. Thus, one class is the Control Group and the other is the Experimental Group.

Participants in the Control Group were taught the English vocabulary lesson in a traditional classroom learning using Flashcards and Handouts at the end of the class period. Participants in the Experimental Group were taught the English vocabulary lesson in an advance learning classroom with technology equipment including an LCD projector, teacher computer, loudspeakers, and a high-speed Internet. The English teacher have employed 'FlipQuiz', which is gameshow-style boards for test reviews in the classroom, during studying the assigned unit. FlipQuiz used to review the given vocabulary lessons at the end of each class period.Then participants in both groups have completed posttest exams, in order to evaluate and compare their scores, at the end of the unit. McDaniel et al. (as cited in Iwamoto, Hargis, Taitano & Vuong, 2017) noted that, experiments that were done in 7th and 8th grade science classrooms applied different quiz and exam items as opposed to earlier reported experiments where questions were the same with random assignment of multiple-choice items.

This quantitative research study is an experimental design that employed pretest and posttest designs (Experimental Group) and (Control Group) in order to compare the outcomes, and a survey used a Likert scale. The survey was given to students to see their opinion toward learning with the use of FlipQuiz as well as evaluated the use of FlipQuiz on their learning motivation and engagement (Iwamoto, Hargis, Taitano, & Vuong, 2017; Medina & Hurtado, 2017; Wichadee & Pattanapichet, 2018).

Participants

In this exploratory cross-sectional study, the sample size was 51 Saudi middle school students from Al-Asamelah Intermediate and Secondary School a public school located in Jazan region, Saudi Arabia. Data were collected during the Spring semester from January 2019 –May 2019 for two weeks. Starting on March 10th and ending on March 25th. Participants enrolled in 7th grade English language course ages 12-13 (100% males). In the present study, convenience sample was used. Students in the Experimental Group used (FlipQuiz), students in Control Group used (Flashcards and Handouts). Both groups were taught using the same learning content and used review tools in the last ten minutes of class period. Survey and pretest posttest data were analyzed.

Procedure

The researcher applied the study with 7th grade students in Saudi Arabia. Students prior the intervention were required to provide a consent form signed by their parents in which they would have the option to participate in survey completion. The Pretest for Experimental Group and Control Group were conducted in order to evaluate the test scores average among students in both groups. The pre-test was a Paper-Based English vocabulary test. Its layout (10 questions-multiple choice exam). The total score of the exam was 20 points/scores, each question equal 2 points / scores.

After that, for two weeks, the researcher used FlipQuiz for reviewing English vocabulary lessons with the students in the Experimental Group. While students in the Control Group were taught with the conventional method, therefore, students in control group were taught by using FlipQuiz if needed following the study. Both groups were taught using the same content of English lessons.

After completing the assigned unit, the researcher conducted the Posttest, which was Paper-Based English vocabulary test. It was the same design of the Pretest exam. As soon as the Posttest conducted, two printed surveys were given to the students in both groups Experimental Group and Control Group in order to evaluate their opinions of studying with the use of FlipQuiz and conventional method as well as their learning motivation and engagement. The data were analyzed using (descriptive analysis, parametric data analysis, and nonparametric data analysis).

Results

A paired-samples *t* test was conducted to evaluate the impact of FlipQuiz on student's English vocabulary test scores. There was no statistically significant difference between Control Group ($M= 16.46$, $SD= 4.71$). Experimental Group ($M=17.6$, $SD= 4.24$) conditions; $t\ (24)=.76$, $p=.45$. These results showed that both groups had no significant difference in posttest English vocabulary exam.

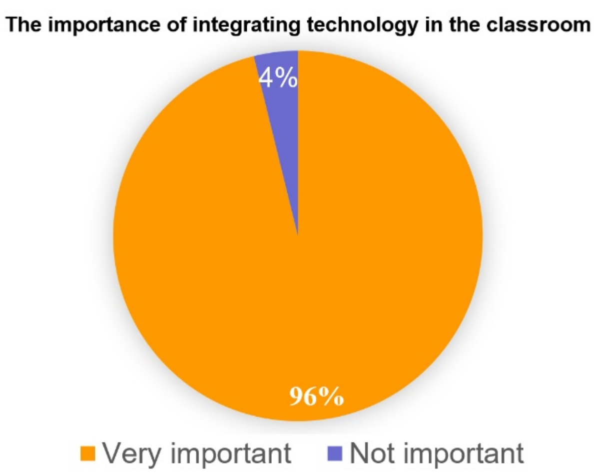
Paired Samples Test

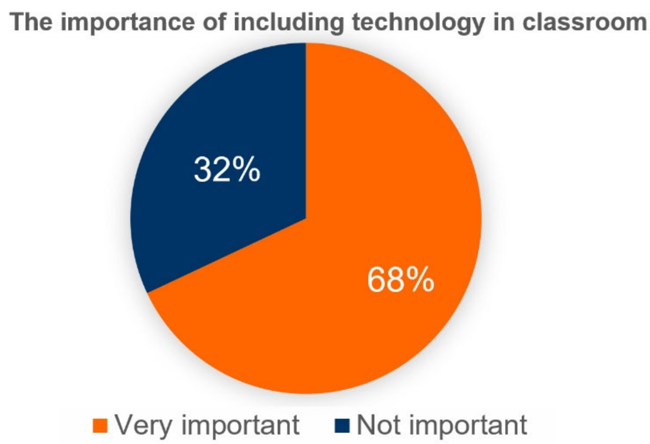
		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Posttest (Experimental group) - Posttest (Control group)	1.040	6.810	1.362	-1.771	3.851	.764	24	.453

Paired Samples Statistics

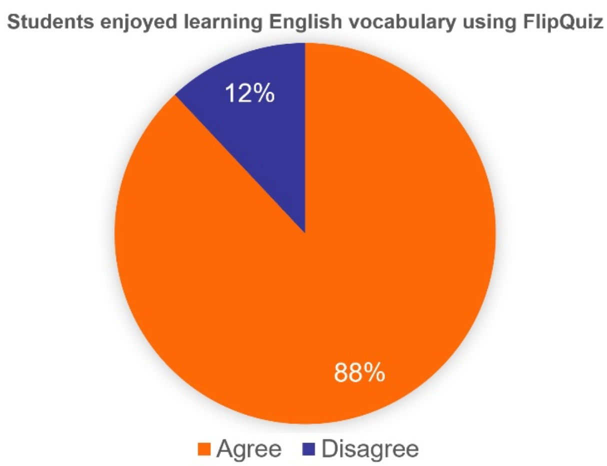
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Posttest (EG)	17.60	25	4.243	.849
	Posttest (CG)	16.46	26	4.709	.924

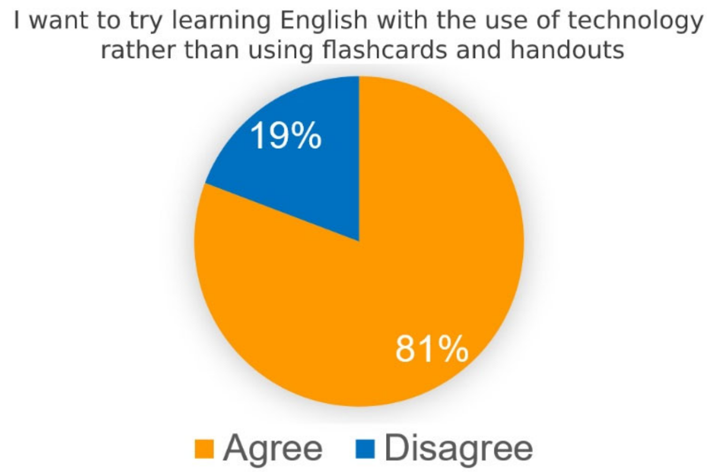
Students in both Experimental Group with 96 % and Control Group with 68 % of the total percentage reported that there is a positive relationship regarding the use of technology and its importance for students in learning English vocabulary. This demonstrate that students were excited to experience the use of gamification in education. Students in Experimental Group used FlipQuiz in an effective way, which impact on the survey answers by stating that it is very important to integrate technology in the classroom. Only 4 % total percentage of participants replied with not important to integrate technology in the classroom. It can be seen also in the Control Group that 32 % total percentage of participants stated that including technology in the classroom is not important.



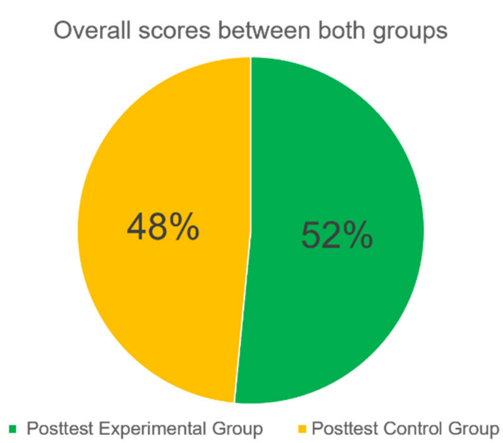


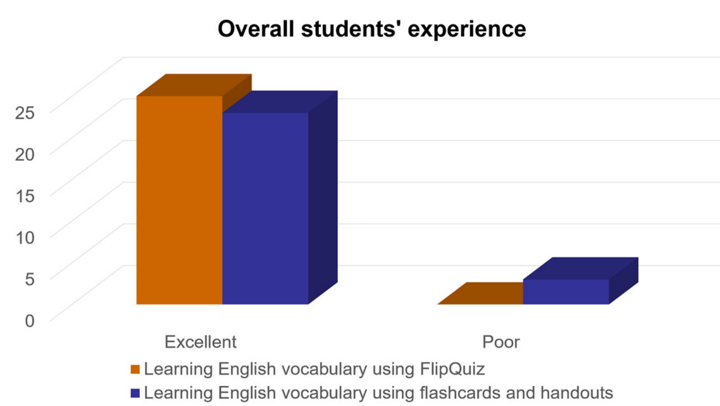
Regarding students' motivation and engagement, Experimental Group with the use of FlipQuiz showed that students were happy with using technology with 88% of the total percentage. While 81% total percentage of students in the Control Group want to try studying English with the use of technology rather than the traditional way of teaching. In terms of engaging technology in educational environment, Solmaz and Çetin (2017) indicated that game-based learning environment showed a positive attitude. This supports also the research by Kim and others (2018) indicated that one of the most important outcomes in learning and education is learning achievements, which results by motivation and engagement.





Overall students' experience illustrated that students in Experimental Group has an excellent impact regarding learning English vocabulary using FlipQuiz. These results support other studies in terms of the positive effects of using gamification in learning (Hanus & Fox, 2015; Heaslip, Donovan, & Cullen, 2014; Medina & Hurtade, 2017; Solmaz & Çetin, 2017; Wichadee & Pattanapichet, 2018). Integrating games in learning process has advantages, and many game design mechanics demonstrated success in educational environments, play again, making errors recoverable (Hanus & Fox, 2015).





Discussions

Learning that includes fun activities in the course outline create a good atmosphere for the students to gain knowledge. It generates more achievement and motivation to the students that are engage in it compared to those that are not. Therefore, FlipQuiz and other similar game review tools are good digital games, which can be used to increase the students' interest in learning language and make it more fun. The results of the research showed that the FlipQuiz has a significant effect on student motivation and engagement, especially in the English vocabulary lessons. These results were consistent with participants' motivation and engagment in terms of using a game-based learning as described. In addition, many studies have illustrated that the use of gamification in learning environments positively influences student motivation, interest, and active participationby (Hanus & Fox, 2015; Heaslip, Donovan, & Cullen, 2014; Medina & Hurtade, 2017; Solmaz & Çetin, 2017; Wichadee & Pattanapichet, 2018).

In this experiment, findings of posttest exams for Experimental Group and Control Group indicate that there was no significant difference among students' English vocabulary exam scores. The surveys demonstrated a strong relationship among students in both groups regarding the importance of including technology in the classroom. Therefore, students in the Experimental Group enjoyed their experience with the use of FlipQuiz as well as students in the Control Group who want to try learning English with the use of technology. Findings also indicated that the learning experience of students in Experimental Group with using FlipQuiz was excellent with 100 % survey answers. On the other hand, students in the Control Group survey answers showed that 88% of students found flashcards and handouts excellent to be used in learning English vocabulary, while 12% of them found that flashcards and handouts poor and not helpful. In a similar research study by Pektas and Kepceoglu (2019), participants showed that they were happy to be involved in the gamification application integration, they enjoyed it, they had an effective and lasting learning experience, they enhanced their success through positive competition, and their interests and motivations improved.

The results of this study compared to others showed that there is a relationship between students' motivation and engagement as well as improving in terms of exam scores. Pektas and Kepceoglu (2019) indicated that teachers who participated in their study have impacted positively when using gamification with their students. They noticed an improvement in motivation, saving time, and preventing cheating, as well as limitations such as difficulty in classroom management and technological problems. In terms of assessment of instruction, participants also suggested to use gamification applications.

It can be suggested that game-based review tools like FlipQuiz have the potential to enhance and improve English vocabulary examination scores at 7th grade level. Students in the experimental group felt positive about their experience towards the use of FlipQuiz. The findings of this study also suggested that including technology in the classroom, creating a fun and engaging, and motivating environment can support academic performance, which reflects on students' exam scores positively. Students will learn what excites them. If a student cares about what he is introduced to, he will be motivated to learn.

Limitations and Future Research

The main limitation of this study was the time period of the study. Within two weeks, it could be difficult to calculate any statistically significant results. In addition, the sample was not diverse in regard to age, gender and level of education. Students used to study with the traditional way of teaching, thus they would be more likely to prefer the traditional methods they are already familiar with. Therefore, the results of the study would be heavily influenced. One more limitation is that some students in the Experimental Group might not have had the opportunity to fully participate in the study because of shyness or hesitation, as FlipQuiz requires verbal participation. This means that motivating and engaging students during the class period is necessary. In this study, FlipQuiz was only applied in an English class with the vocabulary skill.

Future research in a variety of subject areas needs to be accomplished in order to see the wide-ranging advantages and disadvantages of FlipQuiz.

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Developing Computer-Aided Diagramming Tools to Mine, Model and Support Students' Reasoning Processes

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Abstract

Despite the last 40 years of research showing that computer-aided diagramming tools improve learning, little research reveal the cognitive processes that explain how diagramming tools and specific features of the tools affect learning. This study developed a tool that students used to diagram and analyze arguments as it mined students' actions. The mined data was used to develop algorithms to measure the use of backward, forward, breadth, depth-first reasoning. Regression models were compared to identify which algorithm produced measures that best predicted diagram scores, and to determine the relative impact of each reasoning process on diagram scores. The findings show that observing the placement the first five nodes moved on screen in relation to the location of the previously moved node provides sufficient data to generate backward/forward and breadth/depth-first ratio scores that predict scores, while individual frequency counts of each process do not predict scores. The best-fit regression model using the ratio scores show that students using more backward and depth-first processing construct diagrams with higher scores and greater depth of analysis. This study presents new tools, methods, and new lines of inquiry to advance research on ways to integrate analytics into diagramming tools.

Introduction

The ability to evaluate arguments is a critical skill for decision-making and problem solving (Larson, Britt, & Kurby, 2009). Furthermore, the ability to combine arguments and counter-arguments are also essential for constructing coherent and persuasive claims and propositions (Mateos et al., 2018). To develop these abilities, students can be taught the skills of argument analysis and apply them across domains and disciplines (Cottrell, 2017; Davies, 2006; Moore, 2004). Argument analysis is the study of logical relationships between propositions presented in an argument (which can be mutually supporting or opposing claims) for building and evaluating premises used to support a conclusion (Toulmin, 1958). In argument analysis, students identify the functional roles of each proposition (i.e., conclusion, major premise, co-premise, minor premises, counterarguments), analyze the hierarchical relationships among propositions (i.e., levels of premise), and evaluate the quality and line of reasoning represented in a chain of premises linked to each major premise. Argumentation can serve as a means to test uncertainties, extract meaning, achieve understanding, and examine complex ill-structured problems and issues (Jonassen & Kim, 2010; Kuhn, 1993). Identifying and evaluating the reasons to support a conclusion is a fundamental part of human reasoning and decision-making (Mercier & Sperber, 2011).

Given that arguments are difficult to analyze, computer-aided argument mapping (CAAM) tools have been developed (Davies, Barnett, & van Gelder, 2019) to provide a visual method of identifying inferential relationships and evaluating the structural soundness of arguments (Braak, 2006; Davies, 2011b). Diagrams reduce cognitive load, make relationships more concrete, and facilitates the analysis and interpretation of complex ideas (Kirschner, Shum, & Carr, 2003; Novak & Cañas, 2007). Argument Mapper (Wright et al., 2017), GAIL (Green, 2017), and Rationale (van Gelder, 2007) are just a few examples of these tools. Some tools like REASON (ThinkReliability, 2007) prescribes specific logic rules such as backward reasoning and the goal-driven approach to guide users through the argument diagramming process (Sharma, 2012). Research on the efficacy of diagramming tools shows that they improve learning with moderate to large effect sizes (Schroeder et al., 2017) and helps students achieve significant gains in critical thinking skills measured with standardized instruments (Eftekhari at al., 2016; van Gelder, 2015). However, the majority of the studies compare CAAM with traditional treatments where features of the treatment are often unspecified, thus pose as possible confounding variables (Schroeder et al., 2017). Very little of the research reveals the cognitive processes students perform while constructing diagrams and how specific features of the tools affect the cognitive process and resulting learning outcomes. Identifying the cognitive processes used to construct better diagrams is necessary to determine how diagramming tools can be improved to increase learning.

One reason as to why little research has been done on the cognitive processes used to construct diagrams is that coding video recordings of such behaviors is highly complex. Few if any CAAM applications chronologically log each action performed on a diagram. The few studies that examined specific processes are qualitative case studies. Kim (2016) found that all five experts (persons with prior training on analyzing arguments) and four novices used more breadth-first than depth-first process, with one novice using both processes. A depth-first process (Figure 1) is performed, for example, when premise 2 is linked to premise 1, followed immediately by linking 3 to 2. In contrast, a breadth-first process takes place when premise 2 is linked to premise 1 followed immediately by linking premise 4 to premise 1 (premises 2 and 4 being at the same level). The study also found that four of the five experts used a backward process to construct the diagram, while one novice used the backward process and four novices used both processes. The backward process is used when premise 2 is linked to premise 1, followed immediately by linking premise 3 to premise 2. Performing two backward or two forward processes in succession produces one depth-first process.

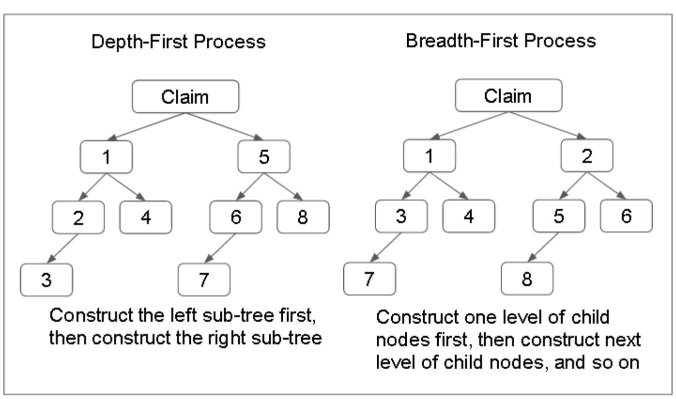


Figure 1. Illustration of the depth-first and breadth-first process

Some studies examined how these processes are used to create causal diagrams for identifying the root causes of a problem and identifying the chain of events that linking root causes to outcomes. Video analysis of students individually working on causal diagrams reveals that the most accurate causal diagrams are produced using a backward process and a breadth-first process when positioning events in the causal diagram (Shin, 2016). Working in two student groups, Lee (2012) found that the most accurate causal diagram produced among three groups used the backward approach to link together the events that contribute to the outcome, while the other two groups show no tendency to use any one specific approach. In addition to these findings, Jeong & Lee (2012) found that placing the outcome node closest to the right edge of the screen and placing causal links that primarily and sequentially flow (or point) from left to right produces the most accurate causal diagrams.

These prior studies show that using the backward and breadth-first process to identify relationships between the claim and premises can be more effective than using the forward and depth-first process. However, these prior findings relied on manual observation and coding of video recordings to identify diagramming processes, which is prone to error and requires the use of complex coding schemes and rigorous training between coders to achieve inter-rater reliability (Shin, 2016). Furthermore, the prior studies (Kim, 2015; Lee, 2012; Shin 2016) focused on identifying overall behavioral tendencies by categorically determining which process is used by each student when most students do not use any one process exclusively. As a result, prior studies did not analyze the number of times students use the backward process relative to the number of times they use the forward process, and hence, did not compare the relative impact of backward/forward versus breath/depth-first processes.

To develop diagramming tools that can assess and guide students through the reasoning processes, this study developed the jMAP tool to mine and log behaviors performed while constructing diagrams and created algorithms using log data to operationalize and measure the number of times each student performs a backward, forward, breadth-first, and depth-first process. Using the frequency counts to compute ratios on the number of times each student uses backward vs. forward (B/F ratio) and breadth- vs. depth-first process (BR/D ratio), this study analyzes the ratios using linear regression to address the following research questions:

1. Which algorithms produce ratio scores that best predict students' diagram scores?
2. Does the use of backward and breadth-first processing produce higher quality diagrams as shown in prior studies?
3. Which of the processes (backward vs. breadth-first) has a greater impact on scores?

Method

Participants

The participants in this study were 17 Masters students in an online course on computer-supported collaborative learning at a large Southeastern university (7 male, 10 female, ages ranging from 22 to 55 years), majoring in learning technology and instructional design.

Procedures and Materials

The participants reviewed arguments produced by students in another prior course that participated in an online debate to support and oppose the claim "One's choice of media significantly affects learning". The students in this study were instructed to create an argument diagram that links the major premises to the claim (a claim that was familiar to all the students in the course and master's program) and to identify and link together the chain of premises supporting the claim. Students viewed a 43-second video on how to position a claim and a premise in jMAP (Figure 2) and how to insert a link to connect the premise to the claim. In jMAP, students can move and position the nodes containing a premise or claim by dragging and dropping and can manually insert links to connect related nodes at any time of their choosing. Making the insertion of links manual (as opposed to automated, as is the case in many diagramming applications) gives students the option to add links later so that they can easily re-arrange nodes to explore their possible inter-relationships without being restricted with nodes inter-linked and anchored to one together.

At no time are students presented with instructions to suggest when and in what order to move and insert links between the claim and premises. Students download the jMAP application to diagram the supporting arguments consisting of 15 nodes. Once students complete the diagram, the students downloaded a second jMAP file to diagram the opposing arguments consisting of 14 nodes. Students are instructed to spend no more than 45 minutes working on each argument diagram. The mean number of minutes students worked on each diagram was 36 minutes (*STD* = 27, *Max* = 103, *Min* = 5). Once the diagrams are completed, students submit their diagrams to receive 20 participation points for completing the activity. The student receiving the highest score on the diagram for the supporting arguments and/or opposing arguments received 10 bonus participation points. The participation points students accumulated across all activities in the course comprised of 25% of the course grade.

Data Analysis

Scoring the diagrams. One student did not submit the second diagram, so the researcher omitted the one submitted by the student to control for practice effect. The 32 diagrams submitted from the remaining 16 students were imported into jMAP containing the criterion diagram created by the course instructor (Figure 3) to score each diagram across the following criteria: a) *Percentage* of links within the student's diagram that match those in the instructor's map x 100 (as opposed to the *number* of links, which students can use to inflate their score by merely linking all nodes to one another); b) the number of nodes correctly identified as a *root* premise (a node with only outward pointing arrows and no incoming arrows) x 10; c) the number of 1st order premises correctly linked from each correctly identified root premise x 10 (A→B); d) number of 2nd order premises correctly linked from each 1st order premise x 10 (A→B→C); and e) number of 3rd order premises correctly linked from each 2nd order premise x 10 (A→B→C→D). No points were awarded by jMAP for 2nd and 3rd order links if any of the downstream links are missing. This criteria measures students' depth of analysis, as used in prior studies (Kim, 2015; Lee, 2012, Shin, 2016). The maximum possible score was 280 points.

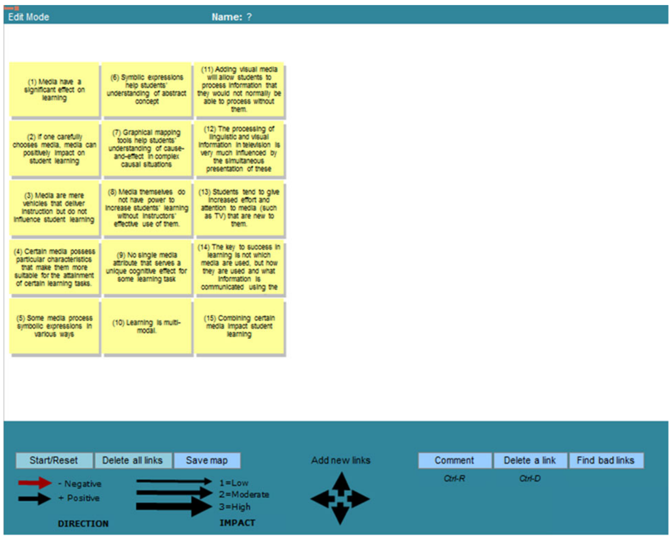
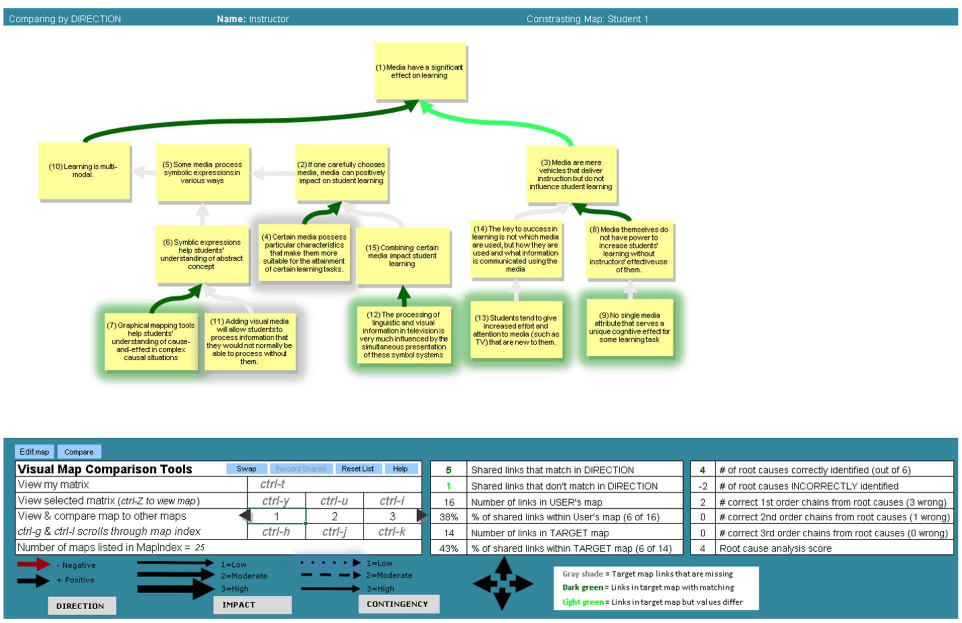


Figure 2. Initial screen with premises (but not claim) randomly arranged on the left screen.



Note: Green/gray arrows = links present/missing in student x's diagram; Green halos = correctly identified root premises; bottom left are navigation tools to select which diagrams to compare with criterion map; bottom right displays diagram scores across scoring criteria; bottom row are buttons used to add links to their diagrams.

Figure 3. Visual and quantitative comparison of instructor to student's diagram in jMAP.

Coding and counting type of process with algorithms. The data from the log files recorded 27 mapping actions (e.g., move node, insert link, delete a link, re-route head or tail of link to a different node, change density or direction of link) performed by each student (including each node's coordinates before and after each node movement) and were used to test various algorithms for measuring the number of times each of the four processes were used when placing *each* node in the diagram. Each log also contained an adjacency matrix that stores information on which nodes are linked to one another (Figure 4). With no prior instructions on how and where to move the nodes and when to manually insert links to connect related nodes, the students constructed the diagrams using four different formats -

top-down hierarchy (*n* = 8), left-to-right structure with claim position near right edge of the screen (*n* = 10), a right-to-left structure (*n* = 7), and network/spoke structure (*n* = 7). Eight of the students used the same format to produce both of their diagrams. The other eight used one format to produce one diagram and then used another format to produce their second diagram. A computer algorithm was used to identify each diagram's format based on: 1) Where the claim node is positioned within three node lengths or width from the top, left, or right edge of the screen; and 2) whether the claim node is at least the third closest node to the corresponding edge of the screen. This algorithm was iteratively revised until the algorithm's classifications corresponded 100% with the manual classification of all 32 diagrams.

Using Microsoft Excel's VBA, two algorithms were formulated (post-hoc versus directional) and tested to find the one that can generate backward/forward and breadth/depth ratio scores to produce a best-fit regression model for predicting diagram scores. The post-hoc algorithm crawls through the log of one completed diagram to determine the chronological order in which the nodes are moved for the first time (e.g., N1 N5 N7 N10). To count the number of times a student performs a backward and forward process, the algorithm combs through all the linked nodes in the final diagram recorded in its adjacency matrix. Upon finding each pair of linked nodes (e.g., N7→N1 claim) in the matrix, the algorithm checks to see if N7 immediately follows N1 in the node-move-sequence or vice versa. If the N7 follows N1, the N7 move is scored as a backward process. If N7 precedes N1, the N7 move is scored as a forward process. To assign a breadth or depth-first process to a moved node B, the algorithm identifies the previously moved node A from the node-move-sequence. If B appears on A's row (indicating A→B) or A appears in B's row (indicating B→A), B's move is scored as depth-first. The B move is scored as breadth-first if the column of B's parent node in the matrix contains the previously moved and sibling node A.

The other algorithm tested in this study, the directional algorithm, is simpler in form and execution. Based on each diagram's identified format (top-down, left-to-right, right-to-left), this algorithm uses the specific move and placement of a node *relative* to the position of the most recently moved node to identify a backward, forward, breadth-first, depth-first process. For example, moving premise A into position followed by positioning the claim above (midpoint of node A at >= -45° and < +45°) premise A in a top-down diagram indicates forward processing. Conversely, moving the claim into a position followed by moving premise A directly below the claim in the top-down diagram counts as backward processing. Moving premise B to the immediate *right* of premise A (at >= +45° and < +135°) and below the claim indicates breadth-first processing. If premise B were moved *below* premise A (instead of the immediate right or left of premise A), this action indicates depth-first processing. This algorithm is also tested using different minimum required distances (from 2 to 11 node lengths) between a moved node and previously moved node (Taricani & Clariana, 2006). Because network diagrams are essentially composed of individual segments that are top-down, left-to-right, *and* right-to-left in format (making any directional analysis problematic), data from the seven network diagrams were not used to test the algorithms.

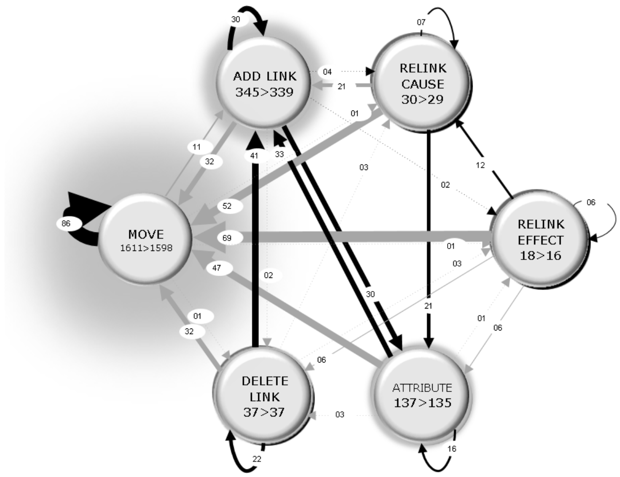
Testing Algorithms with Regression Analysis. Which segment of a log file used to predict scores can affect the accuracy of the algorithms because the mean number of times nodes were moved to complete each diagram was 80.6 (*STD* = 63.4, *Max* = 257, *Min* =17, *N* = 25), averaging five or more moves per node. Students moved nodes multiple times to make structural changes that correct for errors, and to perform cosmetic changes. For example, the sequential analysis (Jeong, 2005) of all diagramming actions examined collectively produced the state diagram (Figure 5) that reveals that 86% vs. 11% of actions immediately following the placement of a node is the placement of another node versus linking two nodes. Inserting a link most often triggers a series of ensuing actions involving relinking, deleting, and commenting on the links, which then triggers more movement of nodes.

To determine if B/F and BR/D ratios are more accurate using only the initial movements of nodes, the algorithms generated ratios using all node movements versus the initial movements of the first 15 versus 10 versus 5 nodes. For each algorithm, results from the regression analysis on the ratio scores generated with each of these four sets of data determine which data set produces the best-fit model for predicting scores. For example, the initial movements of the first 15 nodes performed in the construction of each diagram are used to generate the B/F and BR/D ratios. These two ratios and the associated diagram scores for each of the 25 diagrams are entered into the regression model Diagram Score = $B_0 + B_1*(B/F) + B_2*(BR/D)$. A one-tailed *p*-value at .10 is used to test the eight regression models because prior studies report the positive impact of backward and breadth-first processing on diagram scores and because the algorithms developed in this study are exploratory.

List of Premises	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Media have a significant ef															
(2) If one carefully chooses me			x												
(3) Media are mere vehicles th	-13														
(4) Certain media possess par		13													
(5) Some media process symb						13									
(6) Symbolic expressions help															13
(7) Graphical mapping tools h						13									
(8) Media themselves do not have		-13	13												
(9) No single media attribute that			13								-13				
(10) Learning is multi-modal	13														
(11) Adding visual media will					13										
(12) The processing of linguistic															13
(13) Students tend to give				13											
(14) The key to success in		13													
(15) Combining certain media										13					

Note: The - indicates a negative relationship with parent node. First digit conveys impact on scale of 1 = low to 3 = high. The second digit conveys level of contingency on a scale of 1 = low to 3 = high.

Figure 4. A matrix that records how each node is linked to other nodes in a diagram.



Note: Dark arrows identify transitional probabilities between two actions that are significantly greater than expected based on *z*-score tests at $p < .05$ (Jeong, 2005). The first and second numerical values in each node identify the number of times the action was executed and the number of events that followed the action. The size of the glow around each node conveys the relative number of times the action was performed.

Figure 5. Action sequences observed in the diagramming actions across all students.

Results and Discussion

Research question 1 - Comparing the algorithms

The findings in Table 1 show that the directional algorithm using only the first 5 moves produced the best-fit model. The post-hoc and directional algorithms were run to compile the frequencies of backward, forward, breadth, and depth-first processes across all node movements and only the initial movements of the first 15, 10, and 5 nodes. Each set of data was then put into separate regression models to produce the *p*-values, *R*2, beta weights for B/F, and the beta weights for BR/D (Table 1). With the post-hoc method, the mean B/F ratio was .596 (*STD* = .26), and the mean BR/D ratio was .228 (*STD* = .19). With the directional algorithm, the mean B/F ratio was .427 (*STD* = .42) and the mean BR/D ratio was .679 (*STD* = .28). The *directional* algorithm using only the first five node movements with no minimum required distance from the previously moved node (all varying limits on node distances severely suppressed backward and forward process counts to produce non-significant regression models) produced the B/F and BR/D ratios with the best-fit regression model. With the diagram scores ranging from 10 to 97.8 (*M* = 39.4, *STD* = 22.43, *n* = 25), a significant regression equation was found ($F(2, 22) = 3.01$, $p = .069$), with a R2 of .215.

Table 1
Results from the Regression Analysis across All Algorithms

	First Five		First Ten		First Fifteen		All Moves	
	Direct	Posthoc	Direct	Posthoc	Direct	Posthoc	Direct	Posthoc
p	.069	.280	.367	.730	.282	.780	.975	.730
R2	.215	.109	.086	.028	.108	.022	.002	.028
B/F	20.68	-25.14	-4.81	-6.48	13.24	-3.71	1.61	-9.99
BR/D	-24.62	-26.83	-36.83	5.93	-50.53	5.96	8.05	13.52

* Significant at the *p* < .10 level.

A comparison of the two algorithms (post-hoc vs. directional) and their regression models reveals that node placements at the beginning of the diagramming process provide the best indication of what processes students are using to analyze arguments. In contrast, movements occurring later in the diagramming process provide poor indicators of students' reasoning process. The explanation for this finding is that students move many of the nodes to their desired location before moving the nodes again (each node was moved an average of 5 or more times) simply to space them properly to make room to insert node-linking arrows into their diagrams, re-positioning nodes to revise and correct for errors in the diagram, and making other cosmetic changes (as explained earlier). These behaviors also explain why the directional algorithm performed better than the post-hoc algorithm (where B/D and BR/D ratios are determined by crawling through each pair of linked nodes in the *completed final* diagram and determining which of the paired nodes was moved after the placement of the other node). For example, Figure 5 shows that the students moved or re-positioned a node immediately after they re-linked the tail of an arrow to a different node (Relink Cause) at 52% of the time, re-linked the head of an arrow to a different node (Relink Effect) at 69% of the time, and after deleting a link (Delete Link) at 32% of the time. Moving nodes in the process of making revisions are isolated events that don't follow a sequence that conforms to or reflect the systematic use of backward and depth-first processing.

Overall, the findings suggest that diagramming tools can identify students' reasoning processes by simply observing the first five node placements. The other alternative is to analyze the first five moves immediately following the first time placement of the claim node (which was placed during the first or second move on average). A regression model revealed that the chronological order in which the claim node is placed approached statistical significance at $p = .110$, ($F(3, 21) = 2.59$, $p = .079$), with an R2 of .270. The later the claim node is placed, the lower the score. This suggests that students can create better diagrams if the claim node is placed at a default location from the start so that the directional algorithm can immediately implemented after the fifth node placement to assess a student's reasoning process. In contrast, the post-hoc method produces not only inaccurate assessments of students' reasoning processes, it can only assess students' reasoning processes (and deliver corresponding feedback) *after* the completion of the diagram.

Research question 2 – Breadth-first and backward processing

The best fit model using the B/F and BR/D ratio scores produced with the directional algorithm using only the first five moves revealed that greater use of backward processing over forward processing and the greater use of depth-first processing over breadth-first processing was associated with higher diagram scores. The best-fit model was diagram score = 46.4 + 20.6*(B/F) -24.6*BR/D. Both B/F and BR/D were significant predictors of diagram scores, with $p = .038$ and $p = .059$, respectively. The findings from the best-fit regression model show that a higher B/D *ratio* (or increasing the use of backward processing) increases scores. This finding is consistent with prior *categorical* findings on the use of backward processing to construct causal diagrams (Lee, 2012; Shin, 2016) and argument diagrams (Kim, 2016). This finding also validates the argument diagramming tool, REASON (ThinkReliability, 2007), that explicitly prescribes the use of backward processing. However, this study found that increases in the ratio of BR/D processing were associated with *decreases* in scores, which suggests that increasing the use of depth-first processing increases scores. This finding is not consistent with prior studies that found some but limited evidence that breadth-first processes produced more accurate diagrams (Kim, 2016) and causal diagrams (Shin, 2016) than depth-first processing. In these prior studies and in the current student, all nodes were specified in advance on screen and were not generated by students.

One of the four possible explanations as to why breadth-first had a negative (not positive) effect on scores is that the algorithms do not account for other behaviors associated with breadth-first processing. Another possible explanation is that the arguments analyzed in this study may be more complex than arguments analyzed in prior studies given that the scores in this study were very low in relation to the maximum possible score. To compensate for the increased difficulty, students may be more likely to use the depth-first process because depth-first processing places lesser demands on memory than breadth-first (Al-Ajlan, 2015). Furthermore, students are more likely to use depth-first processing when a clear outcome or conclusion is given from the start (Sharma, 2012). In this study, a clear claim or conclusion was presented to the students. The correlation between the sum frequency of backward + forward processing and frequency of depth-first processing was significant, $r(23) = .788$, $p = .001$. No significant correlations were found between any of the four individual processes.

A fourth explanation is that the use of breadth versus depth-first may not be a zero-sum game and that there may be times when performance can improve by increasing the use of both processes. However, the regression analysis using the observed frequencies of backward, forward, breadth-first, and depth-first (as four independent variables) was not significant ($F(4,20) = 1.33$, $p = .291$). Also, the regression analysis using the sum of backward + forward and sum of breadth + depth-first processes also was not significant ($F(2,22) = 1.40$, $p = .266$). One more possible explanation is that depth-first may be more effective when used to identify root premises and the 1st, 2nd, and 3rd order nodes linked upstream from root premises - a measure that was not used in prior studies that found breadth-first processing to be more effective. The correlational data suggests that this might be the case because the regression analysis of scores *without* the above scoring criteria was not significant ($F(2,22) = 1.34$, $p = .281$, R2 = .109) but was significant with this criteria ($F(2, 22) = 3.01$, $p = .069$, R2 = .215). However, no cause-effect relationships can be determined at this time from these correlational findings.

Research question 3 – Relative impact of backward vs. breadth-first processing

The best-fit model with diagram score = 46.4 + 20.6*(B/F) -24.6*BR/D shows the use of backward and breadth-first processing have nearly equal but opposite impact on diagram scores. Inversely, this finding suggests that the use of backward processing and depth-first processing has a nearly equivalent impact on scores and that both processes can play a necessary role in diagramming complex arguments. However, the inherent structure of the given argument (from few to many branches, from short to long branches) and the criterion used to assess the quality of an argument diagram could determine whether using one process has a greater impact than using the other. Furthermore, students' expectations on what hierarchical structures might or might not exist in arguments can also determine which process they use to complete a diagram. Another possible explanation is that students may choose to use a specific process to perform a specific step in the diagramming task (scan claims, identify the goal, move nodes, link nodes, review and revise links) – particularly steps that are used to create good diagrams (Aguiar & Correia, 2017). For example, breadth-first processing may be more effective when students attempt to move and sort nodes according to their resemblance in the level of generality and to simplify the problem space (Kim, 2015). This behavior is similar to the way high performers sort and group pieces of a jigsaw puzzle based on their similarities before attaching the puzzle pieces (Antle, 2013).

Implications for Designing Diagramming Tools

The findings in this study suggest that algorithms can be used in diagramming tools to identify, assess, and scaffold the use of backward processing and depth-first processing to help students analyze complex arguments with greater accuracy and efficiency. Overall, designing diagramming tools to facilitate the use of backward and depth-first processing can be given equal emphasis because the use of both processes was found in this study to have an equal impact on diagram scores. To help students use both of these processes more effectively, diagramming tools should prompt students at the start of the diagramming task to identify and place the conclusion first before they are allowed to move and position other nodes. By doing so, diagramming tools can identify which map orientation (top-down, bottom-up, left-right, right-left) a student is using to construct the map so that the tool can identify mapping processes accordingly. Once the conclusion is placed, students are then able to use backward and depth-first processing to work from conclusions to root premises. The alternative is to create diagramming tools that require students to place the conclusion at a default location on-screen so that students use the desired map orientation.

To create diagramming tools that can identify the processes students are using, diagramming tools can record where students position the first five nodes that students move. The tools can then determine which process is used by noting where each node is spatially placed in relation to the most recently moved node. Once the processes used to move the first five nodes are identified, diagramming tools can identify each students' primary or preferred mapping process by computing the *ratio* of backward to forward processes and the *ratio* of breadth- to depth-first processes performed by each student because: 1) Students tended to use all four processes to some extent during the first five moves; and 2) the simple frequency counts of each process alone (forward, backward, depth-first, breadth-first) did not predict students' diagram scores. Diagramming tools may be able to identify mapping processes with greater accuracy if the tool automatically and by default inserts link(s) whenever students place a node within a certain area and distance from another node or between two nodes.

To help students use more backward processing, re-design diagramming tools so that two nodes can be linked together only by moving and positioning a node directly *below* another node. To prescribe greater use of depth-first processing to help students better identify root premises and chain together premises that link root premises to main claims, diagramming tools can prompt students to identify the next node down the chain immediately after linking two nodes. To achieve the benefits of using depth-first processing, diagramming tools must apply criteria (like those used in this study) that measures the depth of analysis and not just the number of correctly identified links. These types of constraints and system prompts can be faded out gradually as students master the mapping skills.

Directions for Future Research

In summary, this study used a constraint-free diagramming tool (integrated with data mining) to explore possible approaches to operationalizing the measurement and identification of strategies used to predict and better analyze arguments. The baseline findings and the noted limitations provide a framework for conducting future research. The methods developed in this study will hopefully: 1) open the door to new lines of research to achieve a more fine-grained understanding of the underlying processes behind argument analysis; 2) provide future guidance on how to develop diagramming tools that can verify and gauge students' use of target processes, provide real-time performance feedback, and provide opportunities for more extensive and more efficient practice; and 3) help us to identify how to design diagramming tools that can guide students through the process of analyzing and achieving a deeper understanding of domain knowledge embedded in complex real-world problems.

Future research can build on this study's findings by: 1) validating the mined data and algorithms by analyzing video and think-aloud protocols while using diagramming tools that can playback the log data to closely examine the diagram construction process; 2) using larger sample sizes to test for cause-effect relationships between process and outcome; 3) comparing the effects of diagram format; 4) comparing the use of B/F and BR/D processes between more versus less complex arguments; 5) determining what effects specific diagramming actions (e.g., automated versus manual linking) have on the use of B/F and BR/D processes; and 6) creating diagramming tools that can measure and control for individual differences in mapping skills so that the tools can be used to conduct large-scale assessment of students' understanding of domain content independent of their mastery of mapping skills.

Scenario-based e-learning and Feedback Effects on Learning Outcomes and Motivation

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Introduction

The purpose of this study was to examine whether the use of real-world context and two types of feedback with e-learning affected learning outcomes and motivation over time for learners in medical laboratory science (MLS) and medical laboratory technology (MLT) programs. This study examined incorporating the scenario of landing a dream job in a medical lab, performing virtual lab tests (manual sperm cell counts) and reporting the results. The study also incorporated feedback related to the reported results. Because MLS and MLT professionals will conduct laboratory tests and report those results to physicians, it was thought that delivering contextualized, online instruction with 'virtual' consequences, manual cell count instruction could be less abstract and more meaningful to learners, which might help improve both motivation and learning outcomes.

Literature Review

As far back as 1989, Brown, Collins, and Duguid acknowledged that, "Authentic activity... is important for learners, because it is the only way they gain access to the standpoint that enables practitioners to act meaningfully and purposefully" (p. 36). The authors suggested that in traditional education settings, students may be able to pass exams, but not be able to use the conceptual knowledge in practice. To address the disconnect between knowing and doing, they recommended the use of cognitive apprenticeships, or situated learning, to contextualize learning using the social and physical context of the instruction. In 1995, Choi and Hannafin suggested that situated learning anchors knowledge and skills in realistic contexts.

Scenario-based learning, and later scenario-based e-learning, grew out of this idea that situated learning provides context for how information will be used in the real-world (Errington, 2011). According to Errington (2010), scenario-based learning refers to educational approaches that use scenarios to bring about desired learning outcomes.

Clark and Mayer (2011) asserted that scenario-based learning goes by many names, such as whole-task, case-based, problem-based, and immersive instruction. Researchers have examined the use of scenarios as preparation for flipped learning in which lecture-based material is delivered online and then applied in person (Lehmann, Bosse, Simon, Nikendei, & Huwendiek, 2013).

Errington (2010) asserted that scenarios have the potential to provide rich practical experience that extends past conventional lectures and tutorials and Clark (2016) suggested that "Scenario-based learning can lead to better transfer to tasks different from those used in the training and to greater long-term retention" (p. 55) and that it should be considered "in situations in which on-the-job experience is rare, dangerous, or impractical" (Clark, 2013, p. 13), but she cautioned that more research is needed before we can extend these conclusions to all situations.

Feedback is tied closely to all types of instruction and Keller (2010) suggested that feedback should be provided to help improve student confidence and show learners how to take corrective action. Similar to scenario-based learning, feedback types go by different names. In general, corrective feedback indicates only the correctness of a learner's response; whereas, more elaborative or explanatory feedback not only provides the correctness of a learner's response but also includes additional information about why an answer was incorrect and how to rectify the mistake.

Based on the results of their analysis of 12 meta-analyses in 2011, Hattie and Gan asserted that feedback is a powerful influence on learning outcomes. Feedback has also been found to play an important role in computer-based instruction. In 1995, Azevedo and Bernard extracted effect sizes from 14 studies examining feedback and suggested that feedback has to be regarded as one of the most critical components of computer-based instruction.

Keller (2010), Hattie and Gan (2011) and others have also suggested that feedback can impact learner confidence and motivation. However, despite there being a multitude of research on feedback, the findings are varied and inconsistent (Shute, 2008). Lechermeier and Fassnacht (2018) suggested that "Although an extensive body of research has stressed its importance, a conclusive overall picture on feedback characteristics effects is missing" (p. 145).

Similar to feedback, although a tremendous amount of research has been conducted on motivation, there is little guidance for those who want to be more effective at motivating learners (Keller, 2010). Therefore, Keller developed his ARCS model of motivational design for learning, which includes attention, relevance, confidence, and satisfaction components.

Attention refers to capturing and sustaining learner attention, relevance refers to the perceived usefulness and importance of the instruction to the learner, confidence refers to how confident the learners are they can be successful, and satisfaction has to do with learner expectations and how they feel about their performance. According to Keller (2010), these elements can affect how much effort learners put into accomplishing a goal.

Methods

Two research questions were examined for this study. The first research question involved whether scenario level (present or not present) and feedback type (intrinsic or elaborative) had significant main effects over time on college students' ability to manually count sperm cells or whether there was an interaction between these two independent variables on learning outcomes as measured by the researcher-developed knowledge instrument.

The second research question was whether scenario level and feedback type had an effect on learners' motivation over time or whether there was an interaction between the two independent variables on motivation as measured by Keller's (2010) Instructional Materials Motivation Survey (IMMS). The IMMS is a 36-item self-report measure of students' attention, relevance, confidence, and satisfaction. Its validity and reliability have been described by Keller. The knowledge instrument was designed to measure whether students could recall the procedure of counting sperm cells and doing the necessary computations to report an accurate total cell count. Content validity was established using the Delphi method with experts from the content area.

As such, this study made use of a repeated measures design with two between groups factors, scenarios (present or absent) and feedback (elaborative or intrinsic). Both instruments were administered at three time points with the survey being administered first in case learners' content performance might have affected their motivation.

Treatments

All of the instructional treatments were designed as web-based modules using the existing text-based standard operating procedure and the expertise of an MLS Body Fluids and Urinalysis course as well as other MLS professionals. Each treatment consisted of a worked example followed by two practice activities for learners to complete and those practice activities included either intrinsic or elaborative feedback. All four treatments contained the same information, but it was presented differently based on the scenario and feedback levels.

The scenario-based treatments started with, "Congratulations! You've just landed your first dream job in a medical laboratory. One of the first tests that have come in is a semen analysis…" Then the lesson led learners into the patient scenario and what they would be doing as part of their new job. The remaining lesson pages were also tied to performing job duties as guided by their new supervisor, Dave.

The two treatments without scenarios began, "This lesson is designed to show you how to manually count sperm cells using a standard hemocytometer. A hemocytometer is a specialized microscope slide." The remaining lesson pages contained the same information as the scenario treatment, but presented the information directly without tying it to patients or working in a medical lab.

The intrinsic feedback provided learners with consequences for their responses. So not just informing participants whether they were correct or incorrect, but also the impact of their reported counts. For example, the intrinsic feedback stated, "Although it was within the reference range, your count was significantly different from Dave's calculation of eight hundred fifty-seven million 500 thousand. Such an erroneous calculation could have negative clinical consequences."

Elaborative feedback on the other hand informed learners whether they were correct or incorrect and provided them guidance to rectify incorrect answers. For example, the elaborative feedback for the same question stated, "Incorrect, the correct answer is eight hundred fifty-seven million 500 thousand. It looks like you may have calculated incorrectly."

Elaborative feedback was presented without any context of the medical lab. Both feedback types included a summary of the correct steps as well as the values that should have been obtained.

Because the main interest in this study was the efficacy of a scenario-based instructional approach with intrinsic feedback, the no scenario with elaborative feedback treatment served as the control group for this study.

Data Collection

The target population for this study was MLS and MLT students. This was done to be able to provide real-world, job-related scenarios and relevant feedback. Although faculty in such programs at other institutions across the United States expressed interest in being involved in this study, no students from those programs participated; therefore, the majority of participants were from the researchers' institution and also included participants from other programs at the institution.

Due to the limited number of participants, the study materials were delivered four times in an effort to increase power for inferential statistics. During each iteration, data were collected over seven weeks. Participants were randomly assigned to one of the four treatment groups that were differentiated by the two independent variables. During the first week, informed consent was obtained and participants submitted a demographic survey, which was collected anonymously strictly for describing the sample. After that, participants completed the pre-IMMS followed by the researcher-developed knowledge pretest. During the fourth week, the instructional interventions were delivered via the learning management system followed by the immediate-post IMMS and then the immediate knowledge posttest. Lastly, participants completed the delayed-post IMMS and delayed knowledge posttest during week seven. After all participants had completed the study materials, the data were exported from the learning management system to Excel, where they were anonymized, and coded for analysis using IBM SPSS.

Data Analysis

Descriptive statistics were used to provide a complete description of the sample using participants' reported demographic information. For research question one, a 2x2 repeated measures analysis of variance, ANOVA, was used to determine whether any main effects for scenarios or feedback existed or whether there was an interaction between those two independent variables on learning outcomes over time. A second 2x2 repeated measures ANOVA was used for research question two to determine whether any main effects for scenarios or feedback existed or whether there was an interaction between these two independent variables on motivation over time. Additionally, Chi-square tests of independence were used to determine whether there was a relationship between participants' treatment groups and their ability to manually count sperm cells.

Results

The intended sample was MLS and MLT students so the real-world, job-related scenarios and intrinsic feedback would be relevant to their chosen profession. Therefore, attempts were made to solicit participants from outside institutions; however, although faculty at 10 outside institutions expressed interest, no learners from those institutions participated, which had a major impact on the number of participants obtained as well as trying to ensure relevance of the scenarios and intrinsic feedback to these majors.

Since a limited number of participants from MLS and MLT programs were obtained, university students from other programs within and outside of ISU were invited to participate. These additional calls for participants resulted in the study being conducted a total of four times ($N = 84$).

The first iteration of the study included 48 undergraduate and graduate students taking a Urinalysis and Body Fluids class as part of their Medical Laboratory Science program at a medium-sized university in the West during the fall 2019 semester ($N = 48$). The subsequent iterations included the students from other programs from within the same university as well as outside the institution ($N = 36$). Each iteration saw fewer numbers and by spring of 2020, many schools and other services shut down due to COVID-19.

The descriptive statistics showed that 60% of the participants were non-traditional students, as defined by being 25 or older, 63% were female, and 60% were enrolled in a MLS program. Data were included for a total of 84 participants in the sample descriptives because there was no way to de-anonymize the demographic survey data.

The majority of learners (92%) had previously taken an online course and had taken an online exam or assessment (94%). Nearly 70% of the participants had used the same learning management system that was used to deliver all of the study materials and 81% had not had previous instruction on the topic covered in the instructional treatments, manual cell counts.

For research question one, participants' content acquisition and cell count accuracy, the data were analyzed with and without three outliers identified in SPSS and both analyses yielded similar results. No statistically significant effects were observed for scenario level (present or not) or feedback type (elaborative or intrinsic), nor was an interaction observed for these two independent variables; however, there was one statistically significant result, which was for time.

Pairwise comparisons using a Bonferroni adjustment saw a statistically significant increase from the pretest to the immediate post test, which would be expected as a result of the instruction; however, a statistically significant increase was also observed from the immediate posttest to the delayed posttest, which was somewhat unexpected because of the two-week delay between those two posttests.

A Chi square analysis was used to examine participants' mastery for performing manual cell counts accurately. Correct answers were defined as within plus or minus one standard deviation of the mean of experts' counts. Mastery was defined by answering at least two out of three cell count questions correctly; whereas, not having met mastery was defined by answering one or fewer cell count questions correctly. The results of the Chi square analysis showed no statistically significant differences for the immediate or delayed posttests and the treatment conditions did not appear to have an effect on participants' accuracy of manually counting sperm cells.

In contrast to the results on the content knowledge scores, participants' skill mastery dropped between the immediate posttest and the delayed posttest, which would be expected after the two-week delay. Although not statistically significant, higher mastery levels were observed when intrinsic feedback was paired with scenarios and when elaborative feedback was paired with no scenarios on both the immediate and delayed posttests.

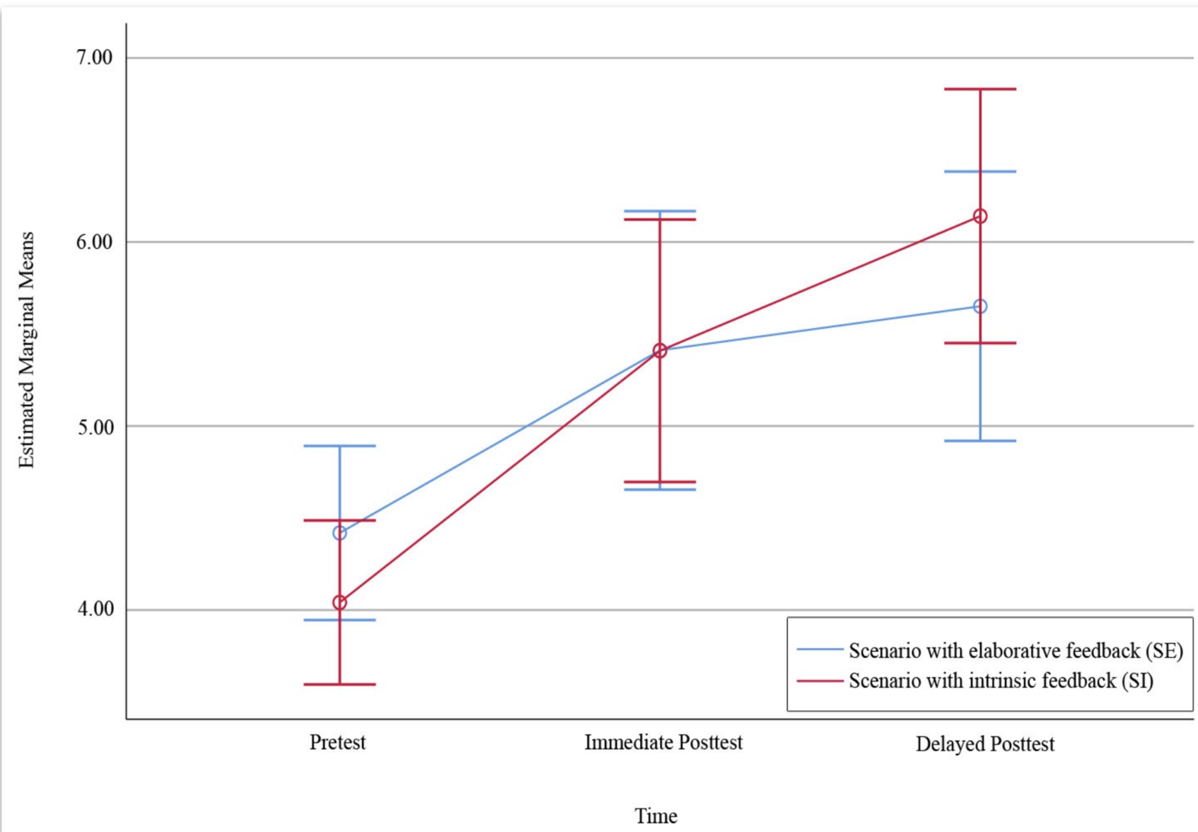
For research question two, examining the effect of scenarios and feedback type on participants' motivation over time, the results of the 2x2 repeated measures ANOVA indicated there was not a statistically significant difference in IMMS scores over time based on scenario level or feedback type. Additionally, no statistically significant interaction between the two variables was observed.

Similar to the knowledge scores, the only statistically significant main effect observed was for time. Pairwise comparisons showed a statistically significant decrease in motivation from the pre-IMMS to the immediate post-IMMS. Although not statistically significant, a slight increase from the immediate post-IMMS to the delayed post-IMMS was observed for all treatment groups except those who received elaborative feedback with scenarios.

Interpretations

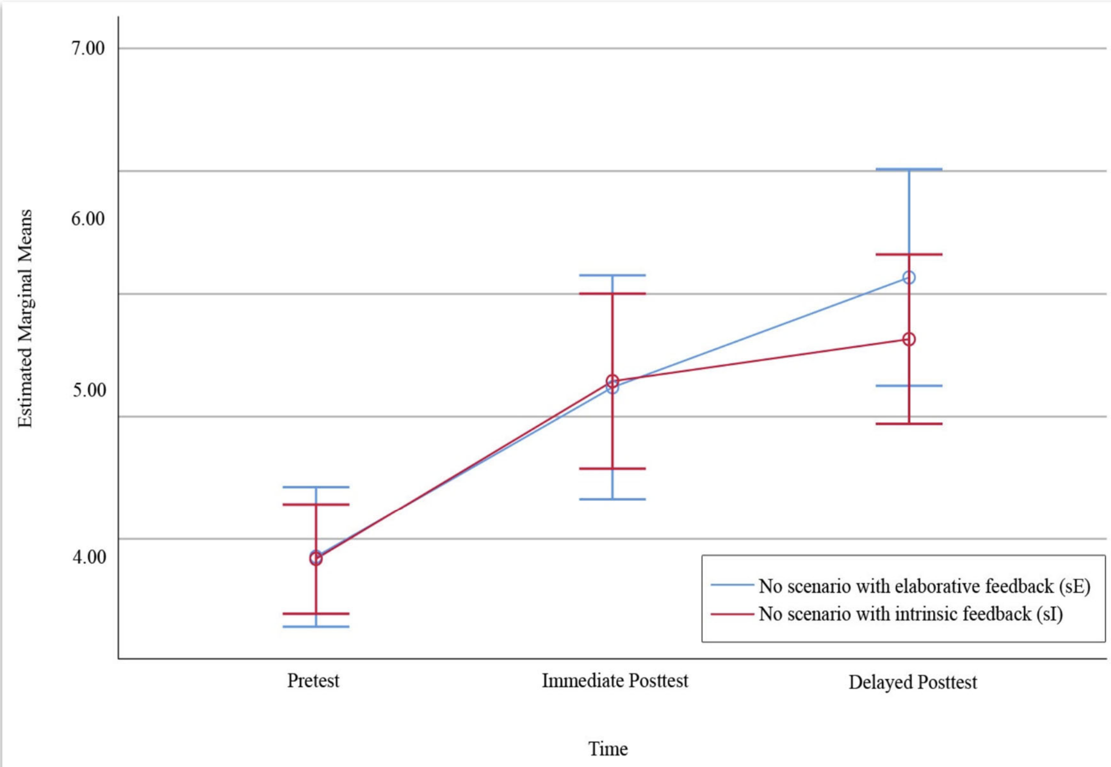
Although no statistically significant differences were observed for research question one, the line graphs in Figure 1 show an apparent interaction effect. For the scenario groups, participants who had scenarios with intrinsic feedback had a lower starting score, but caught up to the participants who had elaborative feedback on the immediate posttest, and then surpassed them on the delayed posttest.

Figure 1



As shown in Figure 2, participants who received intrinsic and elaborative feedback with scenarios had similar means on the pretest and immediate posttest, but those who had elaborative feedback appeared to score higher on the delayed posttest than participants who had intrinsic feedback with the scenarios.

Figure 2

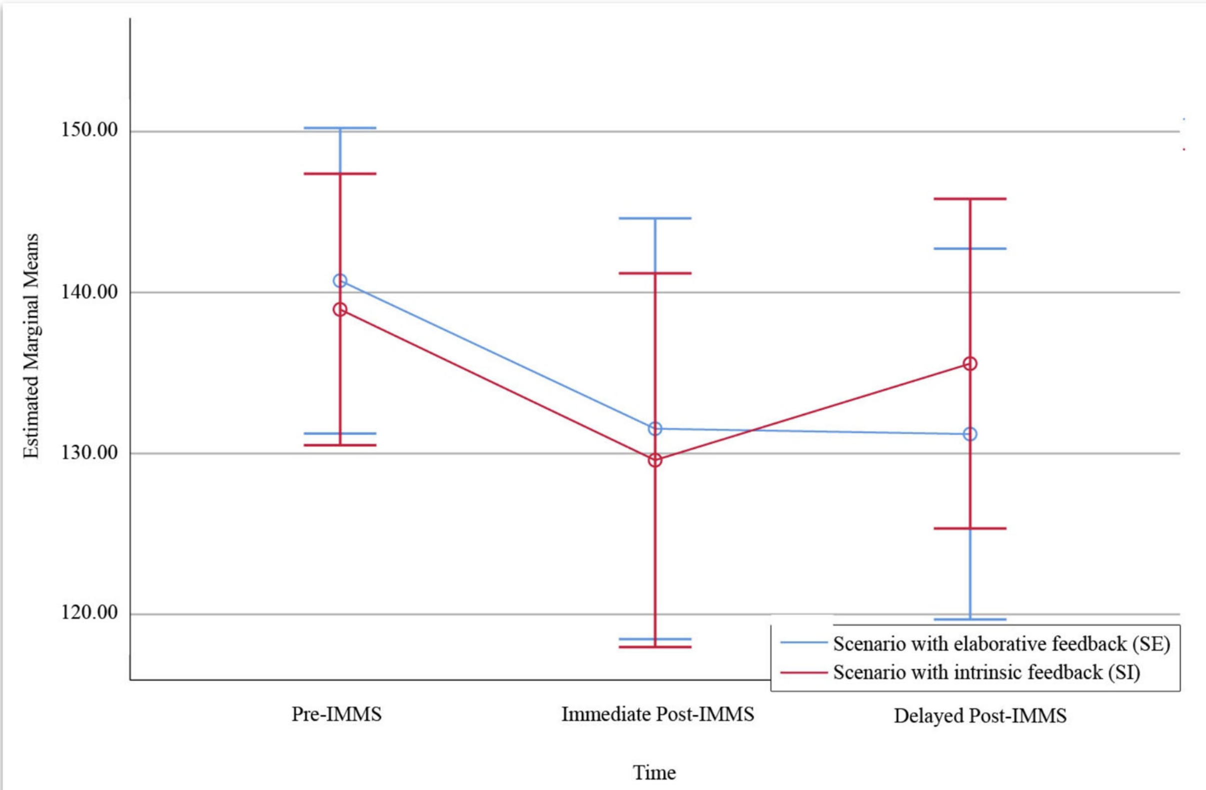


Looking at the results of this study as more of a pilot test due to the low number of participants, it appears the learners in all treatment groups increased their knowledge of manual sperm cell counts regardless of the scenario level or feedback type from pretest to immediate posttest and again from the immediate posttest to the delayed posttest. It is possible this increase was due to the immediate posttest acting as a subsequent learning opportunity. Further, the participants appeared to have learned recall, but not application, which actually decreased from the immediate to the delayed posttest. This could indicate that without sufficient skill' practice, the skill was not necessarily learned (Fisher et al., 2018).

For research question two, participants' IMMS ratings decreased significantly from the pre-IMMS to the immediate post-IMMS, which could have been due to participants being more interested in the study at the start, but having lost interest after waiting two weeks or after having gone through the instructional intervention.

Although not statistically significant, a pattern also emerged for the IMMS results. As shown in Figure 3, while participants in both scenario groups had lower IMMS scores from the pretest to the immediate posttest, participants who had intrinsic feedback rated their motivation slightly higher on the delayed post-IMMS than those who had elaborative feedback paired with scenarios.

Figure 3



Conclusions/Recommendations

Because the lack of statistically significant findings could have been due to the small sample size the first recommendation is for future research using a larger sample. Although the patterns that seemed to emerge were not statistically significant, if future research supports those patterns, a possible recommendation would be to pair intrinsic feedback with scenarios and elaborative feedback without scenarios for optimal knowledge acquisition and improved motivation. Future research is recommended to confirm any possible significance of these patterns with a larger sample and with different disciplines.

Although knowledge scores increased over time, mastery levels did not. Even though that would be expected due to the delayed time after the instruction, it might also indicate that the instructional treatments were not effective for teaching skill acquisition. Therefore, future research examining the effectiveness of scenario-based e-learning for teaching conceptual knowledge versus skill acquisition is recommended.

Further, acquiring skills requires practice so it is possible that the instructional treatments did not include enough practice opportunities. Clark and Mayer (2011) suggested that evidence supports spacing practice over time and future research could help determine whether spaced repetition would be beneficial for teaching manual cell counts.

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Technology Use and Impact of "Voluntary Social Year" on High School Graduates in Germany

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Introduction

A voluntary social year, or what is more known in the United States as a "gap year," typically takes place after the students have finished their high school education and before they enroll in higher education, such as a university or a training program. In Germany, Freiwilliges Soziales Jahr (FSJ), voluntary social year, is "a period of time, generally from six to 18 months, spent doing voluntary work … [d]esigned to offer young adults the chance to find their vocational or academic orientation while contributing to the greater social good…." (Volunteering in Germany, 2018, para. 3) During the social year, students may stay living at home, work at a different city in Germany, or even work and live in a different countries, such as Brazil. In their placements, students typically work with a community that is in need of help, such as a childcare facility, a school, or a hospital.

Although the voluntary social year is quite popular in Germany and even throughout the rest of Europe, the United States seems to view the extended time taken between the end of high school and secondary education as something that is uncommon and not often used. While students in Europe use this time to volunteer, learn new skills, and/or help others, many American students use this time to join the work force and figure out what they feel is best for them while they are out of high school. Americans view this as more of a period of personal growth and reflection, rather than an avenue in which one may further their education through exposure to other cultures and volunteerism in a social area.

This paper focuses on "Voluntary Social Year" (Freiwilliges Soziales Jahr) in Germany. Investigating the issue from the perspectives of German high school graduates and their parents is of interest to the authors. From this paper, the readers will gain a deeper understanding of daily life of the German high school graduates who have participated in a voluntary social year and be informed of how technology has been used by the students during this special period of time of their lives.

Literature Review

The literature review primarily focused on three aspects: the perception that both students and parents have about the idea of a voluntary social year, the use of technology to engage in informal learning while participating in the social year, and how the social year affected students when they returned home.

Perceptions of the Voluntary Social Year

One of the main purposes of this study is to investigate the students' and parents' perceptions of the voluntary social year. This can pertain to not only the perception that one may have before the social year begins but also the perception of how the social year may have affected the students after they returned home.

Although not discussing a typical social year, Clerkin (2019) researched the perceptions of a "Transition Year" (TY) that surfaced throughout 20 schools in Ireland in which students participated in a similar program during grade 10, which acts as a quasi-gap year, since instead of the gap year occurring after secondary school, it is offered midway through secondary school, for example, between grades 10 and 11. Although this is done in a different time frame than the voluntary social year that is being discussed, the activities and assignments are similar to those that are being discussed. Discussions and conclusions within Clerkin's research determined that most students who participated in TY felt more mature in their last 2 years of schooling, whereas students who did not participate in TY felt less mature in those last years. In addition, there were noticeable differences in the responses from males and females, with females claiming they were more independent and self-reliant, whereas the male counterparts were reporting to be less self-reliant and more immature when they did not participate in TY.

Martin (2010) sought to examine the predictors of Australian students' intentions to take a gap year and the academic profile of students who have completed a gap year. Martin specifically looked at motivation, demographics, and "postschool uncertainty" to try and determine the motivating factors behind the allure of a gap year. His hypothesis stated that students with lower academic motivation and those with more uncertainty over postschool plans would lead to the intent to take a gap year. The conclusion was made that the gap year can mend the lower motivation and in fact encourage a study to achieve more success in university after completing a gap year. However, further research is needed to help corroborate or disprove these hypotheses due to the assumption that lower academic motivation was the sole contributor to students' interest in participating in a voluntary social year.

There are few studies that address the students' perceptions of the social year. What was not addressed in these studies was the perceptions that parents may have of the voluntary social year, and whether they felt it was beneficial or detrimental to their children. This is a major plothole in the previous research of the social year because ultimately, students are more likely to seek the approval of their parents before embarking on one of these trips. It is also possible that if parents view this as a negative pursuit, students may be more reluctant to take on a social year experience.

Technology and Informal Learning During the Social Year

Due to students' lack of formal education during a social year, it is important to take a look at what students may be doing to informally further their education and gain knowledge during that time.

Mills, Knezek, and Khaddage (2014) conducted a study in which US undergraduate students were given a survey to reveal the attitudes of students and their use of mobile devices to obtain information. This research study suggested that a better understanding of technological advancements be critical to the shift from formal to informal learning. The authors stated, "Cross-validation with an established Mobile Learning Scale … indicates that Information

Sharing aligns significantly … with Mobile Learning. Information Seeking, Information Sharing, and mobile access are presented as important … in the shift along the formal to informal learning continuum." (p. 324) The authors further stressed the importance of not only knowing what students may be informally learning but also how they may be acquiring this information.

Galanis, Mayol, Alier, and García-Penalvo (2016) suggested a higher emphasis on peer interactions and social settings to encourage informal learning. The researchers asked, "Can the knowledge obtained through non-formal and informal means be quantified and evaluated in order to be formalized and recognized within the competences of a curriculum?" (p. 597). Although the authors did not directly answer the question, students within the social year program are exposed to different cultures and languages when they travel abroad which coincides with the authors' suggestion to emphasize a more social atmosphere when it comes to learning. In theory, the idea of moving to another country and/or city in itself can breed informal learning in ways students may have not thought possible.

Studies may provide information about informal learning and how informal learning can be done; but there is very little information about how informal learning is done during a social year. These studies also do not address how students may be informally learning new languages and cultures by simply living and working in their respective programs. Many students involved in a type of social year program go on to attend other training programs or potentially university, but previous research lacks in attempting to seek out the truth of how students stay current in their education.

The Impact of the Social Year

The sign of whether a voluntary social year was beneficial to both the organization being served and the individual in the program is to see how they are affected by the experience after the fact. When researching this topic, it was noteworthy to pay attention to how the students and communities reacted to the ending of the program.

O'Shea (2011) conducted interviews with students in the UK who returned home from their voluntary social year in which he asked these students about their experiences during their time abroad and how these experiences have shaped them into the persons they are today. From these interviews, he was able to gauge students' motivation, culture shock, psychosocial improvements, and other aspects. He noted that although some students participated in the volunteer gap year for completely altruistic reasons, there were many that simply did it so they could avoid going to university or use the time to figure out what they truly wanted to pursue in life. This is contradictory to what many organizations strive for within their programs with students, but is similar to the American idea of a "gap year" in which they use their time to delay higher education. However, it was determined that overall students came back from their voluntary social year with a heightened sense of self and gained experience and maturity through their time abroad.

Wilde (2016) discusses the dichotomy between wanting to help others while also being forced to reflect on how a person's actions affect others, and concerns herself with the idea that volunteerism in foreign countries merely help people experience the culture for a short period of time, but does not help them gain accurate knowledge and insight on the problems that these countries face. Wilde stated, "What emerged from my fieldwork was an emphasis on individually orientated [sic] activities, in contrast to the ethos of the charity that focus on interconnections and awareness of an individual's impact upon others around them" (p. 79). She found that these social year programs focus more heavily on the interconnected web of relaying global development information, rather than focusing on individualizing their experiences to foster better learning. This could directly affect the idea of "informal learning" that students should be experiencing and questions whether the students are getting enough information about that environment to consider it educational.

Although the impact may be questionable to those students it has served, most research indicates that social year positively impacts the student by increasing maturity and/or independence when speaking about their time during their gap year. King (2010) reported that, after interviews with 23 students from Southern England who participated in a social year, the interviews illustrated that the gap year "enabled these young people to indicate, in this context, that their current self differed from a past self" (p. 353). This conclusion is important for our research because it helps support the fact that students benefit from this time in a gap year also by growing and changing as people.

In this field, there is a void of information of not only the participating students to be interviewed, but also the families and/or communities who are supposed to benefit from the help that the student provides. However, one can hope that the impact of the social year would be beneficial for those who are volunteering and working during that time. Ultimately, what is at stake is the impact that the experience has on the students when they return home, including the families and communities in which they serve.

Methodology

The goal of the research was to gain more knowledge about the process of the social year and how the process has affected both parents and students alike. In addition, the authors investigated how technology was used by the students during the social year.

Research Inquiry/Questions

While investigating this topic, five questions were developed in order to guide the research and to use as the focus for this project. They are listed as follows:

1. What are the perceptions of German high school students about a "Voluntary Social Year"?
2. What do German high school graduates who have participated in a "Voluntary Social Year" think of their experiences?
3. What do parents of German high school graduates who have participated in a "Voluntary Social Year" think of their children's experiences?
4. What technology was used for communication and learning during the social year?
5. How was technology used for communication and learning during the social year?

Data Collection

Data was collected through surveys and interviews from participants who were a convenience sample. This was done in order to collect qualitative data to examine and determine how students and parents both perceive the idea of the volunteer social year.

The surveys were given via Google Forms to high school graduates who completed secondary school in the years 2012-2018. These were given in order to not only obtain contact information from the students but also gain a basic understanding of the students' experiences. Additionally, the survey's purpose was to gauge which students would be open to participating in interviews in which they would go into more detail about their participation in the social year. Included in the survey were four questions with sub-questions attached to questions two and three. Previous information about the program, placement in the program, and technology use during the program were among the questions in the survey. The last question inquired as to whether the student would like to participate in face-to-face interviews. Below were some questions in the survey:

> *"2. Were you aware of the 'Voluntary Social Year' program while you were deciding on your future, e.g., what to study?*
> *2.1. If yes, how did you learn about it? Did you consider participating in the 'Voluntary Social Year' program? Why or why not?*
> *3. Have you participated in the 'Voluntary Social Year' program?*
> *3.1. If yes, where did you go? How long were you there? What did you do? What do you think of the experiences? How did/do the experiences help or change you? Knowing what you know now, would you still make the same decision? Why?*
> *3.2. If yes, what technology did you use for communication/learning during the social year? How did you use it, e.g., for staying in contact with your family members?*
> *3.3. If no, did or do you wish that you had participated in the 'Voluntary Social Year' program? Why or why not? Knowing what you know now, would you still make the same decision? Why?"*

A total of 23 students responded to the survey. It was planned that students completed the survey in early June 2019, prior to the interviews. However, many students completed the survey late, after the interviews were conducted.

Interviews were conducted with both parents and students: four parents and fourteen students were interviewed. Interviews were conducted in late June of 2019, with additional interviews being conducted during Fall of 2019. In June, interviews were done with two focus groups and one individual. The focus groups consisted of students who were in medicine, teacher education, and computers and engineering. Ten open-ended questions were given to students about their experiences and how they felt this process had influenced them. One set of parents was interviewed about their experience of having their children complete the program. These questions were similar in content to the interviews done with the students but was more focused on how they were affected, what they saw in their children when they returned, etc. During Fall of 2019, another set of parents and a student were interviewed using the same interview questions. All interviews were recorded using a recording device.

Data Analysis

Qualitative data obtained from the survey and the interviews were analyzed using both coding and content analysis to determine any similarities or trends between the responses of the individuals. Analysis was conducted separately by two people in which they listened to the recordings of the interviews and made notes and conclusions in order to cross-check the analysis results.

Results

Twenty three students completed the survey. Among them, 14 students participated in a social year while nine students did not participate. Students who did not participate in a social year were asked, *"did or do you wish that you had participated in the 'Voluntary Social Year' program? Why or why not? Knowing what you know now, would you still make the same decision? Why?"* Six of the nine students expressed that they did not regret of not doing it because they knew what they wanted to do during that time, for example, studying at the university, working or/and traveling. One respondent stated that the wages of the social year were too low. Two of the nine students wished that they had participated in a social year, and one of them noted that the social year experience might have made him or her more mature. One of the nine students was not sure if in hindsight, he or she would have wanted to participate in a social year.

After interviewing students from Germany about their time during their voluntary social year, their answers showed that, although the students participated in a variety of placements, whether abroad or more local, many of the answers provided similarities.

When asked how students learned about the opportunity to participate in a voluntary social year, their answers varied from school teachers to siblings, to their parents, and even their peers. In some cases, their older siblings had already participated in the voluntary social year, which inspired the younger sibling to participate as well. Even though a few students explained that they learned about this opportunity from their schools, the students noted that their instructors mentioned the voluntary social year, but rarely went into detail about what it fully entails. Each student's answer varied slightly, but overall, when asked why they had chosen to complete a social year, the word "independence" was overwhelmingly used in order to describe what they wanted to gain out of this experience. Similarly, many students spoke about their desire to experience something new, such as a new environment or a new culture, since most had lived in the same town for many years.

In regards to how students chose where they were placed, not just their town, but also their placement in terms of work, there were a multitude of answers. One student recalled that their church provided a voluntary social year that was of interest to them. Another chose their placement due to their interest in a particular field, such as the medical field, in order to gain more experience for a future career. Others chose their placement either by previously working with the organization prior to participating in the social year or using one of the two main websites that provide information and placement opportunities for students after high school. The placements, in terms of their daily work, ranged from a youth hostel, a daycare facility, an emergency response team, and a school in which students participated in a plethora of daily activities. As mentioned previously, most students that were interviewed stayed in Germany for their placements, but two of the students traveled abroad, one to Bolivia and one to Brazil.

When prompted to share details of their typical day while completing their social year, students provided many explanations. First, students discussed their hours and how long they would work each day which varied from 8-10 hours per day, 4-5 days a week, with the exception of the student that worked with the emergency response team in which she would sometimes work up to 12 hours a day, which would shorten the days per week she worked. On average, the students agreed they worked about 40 hours per week, similar hours to a full-time job. Second, the students were then asked to describe their daily routines and what their workdays consisted of. Students who worked in the daycare facility or in the schools worked with young children, mostly kindergarten, but some a little older. These students would provide the children with homework help, snacks after school, and other enrichment activities, which would be similar to an after-school program. One student provided assistance to a medical emergency response team in which she would ride in the ambulance with the other medical technicians and assist the team in emergency situations. One student worked in a youth hostel in which he would design and provide games and enrichment activities for the students who stayed there.

Next, the students were asked to describe how or if they were paid for their services, and if so, how much and in what form. For the students who were provided lodging (which consisted of usually an apartment or a flat), the students were paid less than if they were not provided with housing. However, given what was leftover from their payment, there was very little room for luxuries, and ultimately, after paying for food and other travels, the students were left with very little profit. The government, the church, a specific social year organization, or a combination of both were funding the students' jobs and travel to their destinations.

In addition to learning about what the students experienced while taking part in their social year, what the students felt they ultimately gained from this experience, whether it be rewarding or challenging, was of particular interest. Overwhelmingly, each of the students noted an increased sense of maturity and independence in addition to heightened self-confidence and knowledge of other cultures and customs. Students also felt that communication with strangers was easier, and overall this experience helped them better decide what steps to take next in terms of their future careers and/or life plans. Although most of the aspects of this year were positive, students that traveled abroad found it challenging to learn some of the customs and languages when first arriving. When working with children in low-income areas, the students felt that it was sometimes difficult to see children in less fortunate situations. The student that worked at the youth hostel also expressed a sense of loss of privacy since the students could essentially call on them at any moment to ask for assistance. This forced the student to essentially remain on-call during most of the evening and night. Another challenge that one student faced was the trauma that comes with being on an emergency response team and having to prepare to be present for potentially harrowing scenes.

Fourteen students participated in the interviews, but little was known about how many students out of their graduating class participated in the volunteer social year. When asked, most students guessed around 10-15% of students in their class decided to complete a voluntary social year as opposed to going to university or enrolling in some other form of a training program. A student also noted that females were found more frequently among those working with younger children. When prompted to discuss how the participating students felt that non-participating students perceived the social year, 13 out of the 14 students said the non-participating students felt positive about it, although some may view the international travel as something to be concerned about. Only one student mentioned that perhaps a small percentage of non-participating students may not view the social year as beneficial due to the delay that it would cause in terms of starting university or a potential career.

Reflecting back on their time engaging in their social year, positivity resonated through their answers. The majority of the students do not regret their time, and if given the chance, they would choose to participate once again. However, when asked if students would have done anything differently, the common answers seemed to be that they wished they would have stayed in placement longer so that they could absorb more in addition to taking more risks, and learning the language better prior to traveling for those who went abroad.

Lastly, the students were asked how technology fits into their lives when conducting their voluntary social year. They all stated that technology played a critical role prior to, during, and after their social year. Prior to the social year, they searched for information about the voluntary social year using technology. During the social year, technology was used to communicate with family and friends. They also used technology to document their time spent away from home through photos, videos, and digital journaling. After the social year, they used technology to keep connected with people who were part of their social year. In regards to what technology used, they expressed that they used a variety of devices, including their cell phones, ebooks, and laptops while using apps such as WhatsApp, social media, blogs, and Skype.

The parents of a student who conducted her voluntary social year service in Germany provided insight into the perception that they have of their child's participation in her social year. They echoed the positive impacts of the social year on their child: being more mature and independent, and knowing what she wanted to do after she returned from her social year. The parents pointed out that the voluntary social year in Germany is connected to the history of Germany. Males in Germany prior to 2011 were drafted into the military, but the option existed to claim to be conscientious objectors. Instead of service in the military, those conscientious objectors then had to participate in community service, which was similar to the service in voluntary social year. This connection to the history might explain why the volunary social year in Germany is so well organized and structured.

The parents of another student who went abroad also provided insight into the perception that the parents have of their children's participation in a social year. The parents found that their children, once back home, showed an increased sense of maturity and independence, which the parents found to be a very positive change. The children also showed more responsibility and a better understanding of what may come next in the child's life. Additionally, the parents felt that because their children came back with the knowledge of other cities and cultures, this also translated over to the parents as well and they felt that they were able to learn along with their child. One parent, however, made an observation that little is said about the impact that the students participating in the social year have on their host families and communities, and it seems crucial to look into how this may affect them, as well.

Limitations

This study shed a good light on a voluntary social year in Germany and technology use by students who participated in the social year. At the same time, the authors identified the following limitations:

The participants of the study were convenience sample, being recruited by two German high school graduates, one in the field of medicine and the other in teacher education. Thus, the majority of the participants were from these two fields of study: medicine and teacher education. Should the participants have been from other or a variety of fields of study, the results might have been different from what was found in this study.

The study focused on perceptions of students who participated in a voluntary social year and also their parents' perceptions. The study did not look into the organization of a social year, for example, how a social year program is organized and structured, or where the funding comes from. Visiting sites of the participants, for example, a daycare center or a youth hostel, will definitely give the authors a better picture of the life of the participants during their social year.

The study indicated a positive impact of a social year on German high school graduates. It did not look into the impact of the German high school graduates on their hosting institutions, as one of the parents interviewed had pointed out. For example, what was the impact of the two German students, who went to Bolivia and Brazil, on the children in the two countries? Would the service they provided continue after they left Bolivia and Brazil?

Conclusions and Recommendations

Based on the information that was gathered through the interviews and information provided by the students, it is evident that the volunteer social year is a positive experience for students. They expressed that they are in favor of the social year and that they have more maturity, more independence, and more confidence. The students also expressed an increase in knowledge of international values and customs which is beneficial. In addition, this study shows that students also claim to be better able to communicate with strangers and other adults, allowing them to be more open to difficult situations. Lastly, this information has also shown that students who come back from the volunteer social year have a better understanding, or idea, of what their future may look like once they return home.

The parents who were interviewed also responded favorably to the social year, and it can be concluded that they find this experience to be beneficial for their children. It seems that the parents' responses echo the sentiments noted by their children that there is a definite increase in maturity and independence when the students arrive home. The parents are overall pleased with the changes that they have seen in their children.

In terms of technology, students communicated easier when able to use devices and apps, such as WhatsApp and FaceTime. Not only has the technology been beneficial in terms of communication, but it has also allowed for students to learn independently through the use of the Internet and other online resources. Technology gives students the opportunity to stay connected, share photographs, and document their journey which added to the novelty of their experience.

Looking forward into future research, it would be wise to look into Germany's history as to what the purpose of the volunteer social year originally was and how it became as commonplace as it is today. Looking into the history and the background, this process will provide a better understanding of the volunteer social year. Additionally, it would be interesting to look into how the host families of these students perceive this process and even more so, looking into the impact that the students leave on their host communities. Lastly, interviews and information from students and parents who did not complete the volunteer social year would also provide more insight into this experience and provide more information on how this process is perceived by others.

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An Empirical Study on Using E-schoolbag to Promote Deep Learning in the Primary Mathematics Course

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Abstract: It is believed that Information and Communication Technology (ICT) can promote deep learning, and E-schoolbag is widely used in primary and secondary schools in China to enhance deep learning in different subjects. There are nearly seventy students in two classes in the fifth grade of a primary school in China， and we designed quasi-experiment research to examine the use of E-schoolbag for promoting deep learning in primary school mathematics. The intervention condition was mainly the learning situation design supported by technology. Data were collected through experiments, interviews, and classroom observation. Through one month of teaching, the teaching of the experimental class and the control class were compared from the three dimensions of deep learning to draw relevant conclusions. It was found that E-schoolbag can promote deep learning in primary school mathematics, thereby optimizing the teaching situation of primary mathematics classroom and enhancing the effectiveness of teaching.
Keywords: Information technology; primary school mathematics; deep learning; E-schoolbag

Introduction

Deep learning is the way of learning for decision making and problem-solving. Through the first cognitive experience, learners reorganize new things, integrate them into the unique cognitive structure (Entwistle, 2005). Learners also find many ways to connect or transfer existing knowledge into new situations. Constructivism provides a theoretical basis for deep learning that "learning depends on the individual's construction of the meaning, the process of constructing meaning is embedded in a specific social context" (Gergen & Davis, 1985). The significance of constructivism in information technology education is that the task-driven, visual demonstration, operational practice, cooperative learning method, and other teaching methods are used in the curriculum to make deep learning more likely to happen. According to the age of students and the laws of cognitive development. The use of information technology has the potential to enable students to establish mathematical learning methods in specific situations to promote deep learning of primary school mathematics.

E-schoolbag is not only a portable device, but also the learning platform and virtual learning environment for ICT in education, it was used to be called "E-textbook", a comprehensive learning platform similar to a learning management system, that contains digitized learning materials such as texts, videos, and audio clips and so on. In addition to the digitized learning materials, various tools were embedded in the E-schoolbag for facilitating teaching and learning activities such as assignment management, discussion space, collaborative tools for the group project, survey tools, tests, etc (Hui et al., 2017). The devices were connected to a wireless network, which makes it possible for creating a social environment where learners can grow together academically (Vygotsky, 1978).

The author has participated in the project titled "Using Information Technology to Promote Effective Teaching Improvement" jointly operated by Ningxia Normal University, Guyuan Experimental Primary School, and TF Enterprise Research Institute, planning course with the primary school teachers, preparing lessons, and conducting classroom observations on the teaching of elementary school mathematics. It has been found that in the current mathematics classroom in elementary school, students only learned the mathematical symbol knowledge that the class teachers hope them to master. However, that is not the essence of learning. The information technology teaching equipment used was mainly E-schoolbags in the study.

The use of E-schoolbag for promoting the deep learning of mathematics in primary schools has become a new research hotspot in recent years. However, the researches on information technology for promoting the deep learning of primary school mathematics at home and abroad basically focus on concept analysis and connotation understanding. In theoretical research such as strategy construction, empirical analysis is not in-depth (Huang, 2015). In this paper, we took "deep learning" as the focus and used E-schoolbag to design, practice, analyze and evaluate the mathematics classroom in primary school. Through the analysis of the teaching classroom observation and test results, it is verified that E-schoolbag is useful to promote the deep learning of mathematics in primary schools, thus providing a more practical reference for K-12 teachers.

Deep Learning

"Deep Learning" as an academic concept originated in the United States in the mid-20th century. The research on deep learning mainly includes two fields: machine learning and cognitive science. In this study, deep learning is a concept developed from the field of cognitive science. It is also sometimes regarded by scholars as deeper learning. The National Research Council's Committee on Defining Deeper Learning (2012) concludes that deeper learning is the process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (i.e. transfer) by developing cognitive, interpersonal, and intrapersonal competencies (NRCC,2012). The Hewlett Foundation (2012) defines deeper learning as the skills and knowledge students will need to succeed in a world that is changing at an unprecedented pace. Deeper learning prepares students to master core academic content, think critically, and solve complex problems, work collaboratively, communicate effectively, and learn how to learn (for example, self-directed learning). Some researchers also believe that deep learning is a new learning method for decision making and problem-solving. The type of learning that results from students′ self-directed application of critical and creative thinking, problem-solving, communication, and collaboration to deepen their understanding of key concepts in the curriculum. Deeper learning is also the outcome of those processes (Bellanca, 2014).

Combining previous scholars' research on deep learning, the author figures that the two aspects including cognitive and non-cognitive factors these two aspects may influence deep learning, as shown in Figure 1. The cognitive factor includes relating new ideas and concepts to previous knowledge and experience, integrating their knowledge into interrelated conceptual systems, and looking for patterns and underlying principles, evaluating new ideas, and relate them to conclusions. Also, deep learning means that learners understand the process of dialogue through which knowledge is created and that they examine the logic of an argument critically. Non-cognitive factors mainly include students' learning interest and attitude, as well as learning situations that can effectively set up for deep learning. The stimulation of learning interest is the key to successful teaching, which makes it easier for students to concentrate on the classroom and may benefit the exploration of new knowledge. Finally, it is possible to have deep learning.

Participants in this study were children aged about 11 years old. According to Piaget's staged division of students' cognitive development, they are in the specific stage of operation. At this period, the children are freed from the apparent thinking, and their cognitive structure already has an abstract concept, so it can carry out logical reasoning. But the operation is still inseparable from the support of specific things (Shi, 2013). Although compared with the first two stages, children have made some progress, their cognitive ability is still weak, and it is difficult to establish links to connect the knowledge. Because of the age characteristics of students, while using information technology to promote deep learning in primary school mathematics, educators should pay more attention to establish the connection between various teaching contents. Teachers need to combine students' cognitive development rules and use information technology to create a kind of virtual reality life scenes for enabling them to establish mathematics learning methods in vivid and specific situations, fully mobilize students' multi-sensory participation, stimulate students' enthusiasm for learning, and change students' learning attitudes. Thus, promoting deep learning of mathematics in primary school.

The construction of the learning context is an important indicator to measure the effectiveness of classroom teaching. Teachers use the skills of creating scenarios to enable students to learn effectively in the learning context. The effect of learning and the ability to transfer knowledge can better reflect the meaning of deep learning, which requires students to learn and apply abstract and complicated knowledge based on understanding, not simply through repeated memory. Studies have shown that the application of ICT can provide certain situational support for the occurrence of deep learning (Peng, 2020). In this study, situational construction is mainly based on the E-schoolbag environment supported by information technology.

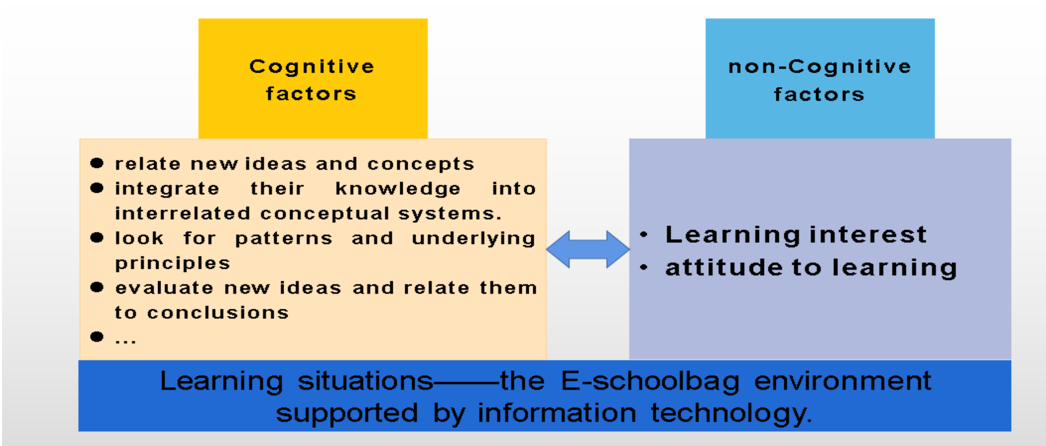

Figure1 Factors influencing the occurrence of deep learning

Research Method

This study adopted a quasi-experimental research design. The content of this study is aimed to confirm that information technology promotes deep learning in elementary mathematics. In this study, information technology mainly refers to E-schoolbag. The process is shown in figure2.

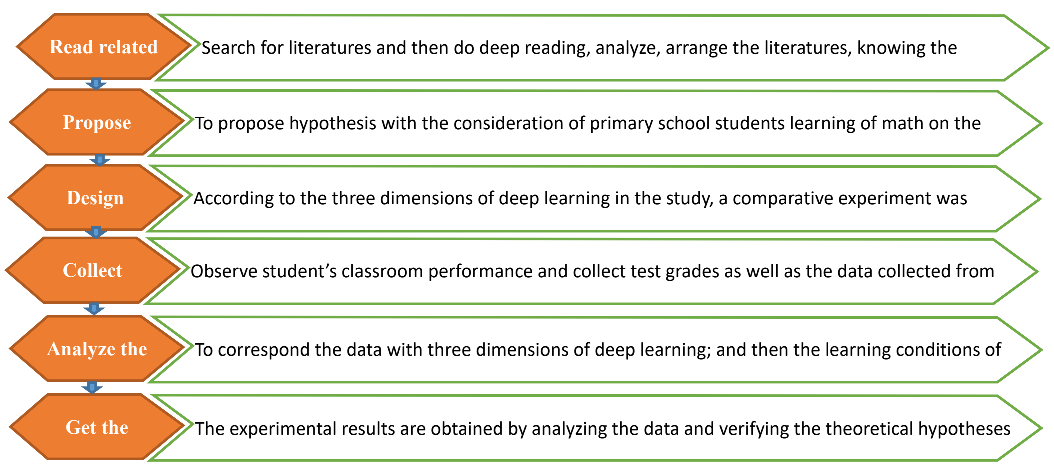

Figure 2 Research process

Research Design

Data source

Two classes in the fifth grade in GY Experimental Primary School were enrolled in the study. In the mid-term exam, the mathematics scores of the two classes were comparable, providing pre-test data for further comparative studies. GY Experimental Primary School is currently one of the province's demonstration schools for information teaching. The school fully recognizes the important role of information technology in education and teaching, and actively promote ICT application in education, increases training on information technology applications for teachers, and actively uses multimedia. The collection and analysis of the data used in this study were carried out with the consent of the school.

The framework of research design

This study is designed from the three dimensions of cognitive ability, learning interest, and learning situation in deep learning. Firstly, data from observing the classrooms of the control class and the experimental class was collected, and then we have analyzed whether the situation constructed by information technology has a certain promotion effect for students; Secondly, some students from the experimental class and the control class were randomly selected to participate in the interview. The goal of selection was to understand the students' interest in learning mathematics and to compare the influence of different pedagogics on students' interest in learning. Thirdly, tests are designed for the course content and the test scores have been analyzed with SPSS software. The scores of the experimental and control classes were compared to see if there was a significant difference between the experimental and control classes, and further to infer whether the students have achieved meaningful learning or deep learning in the classroom.

In this study, we set two classes. In the experimental class, E-schoolbag was adopted to support learning, the control class did not adopt the learning situation supported by E-schoolbag, E-schoolbags were mainly used as learning terminals for students. Besides, the teaching environment of both classes is the same, each student has the textbook, paper, and pen, and the classroom is equipped with a blackboard and an electronic whiteboard.

The data of the cognitive changes of relevant knowledge points of students was collected through tests and then we obtained the non-cognitive data affecting the occurrence of deep learning through interviews and observation.

Informational Instructional Design

In the traditional classroom, students were taught in a passive position. Their knowledge is mainly derived from the instruction of teachers. In the 21st century, the unpredictability of mathematics classrooms in primary school has also increased accordingly. Teachers need to reconsider more factors and carry out a more specific instructional design. Therefore, to optimize the effect of information technology for promoting deep learning of mathematics in primary school, it is necessary to properly handle various contents such as textbook analysis, academic analysis, creation of learning environment, teaching strategy, and teaching process. And then we have proposed a specific teaching design plan here as following:

Analysis of teaching materials

This study selected the content of the “Division” in the fifth grade of the Compulsory Education Curriculum Standard Experimental Mathematics Textbook. These students who take part in our research are 10-11 years old. The textbook contains two sections including the largest common divisor and the divisor. The divisor is the direct application of the basic properties of fractions, and it is a common method to simplify fractions. Learning about fractions can not only improve the understanding of the basic nature of fractions but also lay a foundation for learning the four operations of fractions.

Analysis of the learning situation

Considering that our participants are fifth-grade students, teachers should pay special attention to the specific reflection of the students while teaching, and adjust the teaching plan at any time during the whole class. The case in this study chose a total of seventy students from class 3 and class 4, most of the students were motivated to learn mathematics, who could acquire knowledge from the existing knowledge and experience, the abstract thinking ability has also developed during learning, the basic knowledge is relatively solid, there is the certain ability to learn mathematics.

Results and discussion

Classroom observation analysis and discussion

Through observing the control class and experimental class, it was found that the traditional classroom and the information classroom showed significant differences in the expression forms of the teaching content, the teacher and student activities, the media application, and the teaching procedures as well as methods. In the series of traditional classroom activities featured with a lead-in by reviewing, teaching new lessen, consolidating and summarizing new courses-summary courses, the teaching content is simple, mainly based on imparting knowledge, occasionally joining discussions and questions, and rarely using information technology. Students are only passively accepting knowledge. However, in the series of informational classroom activities from Happy Review-Scenario, context lead-in, explore new knowledge, thinking expansion-consolidation to the summary, the teaching content is diversified. Teacher-student interaction and human-computer interaction are more obvious. The teacher plays the role of a leader and helper of student learning. The students are in the teaching situation constructed by information technology. Thus, their interest in learning is high, the motivation for learning is obvious, and the knowledge is acquired through group discussion and inquiry activities, which contributes to the knowledge content. Deep understanding will result in deep learning.

Interview data analysis and conclusion

Interviewee: twenty students were randomly selected from class 3 and Class 4, grade 5 of G Experimental Primary School. In this interview, 90% of the students in the experimental class reported that they like mathematics classes, because the application of various information methods enables students to actively participate in the classroom, and for some difficult knowledge point. Information technology can transform abstract mathematical symbols into visual and intuitive things, especially many animations that can show the mathematical operation process in the E-schoolbag, which makes students understand easily. Besides, the use of gadgets such as photographs and mutual evaluations increases the curiosity of students in the mathematics classroom, and the students' attention is more likely to focus on the classroom, which is conducive to student learning. 85% of the students in the controlled class say they don’t like mathematics, because mathematics knowledge is difficult, difficult to understand, and they are eager to communicate with their peers at any time to solve the problem and experience. In the context of informational teaching, the classroom tends to be transparent. Each participates, everyone is equal, and it can stimulate students' interest in mathematics.

Test data analysis and conclusion

The data was collected through two different treatments for two homogeneous samples to judge whether the results are different. Therefore, the data processing method of the paired-sample T-test in SPSS software is selected. The data is judged whether there is a significant difference in the mean of the paired population from which the sample is derived. Firstly, establish the null hypothesis $H0:\mu 1 = \mu 2$, that is, it is assumed that there is no significant difference between the test scores of the experimental class and the controlled class. It means that the application of information technology means in the classroom does not have any influence on the student's learning. Secondly, the significance level of the hypothesis is determined to be$\alpha=0.05$. The following is an analysis of test scores:

Table 1 Paired sample statistics

		Mean	N	Standard deviation	The standard error of the mean
1	Scores of multiple choice in experiment class	34.7714	35	10.47149	1.77000
	Scores of multiple-choice in controlled class	35.2857	35	12.13786	2.05167
2	Scores of Ture or False questions in the experimental class	23.4286	35	6.39064	1.08022
	Scores of Ture or False questions in a controlled class	20.7143	35	6.20043	1.04806
3	Scores of subjective exercises in experimental class	22.4286	35	4.59722	.77707
	Scores of subjective exercises in a controlled class	15.7143	35	7.08591	1.19774
4	Total score in experimental class	80.6286	35	16.07535	2.71723
	Total score in controlled class	71.7143	35	15.66106	2.64720

As shown in Table 1. The average score of the experimental class multiple-choice questions is lower than the average score of the control class. The average scores of the Ture or False questions and the subjective questions in the experimental class are higher than that of the controlled class; accordingly, the average score of the experimental class is higher than the average score of the control class. It can be seen the two pairs of samples has a certain amount of change, but to determine whether the change is significant, or whether it is an essential difference, it is necessary to calculate the corresponding statics in two sets of samples.t statistic.

Table 2 Paired sample test

		Pairwise difference					t	df	Sig. (two sides)
					95% confidence interval for the difference				
		Mean	Standard deviation	The standard error of the mean	Lower limit	Upper limit			
1	Experiment class multiple-choice score - control class multiple-choice score	-.51429	15.70008	2.65380	-5.90745	4.87888	-.194	34	.847
2	Experimental class judgment score - control class judgment score	2.71429	8.34397	1.41039	-.15197	5.58054	1.924	34	.063
For 3	The subject class score of the experimental class - the subjective subject score of the control class	6.71429	9.54424	1.61327	3.43573	9.99285	4.162	34	.000
4	Experimental class total score - total score of the control class	8.91429	22.19482	3.75161	1.29010	16.53847	2.376	34	.023

Table 2 shows the key paired sample t-test results. The scores of multiple-choice tests in the experimental class and control class were $p = 0.847 > 0.05$, which means that there is no significant difference between the two. Still, the experimental class judgment scores and the control class judgment questions. The score of $p=0.063>0.05$, there is no significant difference between the two; the score of subjective exercise of the experimental class and that of the controlled class are $p=0.000<0.05$, which indicates that in the case of the significance level of 0.05, the two-sided tests worth accompanying probability value $p<0.05$, so the null hypothesis H0 should be eliminated and the alternative hypothesis

H1should be accepted. Therefore, there is an obvious difference between the scores of subjective exercises of the experimental class and that of the controlled class; the total score of the experimental class and the total score of the controlled class are $p<0.05$, which indicate that in the case of a significance level of 0.05, the two-sided T-test worth accompanying probability value $p<0.05$, so reject the null hypothesis H0 and accept the alternative hypothesis H1. Still, there is also a significant difference between the total score of the experimental class and the total score of the controlled class.

According to the above data analysis results, in the classroom teaching with information technology, the accuracy rate of subjective question is relatively high, so that the overall performance of the class is better than the controlled class, which shows that students start their meaningful learning and generate deep learning.

Limitations

In the early stage of the study, although a large amount of literature was reviewed, a more comprehensive research design was carried out; the teaching classroom was analyzed and tested during the implementation process; the post-experimental data analysis was consulted by the teacher and teachers read many related books, there are still some limits which need to be further explored in the future. Firstly, the experimental samples in the empirical study relatively small, and the experiment was conducted on a tight schedule. Second, due to the limitation of manpower, material resources, and financial resources, the research only selected two classes. The effectiveness of information technology to promote deep learning in primary school mathematics needs to be tested, verified, and adjusted within a larger time and space.

Conclusion

Information technology is a developing concept. In the process of exploring information technology which can promote deep learning in primary school mathematics, by the observation record monthly and teaching effects evaluation on the students in class 3 and 4 in fifth grade, it was found in the primary mathematics classroom that rational application of information technology can promote students' deep learning.

The author believes that teachers should provide students with a good learning environment, create a reasonable teaching situation, and infiltrate lead-in, new teaching consolidation, and other parts of the teaching, to help students to sort out the relationship between various contents, thus achieving the task of completing teaching aims. However, the proper use of information technology in this process will produce a good impetus.

Future research should examine the certain reference significance for the teaching of teachers teaching mathematics in primary school. The author calls on society, schools, teachers, and parents to attach importance to the role of information technology, using information technology to promote primary school mathematics learning, and jointly construct information learning environments for students. And the final purpose is to cultivate students' interest in learning mathematics, improve the effectiveness of students' mathematics learning, and better realize the aim of deep learning.

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Examining 10th Grade Students' Problem Solving Processes in Geometry Using Eye Tracking Technology

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Introduction

Problem solving consists of actions performed for a goal (Anderson, 1985). This ability has been at the core of mathematics education since it reflects the ability to cope with problems in and outside school (NCTM, 2000; Simsek, Uygun, & Güner, 2020). The actions taken to solve a problem are related to cognitive processes (Metallidou, 2009). Researchers proposed various explanations for these processes and stages of problem solving. Lin and Lin (2014b) listed these processes that a solver must comprehend the initial text and the diagram, search for overlapping information with existing one, make a deduction, and do calculations to reach a solution. Correspondingly, Gal and Linchevski (2010) indicated that geometry tasks include consecutive phases from neural processes to higher cognitive ones such as reasoning and deduction. Epelboim and Suppes (2001) stated these stages, respectively, as reading the text, creating a diagram, looking for familiar patterns, recalling relevant information, and reaching a solution. Students might have difficulty while activating required cognitive processes in problem solving. Representations such as diagrams, graphs, tables, and charts are frequently used to help students to understand mathematical ideas within the problem solving context (Bolden, Barmby, Raine, & Gardner, 2015). It has been shown that diagrams presented by geometry problems aid students' understanding of mathematical concepts and problem statements (Brenner et al., 1997) and leading them to a solution (Greeno & Hall, 1997). They play a role in representing and explaining the mathematical ideas required to solve problems. Students should be able to gather properties and relevant information from the diagram and use them while solving geometry problems (Laborde, 2005). However, it is not certain that they can obtain the necessary knowledge (Pape & Tchoshanov, 2001), and they might have difficulty in making correct inferences during this process.

Students use a variety of strategies during problem solving processes. This variation might derive from task characteristics (Gluck & Fitting, 2003). These strategies have different descriptions and classifications. Mayer defined a problem solving strategy as a guideline which not always lead to a solution (as cited in Gick, 1986, p.100). Dividing problems into parts is a common technique used in problem solving regardless of the domains. Another general strategy used by Simon and Newell (1971) is called as means-ends analysis. It includes filling the gap between the initial state and the aim of the problem. Assessing and evaluating students' problem solving processes provides information about their views about the context, difficulties, understanding, thinking methods, and strategies (Hegarty & Kozhevnikov, 1999; Simsek, Uygun, & Güner, 2020). However, it is critical to select assessment tools to reveal this information. Prior studies frequently used self-reports and interview methods to assess problem solving processes and analyze students' strategies used during these processes (Huang, 2017) and considered solution time and accuracy as problem solving measures which generate weak information about the internal cognitive process (Knoblich, Ohlsson, & Raney, 2001). However, it requires more influential techniques due to its complex nature. Eye tracking technology has the potential to observe problem solving processes in depth by capturing information people are attending during working on a task (Andrá et al., 2015). The explanations based on eye movement measures might differ according to the context of the study. As an example, Duchowski (2007) specified that as the complication of problem increase, fixation number, and duration increase in that vein. However, problem difficulty cannot be the reason for the higher duration that individuals spend while looking at a point and higher times they look at that point in all conditions. In the study conducted by Lin and Lin (2014a), solvers good at geometry spent more time in an output area since they desired for more plausible answers. Therefore, it is essential to investigate the changes of eye movements measures and target specific explanations for these changes. Moreover, there have been various research studies about eye tracking and problem solving in different contexts; however, problem solving process itself needs to be investigated as Schindler and Lilienthal (2019) suggested.

Methodology

Eye tracking, which facilitates objective and assessment in an educational context was used in the study. The data of eye tracking was supported by Spatial Ability Test (SAT) results and transcripts of think aloud and interviews. The purpose of the study was to provide an overall analysis of the participants' problem solving processes. Mainly, this study was conducted to examine the following research questions:

- What are the problem solving strategies that high school students are using during problem solving in geometry?
- How do eye movement measures change during problem solving processes at different problems and different parts of the problems?

Eight high school students participated in the study with an approval received from Middle East Technical University Human Subjects Ethics Committee. Both students and their parents signed a consent form to specify voluntary participation and the approval that their children participate in the study. All participants first answered Spatial Ability Test (SAT) which measures participants' spatial abilities. Afterward, they tried to solve six geometry problems on the computer. They were asked to think aloud, and their eye movements were recorded by Tobii X2-60 Eye Tracker during problem solving. In geometry problems posed by a diagram, two Area of Interests (AOIs), which are diagram and text, were defined. Diagram AOI implies problem figures, while Text AOI refers to written information related to the problem. The changes in specified eye movements measures, which are fixation count, total fixation duration, and visit count, were analyzed according to these two AOIs. Lastly, an interview was done with each student to examine problem solving strategies. Eye tracking data was used to decide whether eye tracking measures differ according to variation in problems and parts of a problem. The eye tracking data was compared with Spatial Ability Test (SAT) to make sense of participants' eye movements. This data was also supported by think aloud protocol and interview method to determine participants' problem solving strategies of geometry.

Findings

Spatial Ability Test Scores

Spatial Ability Test designed by Ekstrom et al. (1976) and translated into Turkish by Delialioğlu (1996) is used in this study to assess participants' spatial abilities. It includes four different tests, which are Card Rotation Test (CRT), Cube Comparison Test (CCT), Paper Folding Test (PFT), and Surface Development Test (SDT). First two tests are used to assess spatial orientation ability, while last two tests are used to assess spatial visualization. The results stated that Participant2 has the highest score in all results, while Participant5 has the lowest score. Participants' Spatial Ability Test (SAT) scores indicated that the highest total score out of 282 is 267, which belongs to Participant2. On the other hand, the lowest total score is 105. Specifically, the scores range from 11-19 out of 20 in PFT, 26-58 out of 60 in SDT, 24-33 out of 42 in CCT, and lastly 38-158 out of 160 in CRT. The highest scores for PFT, SDT, and CRT belong to Participant2. Participant7 got the highest score for CCT. Participant1, Participant3, Participant4, Participant7, and Participant8 gave correct answers to more than half of the questions in all parts of the test. Participant5 did not answer all of the questions; in fact, she did not make any selection among drawings of a card within 80 items in the second part of the CRT. There are more unanswered questions than half of the items, which 145 empty questions out of 282. Participant6 has the lowest score for SDT.

Problem Solving Strategies

Table 1. Strategies used by participants

	Holistic Strategies		Analytic Strategies		
	Mereologic Way	Visual Strategy	Preproportional Reasoning	Qualitative Proportional Reasoning	Quantitative Proportional Reasoning
Participants					
P1	4	2			2
P2	3		1		3
P3	1	1	1		
P4	3		2		1
P5		2	2		
P6		1	2		
P7	1		2		1
P8	1		1	2	
Total	13	6	11	2	7

Note: The total number of questions asked in this study was 6. To solve one question, more than one strategy could be used.

In response to the first research question, problem solving strategies were analyzed under two strategies, which are holistic and analytic strategies. Holistic strategies have two subcategories, which are mereologic way and visual in this study. On the other hand, analytic strategies have three subcategories, which are preproportional reasoning, qualitative proportional reasoning, and quantitative proportional reasoning. As seen in the Table 1, the most preferred strategy was the mereologic way. Preproportional reasoning was used at least one by all participants except P1 and it was the second most preferred strategy. Quantitative proportional reasoning was used seven times while qualitative proportional reasoning was used two times by only P8. Lastly, visual strategy was used six times.

Eye Movement Measures Changes

To answer the second research question, eye movement measures, which are Fixation Count (FC), Total Fixation Duration (TFD), and Visit Count (VC), were analyzed. PFT and CCT, parts of SAT, were determined as covariates. The multivariate analysis results indicated a statistically significant difference of problems on eye movement measures, Wilk's λ = .484, F (15,221) = 4.432, p= .000. Also, a statistically significant difference of problem parts on eye movement measures was acquired, Wilk's λ = .424, F (3,80) = 36.195[b], p= .000. The results are shown in Table 2.

Table 2. The Effects of Problem Parts and Problems

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Problem Parts	Pillai's Trace	,576	36,195[b]	3,000	80,000	,000	,576	108,585	1,000
	Wilks' Lambda	,424	36,195[b]	3,000	80,000	,000	,576	108,585	1,000
	Hotelling's Trace	1,357	36,195[b]	3,000	80,000	,000	,576	108,585	1,000
	Roy's Largest Root	1,357	36,195[b]	3,000	80,000	,000	,576	108,585	1,000
Problems	Pillai's Trace	,573	3,871	15,000	246,000	,000	,191	58,072	1,000
	Wilks' Lambda	,484	4,432	15,000	221,246	,000	,215	60,509	1,000
	Hotelling's Trace	,951	4,985	15,000	236,000	,000	,241	74,779	1,000
	Roy's Largest Root	,819	13,437[c]	5,000	82,000	,000	,450	67,186	1,000

The results of between subject analysis to conduct the effects on each measure stated that there is a significant difference of problems on visit count, F (11,84) = 7.813, p= .000. However, there is no significant effect on fixation count, F (11,84) = 1.604, p= .168 and total fixation duration, F (11,84) = 1.508, p= .196. Between subject analysis also indicates the effects of problem parts on each eye movement measures. There is a significant difference of problem parts on fixation count and total fixation duration, F (11,84) = 63.620, p= .000, F (11,84) = 60.247, p= .000 respectively. However, there is no significant difference on visit count, F (11,84) = .988, p= .323. The results of between subject analysis are shown in Table 3.

Table 3. The Effects of Problem Parts and Problems on FC, TFD, and VC

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Problem Parts	FC	1180597,042	1	1180597,042	63,620	,000	,437	63,620	1,000
	TFD	85933,831	1	85933,831	60,247	,000	,424	60,247	1,000
	VC	322,667	1	322,667	,988	,323	,012	,988	,166
Problems	FC	148839,958	5	29767,992	1,604	,168	,089	8,021	,533
	TFD	10757,239	5	2151,448	1,508	,196	,084	7,542	,504
	VC	12760,500	5	2552,100	7,813	,000	,323	39,067	,999

Regarding the problem parts, Table 4 showed that the means of diagram part were higher in all eye movement measures when compared to the text part. A statistically significant difference was obtained means between the diagram and the text parts on FC, p= .000 and TFD, p=.000. However, there was not a significant difference on VC, p= .323.

Table 4. Comparisons of Problem Parts

Dependent Variable	(I) ProblemParts	(J) ProblemParts	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
FC	diagrampart	textpart	221,792*	27,807	,000	166,475	277,108
	textpart	diagrampart	-221,792*	27,807	,000	-277,108	-166,475
TFD	diagrampart	textpart	59,838*	7,709	,000	44,502	75,174
	textpart	diagrampart	-59,838*	7,709	,000	-75,174	-44,502
VC	diagrampart	textpart	3,667	3,689	,323	-3,672	11,006
	textpart	diagrampart	-3,667	3,689	,323	-11,006	3,672

Based on estimated marginal means
*. The mean difference is significant at the ,05 level.
b. Adjustment for multiple comparisons: Bonferroni.

Regarding the problems, the results indicated that there was a significant difference in visit count between Question 1 and Question 2, Question 2 and Question 3, Question 2 and Question 4, Question 2 and Question 5, and Question 2 and Question 6. As mentioned above, there were no statistically significant effect of problems on fixation count and total fixation duration. Therefore, Table 5 shows the results of visit count.

Table 5. Comparisons of Problems

Dependent Variable	(I) Problems	(J) Problems	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
VC	Question1	Question2	-32,938*	6,390	,000	-52,258	-13,617
		Question3	-8,750	6,390	1,000	-28,070	10,570
		Question4	-10,125	6,390	1,000	-29,445	9,195
		Question5	2,500	6,390	1,000	-16,820	21,820
		Question6	-5,813	6,390	1,000	-25,133	13,508
	Question2	Question1	32,938*	6,390	,000	13,617	52,258
		Question3	24,188*	6,390	,004	4,867	43,508
		Question4	22,813*	6,390	,009	3,492	42,133
		Question5	35,438*	6,390	,000	16,117	54,758
		Question6	27,125*	6,390	,001	7,805	46,445
	Question3	Question1	8,750	6,390	1,000	-10,570	28,070
		Question2	-24,188*	6,390	,004	-43,508	-4,867
		Question4	-1,375	6,390	1,000	-20,695	17,945
		Question5	11,250	6,390	1,000	-8,070	30,570
		Question6	2,938	6,390	1,000	-16,383	22,258
	Question4	Question1	10,125	6,390	1,000	-9,195	29,445
		Question2	-22,813*	6,390	,009	-42,133	-3,492

	Question3	1,375	6,390	1,000	-17,945	20,695
	Question5	12,625	6,390	,773	-6,695	31,945
	Question6	4,313	6,390	1,000	-15,008	23,633
Question5	Question1	-2,500	6,390	1,000	-21,820	16,820
	Question2	-35,438*	6,390	,000	-54,758	-16,117
	Question3	-11,250	6,390	1,000	-30,570	8,070
	Question4	-12,625	6,390	,773	-31,945	6,695
	Question6	-8,313	6,390	1,000	-27,633	11,008
Question6	Question1	5,813	6,390	1,000	-13,508	25,133
	Question2	-27,125*	6,390	,001	-46,445	-7,805
	Question3	-2,938	6,390	1,000	-22,258	16,383
	Question4	-4,313	6,390	1,000	-23,633	15,008
	Question5	8,313	6,390	1,000	-11,008	27,633

Based on estimated marginal means
*. The mean difference is significant at the ,05 level.
b. Adjustment for multiple comparisons: Bonferroni.

Moreover, heat maps which are powerful visualizations for visual attention were investigated. As an example, Figure 1 shows the participants' focus for Q1 and Q2. Heat map of Q1 indicates that participants mostly looked at the diagram part compared to text part. Heat map of Q2 specifically indicates the focus on the base of the triangle while the focus is gathered on the line segment AC and also the point F located on this line segment in the diagram part.

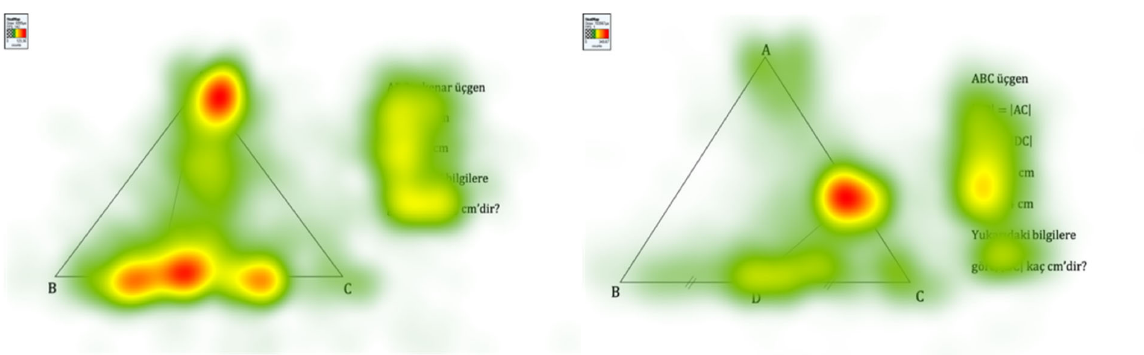

Figure 1. The participants' focus on Q1 and Q2, respectively

Limitations of the Study

This study is limited to one city of Turkey and only high school students who volunteered to participate in the study were targeted. There might be an eye tracking effect since students were aware that they are being recorded.

Conclusion and Discussion

The findings of think aloud protocol and interviews indicate that students use different strategies during solving process. The mereologic way was the most preferred strategy, while qualitative proportional reasoning was the least. This variation in strategies derives from problem characteristics (Gluck & Fitting, 2003), difficulty, and complexity (Gitimu & Workman, 2007). While the use of strategies led them to a solution, they sometimes had difficulty in solving processes. In some cases, students could not reach the correct answer since they missed crucial geometric information to apply their strategies as Lin and Lin (2014b) stated. Another reason that some students could not be successful while applying a strategy is attributing some label to geometric figures without proof or justification. For example, assuming a line is perpendicular or a triangle is an equilateral or isosceles without analyzing well and correctly resulted in incorrect solution. Moreover, participants repeated that they are not able to remember the question type and how to solve these types of question. It means that they focused on the way of solution instead of analysis of the question or use of geometric knowledge.

The eye movement measures findings state that participants have higher fixation count, total fixation duration, and visit count in diagram part compared to text part, after controlling Paper Folding Test and Cube Comparison Test scores. The finding is in line with the results which proposed that participants had longer fixations to the diagram since they required to reread the diagram when they felt difficulty (Lin & Lin, 2014a). Just and Carpenter (1976) suggested that more fixation count is related to cognitive processes, in this regard extracting necessary information from the diagram to solve a problem can be resulted in increasing focus on diagram. Questions asked in the study required modifying diagram such as dividing the object into parts or exploring geometric relationships such as proportionality. Additionally, as mentioned above, some students attempted to recognize and remember the question type while looking at the diagram. Therefore, it is reasonable to obtain higher fixation-based measures. The present study is also in accordance with results that different Area of Interests and problems effect fixation count (Lin & Lin, 2014a).

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Online Courses Accessibility For Low-Vision

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Abstract

This qualitative study tends to explore what accessibility design can be most important to facilitate learning in an online course for postsecondary students with low vision. The study is conducted in a U.S. public university offering online courses in the Midwest. This study was guided by two research questions: (1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning? (2) What accessible features would students with low vision want to exist in future online courses? The theoretical framework for this study was Universal Design for Learning (UDL). Three participants were interviewed to share their experience with online learning and to explore which accessibility aspects were perceived the most helpful for students with low vision. The finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and accessible PDF files—were the most helpful accessible text format in the online courses. In addition, the finding showed headings and color contrasting for the online content are the main aspects of design to increase accessibility and to facilitate reading for students with low vision. The last finding revealed that students with low vision need two additional accessibility design to be employed in online courses: audio response and instructor video.

Keywords – Online learning, Accessibility, Low-Vision, Visual impaired

1. Introduction

In the last two decades, due to flexibility and accessibility, online courses are becoming increasingly popular among non-traditional students and learners who have (in)visible disabilities (Summers et al., 2014). Students with disabilities need support, particularly, students with low vision need special accessible features in online courses because they have some difficulties dealing with the technologies (Crow, 2008; Fichten et al., 2009; Summers et al.,2014). Universal Design of Learning (UDL) provides several accommodations for postsecondary students with low vision through using assistive technology and providing a variety of accessible features for this type of vulnerable population (Crow, 2008). Relevant research (Lorenzin & Wittich 2019; Okiki, 2019) shows that low vision students will succeed academically when they take online courses with proper accessibility design. To explore which types of accessibility design aspects, based on the UDL principles, are deemed to be appropriate for online settings, this qualitative study seeks to understand the perceptions of students with low vision.

2. Literature Review

2.1.Online Courses

Online courses attempt to create a type of learning environment and serve as a process of connecting students, instructors, and learning resources when they are not physically present in the same location (Park & Choi, 2009). In 1997, the first online course platform was launched at famous universities, such as Yale, Cornel, and University of Pittsburgh. In the same year, a Learning Management System (LMS) known as Blackboard™ was founded and has become widespread to deliver online instruction and it is still utilized in many educational institutions and universities across the globe (Morton, 2016). Online courses use asynchronous and synchronous technologies. Synchronous technology requires students and instructors to work at the same time but not in the same place through using video conference (Palmer, 2012). In contrast, asynchronous technology does not require students and instructors to work at the same time (Palmer, 2012). They can work independently at a convenient scheduled time for each of them.

In the last three decades, online courses have significantly increased in higher education (Betts et al., 2013). Recently, 30% of postsecondary students are enrolled in at least one online course in one of the U.S higher education institutions (Cole et al., 2014). Although online courses have increased, students with disabilities enrolling in institutions of higher education have also increased over the last twenty-five years (Lyman et al., 2016). Higher education has attempted to make online courses more effective and accessible for all students, however, some instructors and/or institutions may overlook the needs of students with disabilities (Kharade & Peese, 2012). Cook and Gladhart (2002) stated that 10% to 15% of postsecondary students identify themselves as disabled. According to the American Disabilities Act (ADA), a disability is a physical or mental impairment that substantially limits one or more major life activities. To be labeled as disabled, a person must have a history or record of such an impairment, or a person should be perceived by others as having such an impairment. These self-identified students with disabilities should have equal opportunities in their online courses as other students.

2.2.Online Courses for Students with Low Vision

Low vision is one of the common types of visual disabilities (Richardson, 2014). It is defined as the functional limitation of the eye or eyes or the vision system (The American Foundation for the Blind, 2015). The American Foundation for the Blind (AFB) defines low vision as a condition caused by eye disease in which visual acuity is 20/70 or poorer in the better-seeing eye and cannot be corrected or improved with regular eyeglasses (AFB, 2015). Students with low vision usually have several academic difficulties (Moola, 2015). One of these difficulties is using technology because sometimes they cannot adjust technology according to their needs. For purpose of this study, low vision identifies as "a person who has difficulty accomplishing visual tasks, even with prescribed corrective lenses, but who can enhance his or her ability to accomplish these tasks with the use of compensatory visual strategies, low vision and other devices, and environmental modifications" (Corn & Koenig, 1996, p.4).

Consequently, the emergence of online courses has brought challenges for students with low vision (Argyropoulos et al., 2019; Summers et al., 2014). The literature on the experiences of students with low vision is scarce, and most seminal articles focus on students with disabilities without specifying the type of disability (Lorenzin & Wittich 2019; Okiki, 2019). However, some relevant studies (e.g., Lee & Oh, 2017; Richardson, 2014) had observed that students with low vision are not often active in online courses due to the challenges they face in interacting with learning materials. On the contrary, several studies suggest online courses are beneficial for students with low vision since they provide remote learning experience (Barnard et al.,2012; Haegele et al., 2018; Kharade & Peese, 2012) and allow instructors to provide remote instructional assistance to the students anytime and anywhere even if they live far from the main campuses of the universities (Holmgren, 2018).

Online courses benefit students with low vision because they can find a solution for the challenges attending physically on campus, which poses great difficulty for them (Kharade & Peesa, 2012; William et al., 2006). Kharade and Peesa (2012) addressed that the flexibility in the location, scheduling, and delivery of online courses reduced the challenges for attending on campus by providing flexibility in time and place of delivery. Feucht and Holmgren (2018) reported that students with low vision drop out because they cannot drive to the campus and do not live close to the campus. Walking around campus is also a challenge because sometimes it requires students with a very low vision to use aids such as a cane or a guide dog. This is because in some cases students with low vision cannot even see the small things, or in other cases, students with low vision cannot see things in bright or dark places. Therefore, they often have a difficult time self-navigating outside of well-known environments and prefer to be indoors (Long et al., 1990), and some prefer to study and work in small physical spaces (Haegele et al., 2018). As a result, low vision affects a person's ability to learn or perform many job duties, which severely limits his/her main life opportunities for education and employment (Long et al., 1990). Therefore, online courses became such a great option for students with low vision to complete their educational degrees and be more motivated to succeed (Kharade & Peese, 2012).

Besides flexibility, online courses allow students with low vision to adjust the instructional material through assistive technologies according to their needs (Crow, 2008; Fichten et al., 2009) during learning, reading, writing and acquiring academic and nonacademic skills (Hewett et al., 2017; Rosner & Perlman, 2018). In addition, using assistive technologies in online courses help students facilitate learning and receive equal learning opportunities (Hewett et al., 2017). Because of this equality, students with low vision can be more active and motivated to participate in online activities such as discussion and group work. Assistive technologies help to improve the quality of learning for students with low vision (Crow, 2008). Online courses with assistive technologies encourage students with low vision to be active participants and share the ideas with classmates and instructors remotely in online course activities (Crow, 2008; Fichten et al., 2009; Hewett et al., 2017).

2.3.Accessibility

Accessibility is an important priority in online courses delivered by top universities such as Harvard University, UC Berkeley, and MIT (Alahmadi, 2017). Following their trend, many colleges and universities have started to make program and policy changes in their online courses (Zuriff, 1996). Accessibility addresses the design of technology rather than the needs of specific individuals (Alahmadi, 2017). Accessibility means using course materials and tools by all types of students, regardless of their physical and/or developmental impairments. When a course is accessible, most of the students even those with disabilities can reach the material equally. All can get access to the course delivery system, navigate the course content, submit assignments, and successfully use all course tools. The most common example of accessibility includes obtaining printed materials in alternate formats (Pittman, et al., 2014). Other examples involve the inclusion of a statement of support for students with disabilities in the course syllabus. In addition, all video content (web, DVD, and VHS) should be captioned, and transcripts of audio-based material and video-based materials should be available if they cannot be captioned.

There are several benefits of accessibility in online courses. The accessibility allows students to use flexible materials that can be adjusted according to their special needs and preferences (McKenna & Velasco, 2018; Pittman, et al., 2014). Audio, images, graphics, animations, video, or text which are often the tools to present information and the relationships between objects, actions, numbers, or events. However, visual representations are not equally accessible to all students, particularly visually impaired students (McKenna & Velasco, 2018).

3. Theoretical Framework

Most institutions of higher education in the U.S. incorporate the principles of Universal Design for Learning (UDL) into the educational and instructional materials. UDL is a framework for improving instruction because it helps provide equal opportunities for all learners to succeed. This strategy provides flexibility in how learners to access, engage with and demonstrate what they understand and increases the quality of learning materials for everyone (Rose & Mayer, 2008). UDL principles support students with low vision who have some challenges in online courses by providing resource and flexibility access to engage the students complete learning (Houston, 2018). Most of the research has found that UDL is essential for integrating students with visual impairments into higher education (Al-Azawei et al., 2016; Houston, 2018; McKenna & Velasco, 2018). According to CAST (2008) and Rose and Mayer (2008), there are three UDL principles: representation, action and expression and engagement. The first principle of UDL is "Representation," which involves providing learners with various ways of acquiring information and knowledge that have a connection to the accessibility formats, which require instructors to provide various resources to facilitate students' access to the learning materials. The second principle is "Action and Expression," which provides students with various routes to access the necessary materials using assistive technology. The third principle is "Engagement," which enables an instructor to tap into students' interests, challenges them appropriately, and motivates them to learn through facilitating resources.

This study sought to explore the perceptions of the current experiences of students with low vision in online courses to identify what accessibility design aspects offer the greatest support based on UDL guidelines and would be beneficial. This research is intended to provide recommendations for future instructors and instructional designers to consider when creating online courses for students with low vision.

4. Methodology

4.1. Setting, Sample and Participants

The study took place at a U.S. public university in the Midwest with a total enrollment of students 17,169 for Fall 2018. According to the university website (2018), there are 12,788 undergraduates, 4,121 graduates and 260 college of law. As the mission states, the school celebrates its diverse population in all its forms, including gender, race, ethnicity, ability, spirituality, sexuality, age, and individual identities. This Midwest public university offers approximately 20 undergraduate and graduate degrees online and about 10 additional certificates fully online.

For this study, purposeful sampling was used because the researcher purposefully selected the students with low vision who were enrolled in online course settings. Creswell (2009) stated that in qualitative research, researchers identify participants and sites using purposeful sampling based on places and people that can best help a researcher understand the central phenomenon. The participants were from different major and educational level and ages range from 22 to 54 years old. All the participants registered in the disability resources center (DRC) and had number of online courses taken between 3 to 6 courses. The participants had different low vision types; Retinitis Pigmentosa, Optic Nerve Coloboma, and Blurred Vision.

4.2.Research Questions

1) What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?
2) What accessible features would students with low vision want to exist in future online courses?

4.3.Data Collection

To obtain data, three students were interviewed, and the interviews were audio-recorded. Interviews were conducted either face-to-face or by telephone depending on the participants' preference. The duration of each interview was 45 to 60 minutes. They were asked around 20 questions, consisting demographic questions, questions related to their experience with online courses, and questions regarding accessibility and assistive technologies that helped them overcome their challenges.

4.4.Data Analysis

Using a professional transcription service (Rev.com) to transcribe the interviews. Then, the textual data of the interviews has been read multiple times to gain a deeper understanding on information contributed by participants (Creswell, 2012). Prior to proceeding to the data analysis, a codebook was created based on each research question: accessibility coded as AA and highlighted in pink; assistive technology coded as AT and highlighted in blue; and the wish list of the students with low vision coded as WLA and highlighted in red. The data had been analyzed line-by-line to code thoroughly. Then, applying an open-coding strategy to analyze the responses from the interviews by looking specifically for words that are related to pre-defined codes. For example, when the participants mentioned a screen reader, the researcher coded it as AT and highlighted it in blue. According to Patton (2002), the process of coding starts with segmenting and labeling similar codes to form descriptions and broad themes. Therefore, each of the pre-defined codes labeled as themes. The themes were used to respond to each research question.

5. Findings

5.1.What accessibility design did students with low vision who experienced online courses perceive to be helpful for their learning?

The participants identified three accessibility design aspects: alternative formats for materials, headings, and color contrasting for online content as the most helpful accessibility regarding their learning experiences. Ruby responded that she has a lot of reading requirements to complete the online assignments as a graduate student. She clarified, "Word document and RTF are the most beneficial types of alternative formats for textual online materials. Having formats like word documents or RTF are super helpful to access the text and use Read Aloud feature when I need it."

Sarah added, "I avoided reading. I avoided doing anything that wasn't just hands-on like the building because I'm actually in the construction trades." Also, she mentioned that she has difficulty reading a book but she can read text font "Arial' and size 16 or 18. She said, "sometimes

I get notes, teacher's notes and I actually have to change the font to just an Arial font because the New Times Roman is hard for me to read. Yeah, it has too many like little curves in it and the letters are too close." Thus, she requests alternative formats for the online textual materials to audio: "Well, everything needs to be audio for me."

In contrast, Karen described that she prefers Adobe accessible PDF version, which includes features that allow students with low vision access text to be more readable such as taking notes, searchable text, and tracking of information.

> *I would like to see that used more and more like accessible PDF documents instead of just like taking a picture. I think it's just giving me more access. For example, being able to look at like a PowerPoint in an accessible format. I can use it more easily to take notes and to keep track of information instead of having to like struggle through the slide.*

Sarah and Ruby use screen reader software, which they mentioned as the most helpful assistive technology for them. Ruby said:

> *And so being able to have, like for example, the articles that we had to read were in two formats. They were in like a scanned in PDF and they were in like a word document. And so I was able to use my screen reader to read the word document and I had access to the course material without having to ask somebody to help me read it or help me scan it and to be able to change the scanned document.*

Moreover, Sarah and Ruby use the "Read Aloud" feature in Word. For the web pages and other documents, they use screen reader software "Narrator" in Windows. They mentioned that they do not install JWAS or Kurzweil 3000 on their computers. Ruby has used JAWS in the past; however, she is not using JAWS anymore because the screen reader is available in Windows and helps her read long articles.

Additionally, the participants identified heading and color contrasting for online courses that helped them find and use online course materials. Ruby and Karen mentioned that designing online courses with headings guide them during navigating the online environment. Ruby said, "I'd say headings help split things into sections." Karen said, "have a lot of headings to navigate that makes things easier." In addition, Sarah mentioned that using contrast color for the text and background facilitates reading the PowerPoints. She described her current challenge reading some colors:

> *One of the classes I have now, he has a lecture, it's short, it's a simple lecture. But then he has a PowerPoint and that does not have any audio to it and it's kind of a struggle for me to read through that. It's actually on the university [brand]; the background is red with the black and the gray and that's actually hard to read. I think that's hard to read.*

An additional accessible design that one of the interview participants reported was added description for videos. Sarah said, "I'd say more ideal description from videos" would help students with low vision understand what is happening in the video.

5.2. What accessible features would students with low vision want to exist in future online courses?

The results revealed some of the improvement accessibility suggestions that students with low vision wished would exist in online courses. Audio and instructor video were the two alternative formats that did not exist in most of online course. The participants described two ways of using audio in online courses: audio with PowerPoint and audio response in the discussion boards. Sarah suggested that instructors in online courses should use audio with PowerPoint slides to facilitate learning; she said "when the teacher has a PowerPoint, it's great, but I have to read it. I want it to read to me and I want the word to stand out as are being read." Ruby suggested adding the option of "audio" to participate in the discussion boards; she said:

> *I think more audio would be really helpful. So I don't know if this is something that necessarily instructors would have jurisdiction over, but I guess just having it's different alternatives, communicating with discussion boards, you know maybe having like an audio option to leave audio responses. They're having a more simplified platform. So that would be one of the things on my wish list.*

Additionally**,** all the participants suggested that instructors in online courses should record videos to help the students be engaged in their learning. Karen would have more videos to understand some subjects; however, she did not specify the video types. She said, "Say we were assigned to read a chapter and then the teacher would have provided a video or something explaining certain things. I think that's always helpful." On the other hand, Ruby and Sarah specified to receive instructor-recoded videos. Ruby said, "I wish the professors would do in-person videotaping of themselves." Moreover, Sarah added that seeing the body language helps to engage the students in online courses; she said,

> *When the instructor goes into the connect and has a PowerPoint and he's just talking, I think that's okay. But it would be really nice if you actually saw him because movement, your body gestures are engaging.*

Sarah also recommended the instructors should record video to explain the course content to improve the students' learning performance; she said,

> *Everything was online. It would have been so cool if the teacher had done what my classroom teacher did and said, "Okay, here's 20 minutes, here's the problem on the chalkboard. I'm video recording myself and this is what you do and, oh, you think about this and now, you go to the next step and you have to remember that. And then …" That would have been great. I mean I know that some minor technical classes, safety will say, "Look, my last class was a safety class." I mean, I can't imagine an instructor going, if I taught the class … Ultimately I would like to teach but if I taught the class, I probably would read the book, they're like safety hazards. So let's say in the parking lot or in a building, I probably would record it. "This is a safety hazard."*

6. Discussion

6.1. Accessibility

There were three major findings related to accessibly. The first finding revealed that alternative formats for materials—such as Word documents or Rich Text formats (RTF) and Adobe accessible PDF files—were the most helpful accessible format in the online courses. These alternative formats allowed students with low vision to make changes according to their own needs and use text-to-speech assistive technology such as screen reader software or the "Read Aloud" Word file feature. All participants highlighted that the alternative formats provided them equal access to the online materials. In addition, this finding is consistent with literature (e.g. Pascual, 2014; Spooner, 2014) mentioned students with low vision preferred to use alternative formats because it allows them to edit and make changes that best suits their needs. For example, Sarah explained that she could only read the "Arial" font; therefore, having the materials in Word allowed her to change the font to "Arial" because "Times New Roman" was hard for her to read. This finding is consistent with Houston's (2018) study that recommends using Sans-Serif fonts in online course materials because Serif font types help make online content more legible to all students, including those with visual impairments. Common Sans-Serif fonts include Arial, Trebuchet, and Helvetica. On the other hand, some Serif font types—such as Times New Roman, Courier, New Century Schoolbook, and Palatino—have semi-structural details or small decorative curves on the ends of some of the strokes, making the letters and symbols challenging to read. Overall, this finding aligns with UDL "representation" principles, which entail the accessibility of instructional materials for all students, including students with disabilities, providing them equal access (CAST, 2008).

The second finding was that participants identified assistive technology within alternative formats as one of the most helpful accessibility features. The finding showed that text-to-speech reader software, such as screen reader, was the most helpful assistive technology for students with low vision to read online course materials. For instance, Sarah mentioned that she always needed to use assistive technology such as a screen reader to convert the text materials to audio. Also, other participants mentioned that using a screen reader reduced their challenges when reading online materials, as they did not have to seek assistance in reading the materials. In addition, the finding showed that Word processing was the most helpful assistive technology because of its "Read Aloud" feature. These findings are consistent with the literature that identified text-to-speech assistive technology as the most beneficial to suit the individual needs of students with low vision (e.g., Hersh & Johnson, 2010; Fichton et al., 2009; Nees & Berry, 2013). In addition, this finding is tied to the "action and expression" UDL principle, which asserts that individuals with disabilities should get opportunities for independence through the use of assistive technologies as they help them in overcoming barriers in the educational environment (CAST, 2008).

However, the findings of this study were not consistent with some literature on magnifiers as helpful assistive technology. The participants expressed that they have visual condition abilities to read the original document. Karen mentioned that magnifying or enlarging text were not helpful for her in online courses. Sarah mentioned that she avoids reading and she prefers using speech to text assistive technology to receive information through audio mode. According to this finding, magnifiers as the main method of providing accommodations were less useful than the ability to choose which forms of assistive technology were most beneficial for the online courses. Therefore, the participants needed to hear the information or conversations in online courses, so they did not need to use a magnifier but use speech to text features such as "Read Aloud" or screen reader. This finding evidence that online course designers should provide more accessible types of online materials to allow individuals to choose which type of assistive technology will work best for them such as text-to-speech.

The third finding showed two aspects of design to increase accessibility and to facilitate reading for students with low vision: headings and color contrasting for the online content. The participants indicated that headings is helpful to direct their attention toward key concepts and facilitate navigation; however, the study did not reveal adequate headings styles for students with low vision. This finding is consistent with literature (e.g., Kearns et al., 2013) that recommends online course designers to design online materials with headings and use high-contrast colors, plain backgrounds, and scalable text for low vision or colorblind students as they allow them to skim the page quickly. Headings allow students with low vision to locate the information more easily and grasp the main ideas of the text (e.g. Fichten et.al., 2009; Houston, 2018).

Online materials with low contrast can be difficult to read for students with low vision, making color contrast necessary to improve accessibility (e.g. Houston, 2018). Sarah mentioned that she had difficulty reading the online PowerPoint slides because of the black and gray text font contrasted in a red background. She expressed this background color was not suitable for her visual condition. However, this study did not expand on color contrasted of online materials. Houston (2018) suggests avoiding some color combinations that are not easy to read for students with low vision, such as blue links on black backgrounds, red text on green backgrounds, or other combinations where contrast is not enough. Although, Houston (2018) study did not find a list of color combinations that can assure accessibility for students with low vision, his study suggests that materials in online courses should be presented using a dark font color contrasted with a pale background.

Finally, UDL principles and literature (e.g. Kharade & Peese, 2012; Pittman & Heiselt, 2014) address additional beneficial accessibility aspects for students with low vision, but the findings of this study showed some of these aspects were not applicable in participants' online courses. Aspects that were not present in online courses for most of the participants in this study were closed captions on video media; a transcript of the video or audio presentation; visual analogs to represent emphasis and prosody (e.g., emoticons, symbols, or images); and text descriptors for any relevant image, graph, or chart. However, Sarah mentioned that added description for videos was helpful to understand the video contents. This finding supports UDL representation principle which suggests that presenting information in several formats increase accessibility.

6.2. Wish List for Students with Low Vision in Online Courses

The findings revealed that students with low vision need two additional accessibility design aspects: audio response and instructor video. Students with low vision can benefit from submitting their responses to discussion board as audio files. This would reduce time spent on formatting the answer, such as using a screen reader to double-check response and allow them to focus on content. This finding is consistent with (e.g. Ching & Hsu,2015) that addressed audio discussion modality in online courses; however, the literature does not address the needs of students with low vision.

In addition, the participants expressed the need for videos in which their instructor presents the content. This finding is consistent with the literature (e.g. Choi & Johnson, 2015) that addressed the positive effects that instructor-recorded videos explaining content have on students as they improve students' understanding and engagement with the materials. Relevant literature (Kim et al., 2019) suggests that audio representation of the content helped make curricula more accessible to students with low vision. Therefore, the findings of this study showed the need for inclusion of audio discussion modality and instructor's audio representation of the content to reduce the challenge and enhance the learning of students with low vision.

7. Recommendation, Implication and Conclusion

The findings of this study serve as a foundation for future research on this topic. The literature review presents research on universal design for learning (UDL), especially as it relates to accessibility and assistive technology for students with low vision. This study will help instructors and online designers who might teach online courses or might want to improve online courses. This study could primarily impact those students with low vision take online courses and face challenges, so they will have a better learning experience in online courses. Literature (e.g., Barnard-Brak & Sulak, 2010) found that students with invisible disabilities often are not comfortable disclosing their disabilities. The findings of this study also indicate online instructors should provide audio response to accommodate students with low vision in online courses.

Based on the interpretations of the findings, this study focused on one type of visual impairment; however, a much broader future study can include other visual impairment types. In addition, this case study focused on the fully online courses, so future research can be replicated in blended courses, including face-to-face and online sessions of similar size and student population. The UDL theoretical framework can help future researchers replicate the study by focusing on specific principles of universal designs for learning (UDL) because such factors affect students with low vision engagement in online courses. Other research can expand the case study to examine students' and/or professors' perceptions of the accommodations and assistive technology for engaging students with low vision in online courses. In addition, this study was limited to students with low vision; therefore, future studies can expand this case study to examine instructors' challenges when providing helpful accommodations for students with disabilities in online courses.

The findings for this study showed students with low vision identified a screen reader as the most helpful assistive technology in online courses. Future studies can employ a quantitative approach to compare two groups of students with low vision to examine the effectiveness of using specific assistive technology in online courses. In addition, this study's findings included the students with low vision preference for information delivery methods; future studies can employ quantitative methods to compare groups of students receiving different information delivery methods in online courses to understand the relationship between information delivery method and learning performance.

The overall purpose of this qualitative case study was to explore the most helpful accessibility design and assistive technology for students with low vision in online courses. Individual interviews were conducted to obtain in-depth data. This study found that the most helpful aspects for online content accessibility for students with low vision are headings, color contrasting, and alternative formats for materials, such as Word documents, Rich Text formats (RTF) or Adobe accessible PDF files. Overall, this study reveals that online courses require the inclusion of more accommodations and better implementation of UDL principles to meet the needs of students with low vision. The consideration of the findings of this study may bring about significant understanding and renovation in the online courses design that will guarantee equal learning opportunities for students with low vision. Online designers, instructors and disability resource centers may benefit from this study as the findings can guide their decisions on providing support to students with low vision.

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Appendix A

Semi-Structured Guiding Interview

Part 1:

1. When were you diagnosed with low-vision?
2. In which educational level you did recognize you needed more support and accommodations from the school or teachers/instructors?
3. Do you have other family members who have the same or a similar condition?
4. Do you learn from them? Or did you teach them how to deal with low vision in academic setting?

Part 2:

1. As a student with low-vision, do you prefer online or face-to-face courses?

Face-to-face course

Online course

Hybrid/Blended course

All types of courses

   a. Why do you prefer that type of course?

2. What are the information delivery methods (text such as pdf or word document, audio, video) that you find to be most beneficial with regard to your learning in the past online courses?
   a. How did you use those methods of delivering information to help your personal learning preferences?
   b. What currently unavailable methods of providing the information would you like to become available in the future?

3. How has accessibility and assistive technology helped you to overcome challenges in your online courses? What were these challenges?

4. Which types of accommodations and assistive technologies could contribute better to your engagement, participation and learning of the content of your online courses?

5. According to your experience, what accessibility accommodations in online courses were helpful to you and how were they helpful (to navigate the online courses, to better understand online instruction and/or to complete online activities??

   a. What accessibility design did you need in online courses but did not get to help you understand the material?
   b. What kind of visual information were you looking for in online courses?
   c. What kind of auditory information were you looking for in online courses?

6. What is your wish list regarding accessibility accommodations you'd prefer in an online course? Can you describe a specific experience where you felt like you didn't have access to services or accommodations that you thought would be helpful in your education?

7. Is there anything else you would like the researchers to know about your online course experience regarding your low-vision?

8. What question should I have asked, but didn't?

Developing An Evaluation Framework in Lesson Study on Active Learning Methods

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1. INTRODUCTION

1.1 Lesson Study

A traditional teacher-training method in Japan called Lesson Study is composed of the following four steps: goal setting, planning, research lesson, and reflection (Lewis et al. 2006). Stigler and Hiebert's (1999) book *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom* brought Lesson Study global attention, describing findings from video recordings of Japanese, German, and American eighth-grade classes that were part of the TIMSS(Trends in International Mathematics and Science Study) 1995 survey. The book attributed the high performance of Japanese junior high school students to the skills of their teachers, suggesting that Lesson Study is an approach that provides teachers with such skills. Lewis (2016) states that Lesson Study includes many initiatives that are not part of American teaching culture, one of which is the importance of "research lessons that connect teachers' discussions and practices." There is a tacit understanding that classroom improvement in the United States ends when teachers receive knowledge; this is not the case with the practice-based lesson improvement system seen in the Japanese Lesson Study. Therefore, the research lesson process connects discussions about teachers' empirical knowledge with their practice.

Much research on the Lesson Study method has reported on the nature of research lessons. Rock and Willson (2005) stated that a Lesson Study method in which university faculty members intervened in the creation of research lessons facilitated the transfer of teachers' learning to their daily work. Lesson Study includes three types of support for teachers: social, emotional, and instructional (Laura et al. 2019), suggesting the need for support for the creation of research lessons. However, few studies have been conducted on models of Lesson Study that include expert support.

1.2 Teacher Training in Japan

The National Institute for Educational Policy Research (2014) found that although there is a high demand for teacher training in Japan, there are several obstacles to teachers' participation in such training, one of which is the time consumed by their daily work. Japanese teachers have busy schedules because they spend more time on lesson planning and preparation, extracurricular activities, and administrative work than teachers in other OECD (Organisation for Economic Co-operation and Development) countries. This shows that teacher training in Japan needs to be more efficient in terms of time. However, little research has examined the Lesson Study model with a focus on time efficiency. Therefore, video-based training, which emphasizes time efficiency, was the focus of this study.

A previous study of pre-service teachers indicated that there was an increase in teachers' knowledge when training was provided with clear objectives (Seidel et al. 2013). In addition, teacher training using portable devices has been shown to be more time-efficient and effective than face-to-face training, as it is easier to participate in such training (Watanabe & Akahori 2008). This suggests that the video-viewing model is effective in teacher training; however, as mentioned earlier, it is important in Lesson Study that teachers hold discussions with each other (Lewis 2016). Thus, it was deemed necessary to emphasize face-to-face discussions and provide time for face-to-face meetings. Therefore, we paid attention to the teaching methods of the flipped class.

In the flipped class method, basic materials such as explanatory lectures are given as homework before class, and the learning necessary to develop applied skills is conducted in class (Bergmann & Sams 2012). Flipped training has been reported to promote training transfer in the context of enterprise education (Nakahara et al. 2018). It has been pointed out that teachers' attitudes and teaching methods tend to be caught up in the methods they have experienced as a reproduction of teacher culture (Kawamura 2002), and the flipped training program is expected to provide an opportunity for participants to come into contact with Active Learning methods themselves. However, the effects and challenges of flipped classroom research are unclear.

1.3 Training Evaluation

Describing the need for training evaluation, Kirkpatrick and Kirkpatrick (2006) stated: "Evaluation can tell us how to improve future programs." The evaluation in training has four levels: reaction, learning, behavior, and results (Table 1). Kirkpatrick's four-level model is considered to be the most commonly recognized model of training evaluation. However, some studies have identified a correlation with transfer training, which assesses whether the training is applied in practice, and Levels 3 and 4 (Alan & Lisa 2012).

Therefore, it is necessary to use Level 3 or higher for training transfer. However, few studies have evaluated Lesson Study using Kirkpatrick's four-level model.

Table 1. Kirkpatrick's Four-Level Model

Levels	Evaluation Concept
1. Reaction	What were the participants' reactions to the education?
2. Learning	What knowledge, skills, and attitudes were changed?
3. Behavior	What change in job behavior occurred due to the training program?
4. Result	What effect has education had on the organization and its goals?

Source: Kirkpatrick and Kirkpatrick (2006)

2. Purpose

The purpose of this study was to develop a lesson study model and an evaluation framework to support the creation of research lessons that are time efficient.

3. Method

The Lesson Study was designed based on the ADDIE model.

3.1 Survey and Determination of Training Content

To determine the subject matter of the designed Lesson Study, 42 junior and senior high school teachers and 13 teachers with administrative experience were given seven training courses: instructional methodology, on-campus branch manager, subject, student guidance method, information morality (personal information management, internet, etc.), ICT(Information and Communication Technology), and school administration. The results are shown in Table 2 and indicate a need for instructional methodology.

Table 2. Results of the In-School Training Questionnaire

	Questionnaire	Management		In-Service Teacher	
		M	SD	M	SD
1	Instructional methodology	4.86	0.35	4.31	1.01
2	On-campus branch manager	3.73	0.62	3.76	1.17
3	Subject	4.33	0.94	4.48	0.88
4	Student guidance method	4.10	0.54	4.05	1.11
5	Information morality (personal information management, Internet, etc.)	4.62	0.62	4.02	1.28
6	ICT	4.00	0.71	4.26	1.02
7	School administration	3.80	0.75	3.24	1.34

In-service teacher (n = 42); management experience teacher (n = 13)

Bonwell and Eison (1991) defined active learning as a learning method that fulfills the following five criteria, as opposed to active learning, which has long been vaguely defined:

・Students are involved in more than listening.

・Less emphasis is placed on transmitting information and more on developing students' skills.
・Students are involved in higher-order thinking (analysis, synthesis, evaluation).
・Students are engaged in activities (e.g., reading, discussing, writing).
・Greater emphasis is placed on students' exploration of their own attitudes and values.

Although active learning was originally considered to be a teaching method in higher education, it is defined as proactive, interactive, and deep learning in Japan, and it is a teaching method that is also needed in secondary education (MEXT(Ministry of Education, Culture, Sports, Science and Technology) 2019). In addition, the participants of Lesson Study requested the addition of self-efficacy. Thus, the purpose of Lesson Study is "proactive, interactive, and deep learning and instructional design to enhance self-usefulness."

3.2 Design of Training and Evaluation Methods

A training course was designed for the above content. As mentioned in the introduction to the background, a Lesson Study model was designed employing a flipped Lesson Study that does not put pressure on work time. In the Test-Operate-Test-Exit model, trainees first select necessary knowledge and skills in a pre-test (Test). Next, they learn only the part they did not understand in the previous test (Operate), taking a second test to decide whether they have met the criteria (Test). Upon passing, they can complete the contents (Exit). Otherwise, they return to the knowledge injection step (Operate). The evaluation framework is based on Kirkpatrick's four-levels model. The purpose of this study was to assess the extent of training transfer up to level 3. The evaluation framework is shown in Table 3, and the designed Lesson Study model is shown in Figure 1.

Table 3. Evaluation Framework

Reaction	Comparison of content and ease of learning with conventional classroom research
Learning	Extent to which knowledge has been increased by watching videos
Behavior	To what extent did you apply the content of the video to your classroom practice?
Efficiency	The degree of improvement in the time and quality of research lesson creation compared to the conventional lesson study

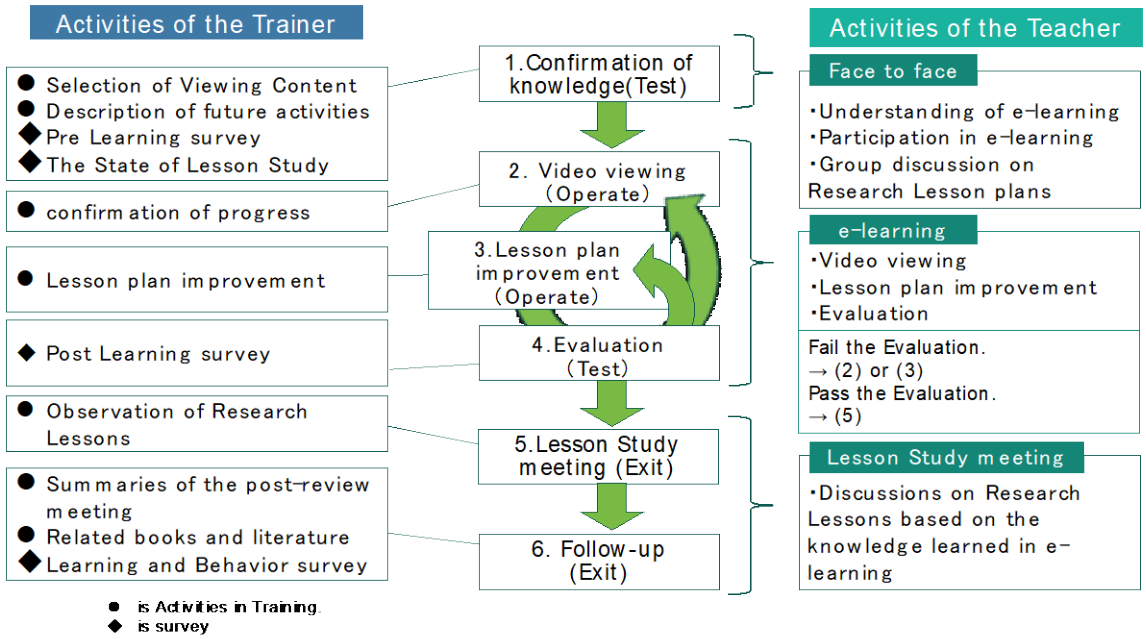

Figure 1. Flipped Lesson Study Model

In (1), a group training session is held, and a pre-test is given to all Lesson Study participants to select the knowledge required. In addition, the outline of the video content and the procedure for viewing the video content was communicated. Next, in (2), we ask participants to watch the selected videos and make assumptions. In (3), teachers are asked to use the video content in their lesson plans in preparation for the Research Lesson. In (4), the teachers who conduct the research lesson are evaluated (3), and those who do not conduct the research lesson will be tested on the video. From the results, we return to (2) or (3) if necessary. The students must repeat the above procedure, and when they reach the required level, they are considered to be ready for the lesson and wait until the Research Lesson. In (5), we will hold a Research Lesson and discuss the improvements in the Research Lesson at a post-meeting. Finally, (6) concludes the Lesson Study by providing comprehensive feedback and insights for development.

3.3 Development of Training Contents

We developed video contents for e-learning in inversion training. Ten videos on instructional design and three videos on self-efficacy were developed. The video content was created by referring to the video content of the remote asynchronous lecture given in the class of educational methods and technology, which is a compulsory subject in the teaching course at T university in Tokyo. Additionally, narration was added to the video. This class covers the basic knowledge of educational technology and has a heavy theoretical background. Therefore, we added a scene to introduce a specific teaching technique in the active learning video. The videos were delivered on Google Classroom so that the participating teachers could view them anywhere, at any time.

4. Implementation of Lesson Study

We conducted a developed Lesson Study with the participation of 23 teachers (one faculty member conducting the Research Lesson) in A City of Education, Mathematics Research Group. The program lasted from July to October 2020. The first workshop was held in August to confirm the teachers' prerequisite knowledge and their ability to participate in e-learning. From there, the participating teachers engaged in e-learning until the day of the Research Lesson in October. We broadcasted a pre-recorded research lesson at a review meeting and conducted observations. Then, the participating teachers engaged in e-learning until the day of the research lesson in October.
In view of the recent social situation, the research lesson was recorded in advance and replayed at a reflection meeting for observation. In the reflection meeting, the KJ method, which includes individual work with worksheets to ensure the homogeneity of perspectives, was applied to the observed lessons.

5. Data Analysis and Evaluation

The collected data are currently being analyzed according to the evaluation framework. Behavioral analysis will be conducted 1 month after the end of the Lesson Study in accordance with previous research on training. One issue is that some teachers have watched the videos, while some have not. We plan to qualitatively investigate the reasons teachers were not able to watch the videos in the flipped lesson study, according to the problems that can be seen from the quantitative data.

6. Discussion

We developed and implemented a reversible classroom study to ensure time efficiency. Additional research will be conducted to determine which factors are related to the presence or absence of video viewing, and whether the model takes into account the increasing time constraints of Japanese teachers.

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Tracing the Effect of Computerized Feedback on Learner Summaries: A Qualitative Analysis of Structural Change

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Abstract

In this study, we examined how students made changes in their summaries of complex scientific texts, supported by a technology-enhanced feedback system. Referring to system-generated indices that describe student mental models of texts, we conducted qualitative reviews on selected cases in which students in a graduate-level course wrote at least two revisions of the summaries of texts. Learners used feedback to introduce more relevant concepts and build an integrated structure in a text by connecting concepts across adjacent sentences.

Introduction

Summary writing is an instructional strategy that promotes students' deep understanding of main ideas and their inter-relations in a text. Also, summaries reveal the extent to which learner mental representations have changed as a result of instructional support (Graesser, Singer, & Trabasso, 1994; Kintsch, 1988). Accordingly, it is important to understand strategies that learners use to improve their summaries when they are provided with constructive, extended feedback on their products. To that end, the present study builds on a previous study (Kim, McKarthy & Heidari, 2020) that explored various indices used for the assessment of students' summaries in surface, structural, and semantic dimensions. Structure-related indices demonstrated that students made significant changes in their summary during revisions (e.g., the systematic order in which concepts are organized and related in the mental model). The present study further examined the nature of linguistic modifications via qualitative analysis of selected learner summaries from initial to final versions. The findings of the study specified what linguistic changes made in summaries as a result of feedback and defined the structural aspects related to quantitive indices.

Text-Based Analytics

Text-based approaches to reading comprehension assume that reading or discourse comprehension is based on simultaneous activation of processes occurring at three different dimensions of surface code, textbase, and situational models. Surface code relates to linguistic components at the word and phrase levels, constituting the linguistic content of a text (e.g., lexical frequency). Textbase and situational models relate to essential inferences that connect ideas from different parts of the text and that connect information from the text to information in prior knowledge (e.g., discourse-level cohesion– that is, the degree to which information is connected across the text). All these dimensions relate to how students form an organized, inclusive, and cohesive mental model of a complex text.

In a previous study, we used text-based analytics tools such as Tool for the Automatic Analysis of Lexical Sophistication (TAALES, Kyle et al., 2018) and the Tool for the Automatic Analysis of Cohesion (TAACO, Crossley et al., 2016) that provide indices at the surface, structure, and semantic levels, demonstrating the potential of the indices to track changes in the three dimensions. For example, Table 1 summarizes structure-related indices. However, it was unclear what structural aspects of learner comprehension were addressed by the indices and how students made changes in the structure of their summary in response to feedback information. To answer the remaining questions, this study conducted qualitative reviews of selected cases.

Table 1. Structure-Related Indices

Index	Definition
Overlap N-1S	A measure of lexical overlap across sentences and refers to the number of sentences whose lemma overlaps with the next two sentences in the running text.
Overlap lemma-2S	A measure of lexical overlap across sentences and refers to the number of sentences whose content words (Noun, Adjective, Adverb, Verb) overlaps with the next two sentences in the running text.
Overlap CN- 2S	A measure of lexical overlap across sentences and refers to the number of noun lemma (base of a word) types (unique, non-repeated words) that occur at least once in the next sentence.
Overlap N-2S	A measure of lexical overlap across sentences and refers to the number of sentences whose lemma noun (base form of a noun) overlaps with the next two sentences in the running text.
Overlap ARG-2S	A measure of lexical overlap across sentences and refers to the number of sentences whose noun and pronoun lemma (base form) overlap with the next two sentences in the running text.

Data Collection and Analysis

We used 47 cases in which students in a graduate-level course wrote at least two revisions of the summaries of texts in the Student Mental Model Analyzer for Research and Teaching system (SMART; Kim, 2019). SMART analyzes students' summaries of readings to assess the quality of their summary and then drive formative feedback to help students revise their summary. For all the cases, we analyzed the magnitude of changes in the structure-related indices and selected three extreme cases (see Table 2): One stayed at a similar level (Student 4), another showed the most negative change (Student 15), and the other demonstrated the most positive change (Student 23). Then, we deployed a case study approach to examine students' different patterns of revisions in response to SMART feedback. We conducted visual inspections of selected students' initial and final versions of the summaries, referring to the numerical information of the structure-related indices.

Table 2. Initial vs. Final Case Data

Version	Word Count	Overlap N-1S	Overlap lemma-2S	Overlap CN- 2S	Overlap N-2S	Overlap ARG-2S	Nature of Change
S4Initial	230	1.00	0.84	0.11	0.53	0.61	Minimal
S4Final	237	1.00	0.84	0.10	0.61	0.69	
S15Initial	127	0.70	0.50	0.06	0.40	0.40	Nagative
S15Final	283	0.60	0.42	0.04	0.34	0.34	
S10Initial	259	1.00	0.70	0.07	0.50	0.50	Positive
S10Final	296	1.00	0.81	0.10	0.77	0.77	

Findings and Discussion

Minimal Change: Student 4

Student 4 has generated a draft that indicates minimal changes as a result of the feedback. The word count for the initial version is 230 words and 237 words for the final version. The changes made in the final version include modifications of the content to match key concepts in terms of accurate terminology. For example, the initial version reads as "It is the responsibility of the **program** designer to ensure **the program** has objectives, relevant content, expectations and involves leadership" becomes more aligned with the theme of the reading as it is changed to " It is the responsibility of the **instructional designer** to ensure **the technology-based learning** has impact objectives, application objectives relevant content, business impact, expectations and involves leadership." As to structural changes, the student revised his summary, overlapping nouns across adjacent sentences and the next two sentences.

Negative Change: Student 15

Student 15's final version shows negative change, referring to structural indices. The initial version has a word count of 127 words, and the final version consists of 283 words. We expected that the revision work with more words could show improved structure. However, consistent with the indices, our qualitative inspection showed new concepts introduced in the final version tended to be disconnected from the current concepts.

Positive Change: Student 10

We detected notable positive changes from the initial to the final version of the student's summary. Student 10 added more key concepts and linked new concepts to existing concepts. The final version shows more nouns and pronouns overlap across adjacent sentences and the next two sentences. The student might notice that some important concepts and their relations were missed, and in response, attempt to include them cohesively during revisions.

Conclusion

Qualitative analysis of three cases indicated that learners use feedback to align their summaries with the expert model, integrating more relevant key concepts. The most common pattern for the development of cohesive and coherent summaries was through the use of overlapping nouns and pronouns across adjacent sentences and the next two sentences.

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Comparison of the effects of two approaches to teaching conditionals with block-based programming in an online environment.

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Abstract

To date, while many educators and researchers have greatly argued for the importance of teaching computational thinking skills, there is a lack of research on an effective approach to CT education. This study aims to examine the effectiveness of two different approaches when teaching computational concepts with block-based programming language in an online environment. The study conducted a quantitative research using a pretest-posttest randomized-group design. Participants in the study were be 101 undergraduate students enrolled in a computing and information technology online course. Two different teaching approaches (inductive vs. deductive) were delivered in an experimental web-based instruction during the spring semester of 2020. The knowledge test scores revealed that both groups were effective to increase the understanding of programming concepts. The inductive group outperformed the deductive group on the programming task of “repeat until”. Although the inductive group increased higher in the positive programming attitude than the deductive group, the change did not significantly differ between the groups. Lastly, the deductive instructional approach had a more positive attitude toward online instruction. Practical implication was further discussed.
Keywords: computational thinking, programming, online instruction, conditionals, block-based programming

Introduction

As programming requires cognitive and non-cognitive competencies, various pedagogical approaches should be considered. In a variety of subject areas, attempts to find effective pedagogical approaches have yielded significant advances in teaching and learning; however, block-based programming is not a common context in previous studies. Also, since block-based programming languages are taught to and played with individuals of all ages and at different levels of education, different approaches could be considered. For example, in order for helping novice learners increase the process of constructing key programming concepts, research is imperative to find out how to teach block-based programming effectively. In particular, conditional is one of the foundational computational concepts for controlling logical flow involved in programming and also necessary for solving conditional problems. The conditionals usually involve the use of variables and operators to control the algorithmic flow, so it would make learners hard to acquire required knowledge and skills in conditionals (Duncan & Bell, 2015; Fronza et al, 2017; Grover et al., 2014). To facilitate learners to master the conditional statements of programming syntax, there is a need for studies to investigate effective approaches to teach the concepts in block-based programming environments.

Two distinct instructional approaches are divided into "inductive" and "deductive" (Felder & Silverman, 1988; Prince & Felder, 2006; Rieber & Parmley, 1995). Inductive and deductive teaching is an umbrella term that encompasses a range of instructional methods or strategies. The inductive approach proceeds from specific to general information. Conversely, the deductive approach goes from general and moves to specific. The two approaches have proven to be effective in other subject areas, such as language, mathematics, science, and chemistry. However, empirical evidence has not supported a consistent conclusion with regard to the effects of the inductive and deductive instructional approaches. Some studies reported inductive approach superior (De Jong, Acampo, & Verdonk, 1995; Kersh, 1958; Klauer, 1996; Schelfhout et. al., 2006), while others reported findings in favor of deductive approach (Barrish, 1970; Erlam, 2003; Mohammaed et al., 2008; Owen, 2009). The other studies found the two approaches equally effective (Forgus & Schwartz, 1957; Shaffer, 1989). More importantly, no other studies exist examining the difference between inductive and deductive approach to teach block-based programming. Although deductive approach has been found typical to constructing new knowledge in other subjects (e.g., Atta, Ayaz, & Nawaz, 2015; Chiapetta et al, 1998; Prince & Felder, 2006; Murawska & Zollman, 2015; Shaffer, 1989; Singh & Yadav, 2017; Taha, 2014), inductive approach has not been applied to teach block-based programming. This study therefore focuses on how two different instructional approaches would help learners' cognitive and noncognitive aspects of programming in block-based environments.

Purpose of the Study

The main purpose of this study is to compare inductive teaching with deductive teaching approaches on students' Computational Thinking (CT) knowledge achievement, programming skill, and attitudes towards CT and programming. Although the deductive teaching and learning has been found normal to constructing new knowledge in programming courses, the effect might depend on different context of learning and/or domain of learning; hence, inductive approach requires investigation. The inductive approach proceeds from specific to general information, whereas the deductive approach goes from general and moves to specific. Both approaches can offer certain advantages, but the biggest difference is the logic of reasoning. One way to advance this area of research is to compare the two different teaching approaches for learning a difficult computational concept, which can offer insight into instructional strategies. This study aims to examine the effectiveness of two different approaches when teaching undergraduate students about the construction of a computational concept. The conditionals (e.g., if/then, if/else, while conditional) are one of the difficult CT concepts. Also, these concepts are heavily related to other concepts (e.g., variable and operator) and also involved in constructing algorithms of programming. Therefore, meaningful understanding of these concepts by the students determined their CT competencies (i.e., knowledge and skill). In addition, this study explored the difference in online learners' attitudinal perceptions towards the two instructional approaches.

This study investigated various learning outcomes of two teaching approaches (inductive vs. deductive) as follows: knowledge achievement, programming skill, and attitudinal perceptions. This study has the following research questions:

(a) RQ1: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' knowledge of conditionals?
(b) RQ2: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' programming skill of conditionals?
(c) RQ3: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' attitude toward block-based programming?
(d) RQ4: Does the student's attitude toward instruction differ between two instructional approaches?

Theoretical Framework

Inductive and deductive teaching is an umbrella term that encompasses a range of instructional approaches. Inductive approach has the following characteristics: (a) Particular cases to general rules, (b) Concrete instance to abstract rules, (c) Known to unknown, (d) Simple to complex; deductive approach, on the other hand, has the opposite (Singh & Yadav, 2017). Some studies reported the inductive approach superior (De Jong, Acampo, & Verdonk, 1995; Kersh, 1958, 1958; Klauer, 1996; Schelfhout et al., 2006); others reported findings in favor of the deductive approach (Barrish, 1970; Erlam, 2003; Mohammaed et al., 2008; Owen, 2009).

Method

The study conducted quantitative research approach, and pretest-posttest control-group randomized-group design.

Participants

Participants in the study was 101 undergraduate students enrolled in a computing and information technology online course at a large southwestern university during the spring semester of 2020. The participants enrolled from varied majors, were of various ages, and were both male and female.

Course Information

The course focused on a set of core competencies that shapes the background of computer science and also provided students with experience of learning Scratch block-based programming language. Out of 15 learning modules, nine modules were related to Scratch programming. In the learning module of conditionals, the two different teaching approaches (inductive vs. deductive) were delivered in an experimental web-based instruction.

Learning Content

The desired learning outcome was to create decision-making algorithms through the use of three conditionals (i.e., if/then, if/else, repeat until). Although the content of the topic studied in each group is the same, the sequence of the content was given in the reverse reasoning order to each group.

Instrumentation

Two groups' CT competencies will be assessed from (a) Computational Thinking test (CTt; Roman-Gonzalez, 2015), (b) Dr. Scratch and Rubric programming artifact analysis (Moreno-León, Robles, & Román-González, 2015), and (c) Attitude survey (Authors).

Procedures

The pre- and post-test controlled group method is an effective design to minimize internal threats on experimental validity. The participants took a pre-test and pre-survey before taking the first module with Scratch. One group was taught on the topic of conditionals by the WBI with inductive teaching approach, whereas the other group was taught by the WBI with deductive teaching approach. The length of the WBI instruction took approximately three hours. The participants were randomly assigned to different conditions. They were asked to carefully read instruction on the computer screen and then followed the steps. After the online instruction, they took a post-test and post-survey. The Scratch artifact was collected in the assignment submission.

Analysis

The data was analyzed by T-Test or Analysis of Variance (ANOVA) to analyze the differences among group means in a sample. Also, multivariate analysis of variance (MANOVA) was used for comparing multivariate sample means. Moreover, repeated measures multivariate analysis of variance (RM MANOVA) was used to determine whether there were any differences in multiple dependent variables over times.

Findings

Researchers identified and coded significance statements pertaining to patterns and challenges in the coding journal responses. Codes were applied and revised as needed by combining and eliminating codes for parsimony. The final number of codes were counted for each category–*being incremental and iterating, testing and debugging, reusing and remixing, abstracting and modularizing*. According to Scratch coding journal responses, undergraduates' reaction towards their programming experience considerably differed. The results are presented in the order of the research questions.

RQ1: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' knowledge of conditionals?

The result of multivariate test for time by instructional approach interaction was not significant (Wilk's $\lambda = 0.93$, $F(3, 97) = 2.56$, $p = .06$, partial $\eta^2 = .07$). Instructional approach was significant for the score on the "Repeat until" conditional ($F(1, 99) = 6.43$, $p = .01$, partial $\eta^2 = .06$). Deductive teaching group made greater gains in the "Repeat until" score as compared to those in the inductive teaching group.

RQ2: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' programming skills of conditionals?

The total score was significantly lower for the deductive group ($M = 11.40$, $SD = 3.93$) than for the inductive group ($M = 13.10$, $SD = 2.77$) ($t(99) = –2.42$, $p = .01$, $d = 0.50$) and the difference was moderate. The score for the "If/then" conditional was significantly higher for the inductive group ($M = 4.53$, $SD = 1.14$) than for the deductive group ($M = 3.66$, $SD = 1.56$) ($t(99) = –3.21$, $p < .001$). The score for the "If/else" conditional was also significantly higher for the inductive group ($M = 4.57$, $SD = 1.06$) than for the deductive group ($M = 4.02$, $SD = 1.49$), ($t(99) = –2.13$, $p = .04$).

RQ3: Which approach, inductive or deductive, is more effective for enhancing undergraduate students' attitude toward block-based programming?

Both groups made a positive change in the perceived programming attitude, which were statistically significant ($F(1, 100) = 6.94$, $p = .01$, partial $\eta^2 = .07$). The time effect was significant ($F(1, 100) = 6.43$, $p = .01$, partial $\eta^2 = .06$), but the interaction between time and instructional approach was not significant ($F(1, 100) = 2.93$, $p = .09$, partial $\eta^2 = .03$).

RQ4: Does the student's attitude toward instruction differ between two instructional approaches?

The total score was significantly higher for the deductive group ($M = 3.69$, $SD = 0.84$) than for the inductive group ($M = 3.34$, $SD = 0.84$) ($t\ (99) = 2.09$, $p = .04$, $d = 0.04$). The score for Item 1 ("I like the online instruction") was significantly higher for the deductive group ($M = 3.76$, $SD = 1.10$) than for the inductive group ($M = 3.27$, $SD = 1.15$) ($t(99) = 2.17$, $p = .03$). The score for Item 3 ("My interest in the subjects has been aroused.") was also significantly higher for the deductive group ($M = 3.62$, $SD = 1.11$) than for the inductive group ($M = 3.06$, $SD = 1.24$) ($t(99) = 0.18$, $p = .02$).

Discussion and Implications

First, deductive approach produced a higher learning effect in terms of knowledge gain about conditionals, mainly when complex concepts or large numbers of facts are taught. Deductive approach is more effective for learning new conceptual information by making inference efficient to online college students. Second, inductive approach produced a higher learning effect in terms of programming skills of conditionals, particularly when guided practice is provided. Inductive approach is more effective for learning new programming skills by making generalization meaningful for online college students. Third, both the deductive and inductive approach produced a higher learning effect in terms of programming attitude. Inductive teaching made a greater positive change in programming attitude, although it is not statistically significant. Lastly, deductive approach made a more considerable positive effect in instruction attitude. Inductive approach may need more planning and resources to create clear guidelines and adequate scaffoldings.

The findings imply that both instructional approaches have proven to be useful when teaching programming competencies; however, both advantages and disadvantages exist between the two approaches. As a more diverse body of learners begins to learn block-based programming, educators need to consider the possible effects of different instructional approaches and incorporate them into their online programming instructions. For instance, appropriate Instructional approach should be adopted depending on learning objective(s), target learners, or level of complexity. Also, inductive approach needs to be more prepared to implement, and students' understanding of learning topics should be assessed by a variety of measures. Moreover, tools and resources should be utilized for inductive approach to facilitate their learning process. Since both advantages and disadvantages exist between the two approaches, CS educators or instructional designers need to consider the possible effects of each instructional approach and incorporate them into their programming instructions. Although the study has some limitations, it would offer insight into the direction of instructional methods or strategies for learners to have meaningful learning experiences in online programming courses.

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Gender Differences in Student Perception of The Role of Learner-Content Interactions On Their Engagement In Online Courses

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Introduction

Online education continues to rise. With the outbreak of the global pandemic, various institutions have opted to put their courses online so that faculty members, students and staff members could be safe (Hodges et al, 2020; Zhou et al, 2020). With the high number of online learners, instructors and course designers may need to establish ways of engaging their students in an online course. Numerous practices have been suggested for engaging learners in an online learning environment. These strategies proposed center around how learner-content interactions, learner-technology interactions and learner-learner interactions can be improved to engage online students (Chakraborty & Nafukho, 2014). However, very few studies have investigated if there are gender differences in student views of the role of learner-content interactions on their engagement in an online course.

This study focuses on learner-content interactions and how it plays a role in learner engagement. The learners rated how the following aspects of course content impacts their engagement in an online learning environment; personal interests in the subject matter, narrated lecture videos provided as a class resource, interactive assignments presented in the class, critical thinking assignments presented in the class and problem-solving assignments presented in the class. Researchers examined if male and female perceptions of the role of learner-content interactions on their engagement in an online learning environment was different.

Interactions

According to Zimmerman (2012), "Interaction plays a critical role in the learning process. For online course participants, interaction with the course content (learner-content interaction) is especially important because it can contribute to successful learning outcomes and course completion" p. 152. With the importance of interactions in a learning environment, the challenge for course developers and instructors is determining how to promote this type of interaction. According to Xiao (2017),

> Despite the fact that interaction with content is inextricably interwoven with learner–learner and learner–instructor interactions in conventional face-to-face, campus-based

educational settings, how to promote this type of interaction has always been top on the research agenda in the field of general education. (p. 124)

Learner-content interaction are very important in education because "without it there cannot be education, since it is the process of intellectually interacting with content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind (Moore, 1989. p. 2)

In a study conducted to test 'a regression model for student satisfaction involving student characteristics (three types of interaction, Internet self-efficacy, and self-regulated learning) and class-level predictors (course category and academic program),' the authors found that, 'Learner–instructor interaction and learner–content interaction were significant predictors of student satisfaction' (Kuo et al., 2014). Accordingly, this study will explore how learner-content interactions may have an impact on student engagement in an online learning environment. This study categorized learner-content interaction in an online learning environment into, personal interests in the subject matter, narrated lecture videos provided as a class resource, interactive assignments and critical thinking assignments.

Gender Differences

There are a number of studies which have been conducted on gender differences in online learning environment, for example, (Sullivan, 2001; Wang et al., 2009; Ma & Yuen, 2011; Yukselturk & Bulut ,2009; Rovai & Baker, 2005). However, only a few of the many studies examined if there were any gender differences in learner perspectives on the role of learner-content interactions in an online learning environment. According to Yukselturk & Bulut (2009),

> In the literature, gender based differences in education have been recognized as an important focus for research for a long time, especially, since increasing number of online female students. When reviewing gender related studies, the effects of this variable are inconclusive on student experience in distance education. (p. 13)

Some studies focused on the gender differences in online courses with regard to learner perspectives on online courses in general. For example, according to Sullivan (2001), online courses were reported to be of great value to female adult learners with family responsibilities or with children. Other studies focused on gender differences in learner performance and interactions. For example, in one study, researchers found that,

> women studying online are confident independent learners who may outperform their male counterparts. They do not have reduced computer and Internet access compared with men, nor are they disinclined to enrol [enroll] on online courses. They attach greater value to the pastoral aspect of tutoring and have different interaction styles from men, which may have implications for online tutoring support. (Price, 2006, p. 349)

With regards to learner-learner interactions, some studies focused on how male and female students communicated in an in an online learning environment. For example, researchers in another study found 'empirical support for the idea that men and women communicate at different levels, perceive community differently, and have differing views of perceived learning in an online educational environment' Rovai & Baker, 2005, p. 42).

In another study which was conducted to determine if there were gender differences in learner use of learning strategies and motivation, the authors found that 'test anxiety explained a significant amount of variance in female students' achievement and two variables (self-efficacy for learning and performance, and task value) explained a significant amount of variance in male students' achievement' (Yukselturk & Bulut, 2009, p.12).

Very limited number of studies focused on gender differences in learner perspectives of the role of learner-content interactions on their engagement in an online learning environment. This study on the other hand, will bridge this gap in the literature by focusing on gender differences in learner perspectives on the role of learner-content interactions on their engagement in an online learning environment.

Engagement

Student engagement is one of the topics which has been studied in the literature, for example (Robinson & Hullinger, 2008; McBrien, Cheng & Jones, 2009; Czerkawski & Lyman, 2016; Kahn, et al., 2017). Student engagement is defined 'as the interest and motivation students have in their own learning of course content' (Young & Bruce, 2011, p. 220). This study adopts this definition of engagement.

One factor which influences engagement in an online learning are learner-learner interactions which are established in learning communities. According to Young & Bruce (2011), there is a close relationship between a classroom community and student engagement.

Another factor related to engagement in an online learning environment is the content. According to one study conducted to determine what students found engaging in an online learning environment, students reported that activities which involved applying concepts in problem solving or case studies, research papers and labs were engaging (Dixson, 2010).

With regards to gender differences in student engagement, women who were taking an online version of a course were found to be more engaged in the course than the male students in the same course (Price, 2006). According to the same authors, the women in the online course also liked to learn from other students and were more confident.

Few studies on engagement in online learning environments focused on gender differences on the role of learner-content interactions on student engagement. By linking engagement to learner-content interactions in an online learning environment, this study will examine if male and female students perceived the role of learner-content interactions on their engagement in an online learning environment differently.

Method

Participants

Participants in this study (N=147) were undergraduate students from a land-grant university in the southeastern part of the United States. The students were enrolled in four online courses and age ranged between 18-34 years. About 72 were males and 75 females. Majority of the students were Caucasian (n=115). Asians were the second largest group (n= 12), and African Americans was the smallest group (n=10).

Instrument and Data Collection

Researchers conducted an initial study using the ‘Student Perception of Engagement in an Online Course’ survey to measure student perception of engagement in an online course. One of the questions centered on student views on the role of learner-content interactions on their engagement. The survey was adapted from surveys that had been used by other researchers and based on the literature. The survey consisted of 12 questions. The first questions gathered demographic information such as age and race.

Analysis and Results

Before conducting an analysis, reports feature in Qualtrics was used to view the results. The results were sorted by gender and a side by side comparison was made to observe differences between male and females’ views on the impact of the following learner-content interactions on their engagement,

a. Personal interests in the subject matter
b. Narrated lecture videos are provided as a class resource
c. Interactive assignments are presented in the class
d. Critical thinking assignments are presented in the class
e. Problem solving assignments are presented in the class.

Figure 1 and 2 shows the observable differences which showed that males thought that critical thinking assignments where somewhat engaging (*n*=26) vs females (*n*=17). However, a high number of females (*n*=33) thought that narrated lecture videos where highly engaging compared to their male counterparts (*n*=19).

Figure 1
Male Scores on Five Aspects of Learner-Content Interactions

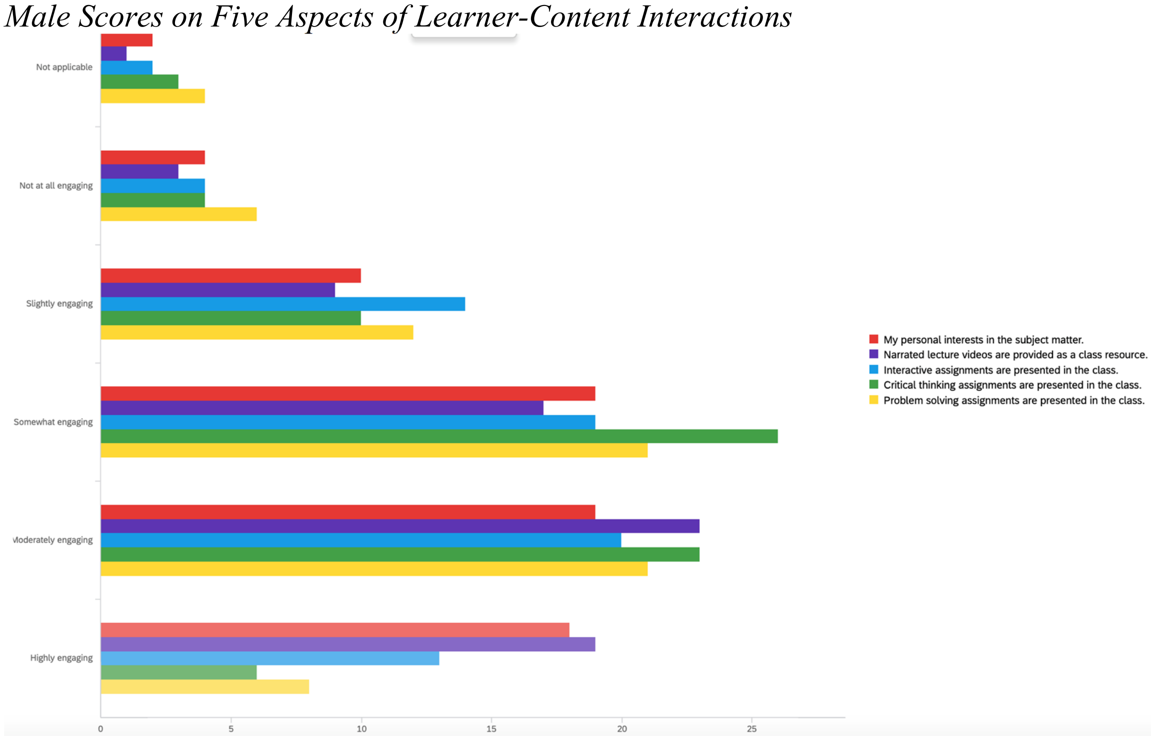
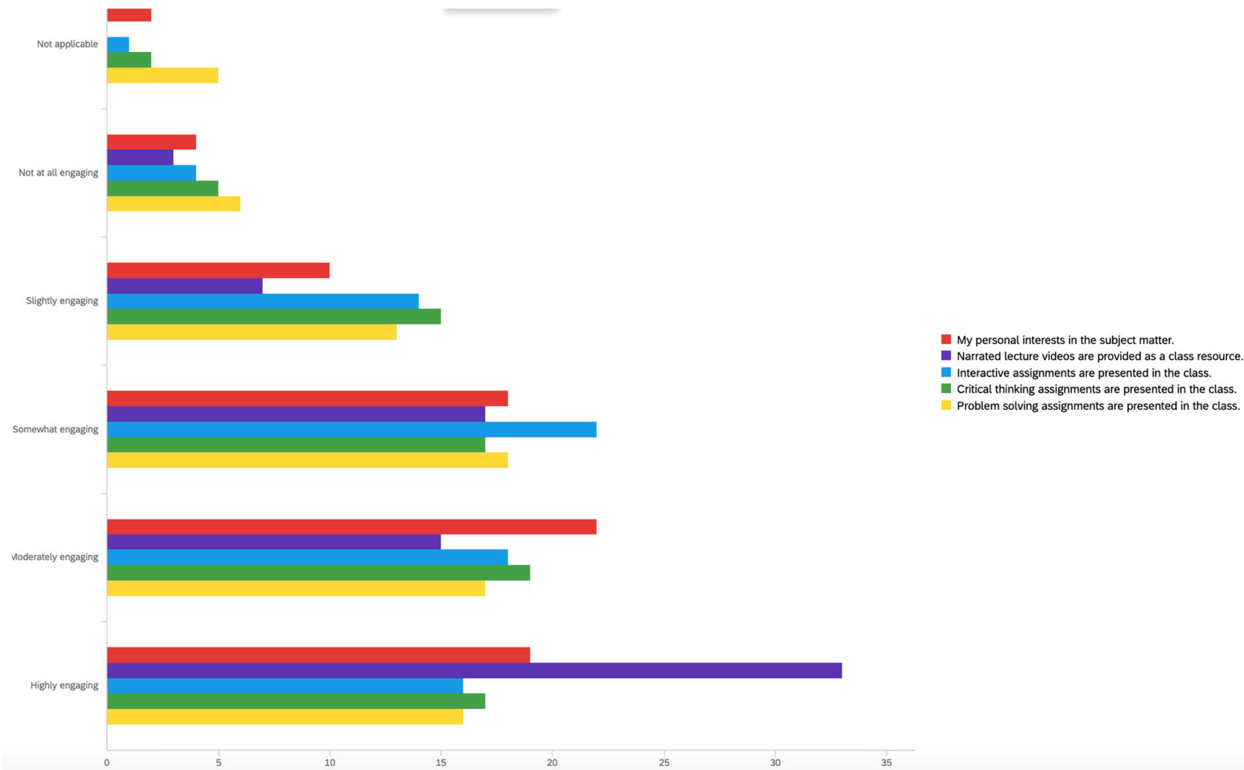


Figure 2
Female Scores on Five Aspects of Learner-Content Interactions



Independent samples *t* tests were conducted to determine if there were gender differences with regards to learner perspectives on impact of the following learner-content interactions on their engagement,

a. Personal interests in the subject matter
b. Narrated lecture videos are provided as a class resource
c. Interactive assignments are presented in the class
d. Critical thinking assignments are presented in the class
e. Problem solving assignments are presented in the class.

To evaluate the hypothesis that there were no significant differences between male and female students' perspectives of the impact of the five elements of learner-content interactions on their engagement, independent samples *t* tests were conducted. See figure 4.

On the impact of personal interests in the subject matter on student engagement, no significant differences were found between males and females, t (145) =-.230, p = 0.818.

On the impact of narrated lecture videos provided as a class resource on student engagement, no significant differences were found between males and females, t (145) = -1.567, p = .119.

On the impact of interactive assignments presented in the class on student engagement, no significant differences were found between males and females, t (145) = -.403, p = .688.

On the impact of critical thinking assignments presented in the class on student engagement, no significant differences were found between males and females, t (145) = -.872, p = .385.

On the impact of problem-solving assignments presented in the class on student engagement, no significant differences were found between males and females, t (145) = -.457, p = .648.

Figure 3

Group Statistics

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: – My personal interests in the subject matter	Male	72	4.43	1.309	.154
	Female	75	4.48	1.298	.150
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: – Narrated lecture videos are provided as a class resource	Male	72	4.60	1.206	.142
	Female	75	4.91	1.187	.137
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: – Interactive assignments are presented in the class	Male	72	4.25	1.275	.150
	Female	75	4.33	1.234	.142
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: – Critical thinking assignments are presented in the class	Male	72	4.11	1.181	.139
	Female	75	4.29	1.343	.155
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: – Problem solving assignments are presented in the class	Male	72	4.01	1.327	.156
	Female	75	4.12	1.479	.171

Figure 4

Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: - My personal interests in the subject matter	Equal variances assumed	.007	.932	-.230	145	.818	-.049	.215	-.475	.376
	Equal variances not assumed			-.230	144.648	.819	-.049	.215	-.475	.376
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: - Narrated lecture videos are provided as a class resource	Equal variances assumed	.000	.987	-1.567	145	.119	-.309	.197	-.700	.081
	Equal variances not assumed			-1.567	144.533	.119	-.309	.198	-.700	.081
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: - Interactive assignments are presented in the class	Equal variances assumed	.024	.878	-.403	145	.688	-.083	.207	-.492	.326
	Equal variances not assumed			-.402	144.207	.688	-.083	.207	-.493	.326
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: - Critical thinking assignments are presented in the class	Equal variances assumed	4.103	.045	-.872	145	.385	-.182	.209	-.595	.231
	Equal variances not assumed			-.874	143.913	.383	-.182	.208	-.594	.230
Course Content Based on your experience with all online classes, please rate the following statements based on your level of engagement: - Problem solving assignments are presented in the class	Equal variances assumed	1.738	.189	-.457	145	.648	-.106	.232	-.565	.353
	Equal variances not assumed			-.458	144.343	.647	-.106	.232	-.564	.352

Discussion and recommendations

This study examined the differences between male and female students' views on the impact of five aspects of learner-content interactions on their engagement in an online learning environment. These aspects are,

a. Personal interests in the subject matter
b. Narrated lecture videos are provided as a class resource
c. Interactive assignments are presented in the class
d. Critical thinking assignments are presented in the class
e. Problem solving assignments are presented in the class

After an analysis, the results showed that there are no significant differences between male and female students' perspectives on the role of the five aspects of learner-content interactions on their engagement.

However, the results also show that some aspects of the learner-content interactions were engaging to the learners. For example, both males and females thought that narrated lectures videos where engaging highly engaging. However, we recommend the use of shorter videos as per findings from Guo et al., (2014) who reported that shorter videos were highly engaging to students.

Critical thinking assignments and personal interest in the subject where also moderately engaging for both male and female students. Critical thinking may involve solving unstructured/ open-ended, problems (Mastrian et al., 1999). Critical thinking 'assumes an inquiry and hypothesis based approach to ideas as well as thinking that is open to revision' (Çavdar & Doe, 2012, p. 298). Incorporating critical thinking assignments in the class could benefit the learners by assisting think critically.

Recommendation for practice

The authors recommend the use of short narrated videos in online courses. The literature is not conclusive on the exact length of an educational video. Mukuni (2020) recommends that videos should be between 3-20 minutes long and that long videos should be segmented. The videos used should be related to the topic.

The authors also recommend the use of critical thinking assignments in an online learning environment. The assignments used could involve problem solving and could also be open-ended (Mastrian et al., 1999). They could be designed in such a way that they enable learners to inquire and approach the problem in a hypothesis-based manner (Çavdar & Doe, 2012).

Recommendations for further research

Even though this study found no significant differences between male and female views on the role of learner-content interactions on their engagement in an online course, further studies need to be done on this topic. The aim of identifying gender differences in online learning environments is to ensure that both male and females' differences are accounted for in the design of the course. Given the current global crisis which has pushed k-12 to online learning, future studies may need to be done in the k-12 online learning to determine if there are gender differences between male and female students' perspectives on engagement in an online learning environment.

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Giving Virtual Office Hours a Makeover: Improving Instructor Presence

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Welcome to your online classroom! (Now figure it out!)

As online learning has grown in prevalence over the past decade (Allen et al., 2016; Brown & Green, 2019; 2018), new challenges have emerged for both students and instructors alike in navigating this learning environment. Instructors who have previously found success in face-to-face learning environments may not automatically see those skills translate into successful online teaching (Dunlap & Lowenthal, 2018; Lewis, 2018). Many instructors have found the transition from face-to-face teaching to online teaching to be an adventure of discovery (McGee, Windes, & Torres, 2017).

The present study is a case study that tells a story: the story of how I became dissatisfied with an aspect of my own online teaching practice, and sought to improve it. Many online instructors—even experienced instructors—continue to learn how to conduct their craft by discovery and by learning through the examples of other instructors (Dunlap & Lowenthal, 2018). I will refer to learning by discovery as "the school of hard knocks," that is, learning by trying things, sometimes failing, and revising for the next time around. This might sound similar to design-based research (Brown, 1992; McKenney & Reeves, 2012) but the telling of this story will play out as a qualitative case study (Creswell, 2013) as we consider how online instructors approach discovering how to engage students in learning in the online classroom.

A brief review of relevant literature

The Community of Inquiry (CoI) model developed by Garrison, Anderson and Archer (2000) has become a dominant model for explaining interactions in online courses that lead to meaningful educational experiences (Dunlap & Lowenthal, 2018; Swan & Richardson, 2017). The CoI model describes how cognitive presence, social presence, and teaching presence interact in dynamic ways to foster the development of community through interpersonal relationships in "the pursuit of meaningful inquiry" (Swan & Richardson, 2017, p. 64). While much investigation of online learning has been conducted using this model for a theoretical lens, new research endeavors building on this model are beginning to investigate instructor presence as a construct (Martin, Wang, & Sadaf, 2018; Oyarzun, Conklin, & Baretto, 2016; Richardson & Lowenthal, 2017).

Instructor presence has been described as being composed of three elements: teaching presence, instructor immediacy, and instructor social presence (Oyarzun et al., 2016). Teaching presence is the way the instructor design and organizes the course, plans materials and learning activities, and facilitates and encourages learning (Garrison et al., 2000). Instructor immediacy is a way of describing the communication factors that instructors use to decrease perceptions of psychological distance between the instructor and the students, which can increase student motivation, participation, and achievement (Oyarzun et al., 2016). Instructor social presence is the ways the instructor demonstrates they are a real person (Richardson & Lowenthal, 2017). It is worth noting that several of these elements are aspects of the CoI framework, but the way they interact for instructors may take on a different flavor than they do for students. These three elements of instructor presence come together in the way the instructor facilitates the online course, demonstrating their real care and concern for students and their learning.

There many methods for instructors to demonstrate their presence in asynchronous online courses. Some common approaches include the use of video-based personal introductions, course orientation videos, timely response to student questions, sending announcements to the class, being active participants in discussion forums along with students, and providing timely, personalized feedback on student assignments (Martin et al., 2018). Many of these strategies require some planning ahead to incorporate into the design of an online course. However, even simple instructional moves, such as addressing students by name, or including personal stories as examples can enhance instructor presence (Richardson & Lowenthal, 2017.)

Another approach online instructors might consider for boosting their presence is the inclusion of synchronous, web-based meetings as a component of asynchronous courses (Martin et al., 2018). Results of this approach are mixed, but it may merit consideration in some circumstances (Elwood & Brauhn, 2017; Lowenthal, Dunlap, & Snelson, 2017; Watts, 2016). In particular, synchronous web-based meetings may be an effective way for online instructors to hold office hours for their students at a distance when structured effectively (Lowenthal et al., 2017).

Method

The present study is a case study explaining an intervention used to boost instructor presence in an asynchronous online course, and an exploration of the students' response to this intervention. The use of case studies has a long history in the field of education (Creswell, 2013; Merriam, 1998; Yazan, 2015), but only more recently have they been used in the field of Educational Technology (Mardis, Hoffman, & Rich, 2014; Oliver, 2014). In her explanation of the value of case study methodology for educational research, Merriam (1998) suggested, "case study research in education is conducted so that specific issues and problems of practice can be identified and explained" (p. 34), which is the approach taken in the present study. Further, Oliver (2014) suggested that applied case studies might be the most relevant for practitioners in the field of educational technology because they "directly address the problems of implementation in specific contexts they face when teaching with technologies" (p. 912). This might be the sort of research encouraged by Reeves & Reeves (2015) of shifting from research focused on "things" towards research focused on "problems" (p. 29).

Case studies are, by their nature, studies of the particular (Eisner, 1991; Yin, 2014). Due to the small sample size—often a single case—a key aspect for developing effective case studies is researcher reflexivity (Richardson & St. Pierre, 2005; Stake, 2005). Reflexivity involves careful introspection on the part of the researcher, and an awareness of their own positionality with regard to the case, which they must make explicit in the reporting (Creswell, 2013, Stake, 2005). Richardson & St. Pierre (2005) suggested that a key marker of reflexivity is a sense of self-awareness and self-exposure in the author's writing. Merriam (1998) urged case study researchers to employ "thick description" in their elaboration of the case (p. 30). Thus, in my exposition of this case, I will be intentional about describing the role I played as the instructor, while also providing a detailed explanation of the context, the problem, the intervention, and the students' response.

Case study: Reimagining office hours for "Issues in Education"

As a qualitative case study, this report describes an educational intervention I employed to tackle a problem of practice: improving my presence as an instructor, and thus boosting student engagement in online office hours. and inviting students into a learning community. As the story of this case unfolds, I position myself as a participant-researcher (Creswell, 2013), explain the context for this research and the participants, elaborate on my approach to intervention, share the data I collected from students, and describe the results uncovered. Considering generalizability of qualitative research, Eisner (1991) suggested that the coherence of the narrative is essential, that it holds together and makes sense. My intent in exploring the case is to do just that; the particulars of this case may not generalize to every situation, but as a coherent story of an educational intervention, the reader may find it informative for their own practice. For structuring this report, I appreciated the models of qualitative case studies exemplified by Lewis (2018) and van Rooij and Zirkle (2016).

Research context

I serve as an instructor in Master of Education program at Dordt University. Dordt is a private university located in the upper midwestern United States. The M.Ed. program has seen rapid growth in the past five years, from approximately 60 students in 2015 to approximately 230 students in 2020. This program is a fully online program with no on-campus residency requirements. There are eight tracks in the program, with the largest numbers of students in the School Leadership, Teacher Leadership in Curriculum and Instruction, and Special Education tracks. Courses are offered in the Fall, Spring, and Summer terms. The focus course for this study was offered in asynchronous format during the Summer term, which is a compressed schedule, 8-week course that runs from mid-June through the first week of August. The courses in the program are designed in modules that correspond to the eight weeks of the course, and students moved through the modules as a group week-by-week.

Students enroll in the M.Ed. program from across North America, and around the world. Approximately 75% of the students in the program are from the United States, with approximately 15% from Canada, and approximately 10% hailing from other countries, including Indonesia, South Korea, China, Thailand, Nigeria, Libera, and Nicaragua. All students in the program take a shared core of four courses, including Issues in Education, the focus course for this study. While the program is not structured around a cohort model, small class groups are utilized to increase students' sense of connection and camaraderie with their classmates. Typical class sizes in the program are approximately 20 students.

The problem: Lack of participation in online office hours

I have been teaching online courses since 2010, and much of my early learning about effective online instruction came through the school of hard knocks. I tried things, failed, and learned from my missteps. This is not an uncommon experience for many instructors new to the online classroom (McGee, Windes, & Torres, 2017). I often emulated things I saw other online instructors doing, whether it was actually proving effective or not. One of these teaching moves was offering virtual office hours for students taking my online courses. I began including synchronous office hours for my online students in 2012. What this involved, initially, was including a line on my syllabus listing the hours I would available, and several contact methods for setting up a meeting: email or text, through which we would set up a web conference. In my first six years of using this approach, I had exactly two students take me up on this—not exactly a resounding success! It is embarrassing for me to think this through now, because I was clearly not designing these opportunities for connection with my students' needs in mind. I was operating out of my own convenience but feeling good about myself for offering students the opportunity to connect.

A kind colleague pointed this out to me once during a conversation about online office hours. I admitted that it was quite pointless for me to just list available hours if I was not going to take any steps to actively reach out to my students in a way that really made me more accessible to them. Office hours were not a substantial part of my instructor presence, and I decided that if I wanted to take this aspect of my teaching practice seriously, some changes were needed. In 2018, I began publishing a link on the main page of my online courses that directed students to a standing web conference meeting. I explained that I would be present during the designated times in the web conference, and they could drop in as desired. This change in approach did have an impact: that year, I had three students actually reach out via that web conference link. While still not an exceptional result, at least I felt I was moving the needle a bit. But the problem remained: if office hours were to be a valuable part of my course—for both my students, and for me as the instructor—a re-imagination was needed.

<u>The intervention: Shifting from “office hours” to “happy hour”</u>

It was about this time that I my memory was jogged of an experience I had in grad school when a friend mentioned attending “happy hour” at a local establishment. I remembered a research study I was a part of while I was taking a course with Patrick Lowenthal at Boise State University, and I recalled the engaging way office hours played out in that course. I did a little sleuthing and found the article that described his own shifting approach to office hours (Lowenthal et al., 2017). I remembered Dr. Lowenthal making the comment in one of our office hours meetings that “Office hours have a marketing problem—no one wants to come to ‘office hours,’ but no one wants to miss ‘happy hour’” (P. Lowenthal, personal communication, July 12, 2015). I decided I had nothing to lose by trying this small shift in re-marketing office hours. While I was making changes, decided to follow a few other suggestions from Lowenthal et al. (2017), including ensuring that office hours were optional, recording the meetings so students unable to participate synchronously could still view the video afterward, and adding an instructional component to each meeting.

After reflection, I decided to host an online “happy hour” each week during the 8-week summer term of 2019, telling students that “the drinks were on them” but welcoming them to participate in optional synchronous meetings. Knowing that I would be teaching four sections of Issues in Education that term, I decided I could have multiple “happy hour” sessions, and I would not restrict attendance to any particular class section for a given synchronous meeting. All students were welcome to choose a synchronous session that would work well for them timing-wise. I decided to schedule a morning session, an afternoon session, and two evening sessions each week. I planned the meetings to be held on Tuesday afternoon and evening, and Wednesday morning and evening. Part of the plan for having meetings at different times of day was to accommodate my students located outside of North America, for whom holding just one synchronous meeting each week would almost certainly prevent them from ever attending.

As for the content of the meetings, I decided that I would have the same basic plan for all four happy hour meetings for a module, and I would publish a brief agenda ahead of time. The general plan for each week’s happy hour meeting included an opening check-in with attendees, a content-oriented presentation from me as the instructor, and then an open time of discussion, wonderings, and clarification based on students’ questions related to course content and assignments. Each happy hour meeting was scheduled to last one hour, with about 20 minutes spent on each of the three segments of the agenda. Students would not be required to attend but were warmly encouraged to participate synchronously in the learning community. I recorded one of the four weekly meetings for each module, and if students were unable to attend, they were encouraged to watch at least the "lesson" segment of the videos which were published online.

Student participation

A total of 77 students were enrolled across four sections of the Issues in Education course during the summer term of 2019., with 19 or 20 students in each section. These students ranged from graduate assistants with no K-12 teaching experience, to novice teachers with 1-3 years of experience, to moderately experienced teachers with 4-8 years of experience, to veteran teachers with 9 or more years of experience in the classroom. Students in the various sections of the course were from four different countries: the United States, Canada, Indonesia, and Liberia.

By my tally, 45 of the 77 students taking Issues in Education participated in at least one happy hour meeting during the summer of 2019. Six students attended happy hour all eight weeks of the summer term. Some students always came to the same meeting each week (e.g., always attending the Wednesday morning meeting) while others varied in their choice of which meeting to attend. Attendance varied depending on the rhythm of the term and the topic of the meeting. For instance, in week 4 of the term, when I introduced a major research project that would take them several weeks to complete, 44 students joined in happy hour meetings held during that week to hear more and get their questions answered. In contrast, the last week of the term, only seven students attended happy hour meetings.

Student response to happy hour

As part of my normal teaching practice, at the end of each term I invite my graduate students to anonymously share about their experiences in the course. I do this by way an instructor-created survey of mostly open-ended prompts that address different aspects of the course: the course content, the structure of the course, and their impressions of the instructor. In the summer of 2019, I added additional questions specifically about happy hour to gauge their perceptions of this intervention. I built some internal logic into the survey so participants would see customized surveys based on their answers to some of the initial questions. The survey questions about happy hour are included as Appendix A. Of the 77 students taking the course, 56 completed the survey. Of the survey completers, 27 students (48.2%) attended happy hour at least once. 13 students (23.2%) did not attend at all, and 16 (28.6%) reported that while they did not attend, they watched the videos afterward.

Students who attended happy hour meetings were largely appreciative of the opportunity to connect with classmates and with me as their instructor. Main themes that emerged as positive outcomes of participating in happy hour were opportunities for personal interactions with classmates, opportunities to get their questions answered, and opportunities to hear more of their instructor's thoughts on the content from the readings and discussions. As for advice they had for improving happy hour, no clear patterns emerged, but I gleaned a few helpful suggestions, including ideas such as incorporating more stories into my lessons, offering some prompts for possible discussion topics ahead of time along with the agenda for the meeting, and considering replacing one or more discussion forums with synchronous discussions of the readings. Many students commented that they appreciated having multiple options for meeting times, which made it possible for them attend.

The students who reported that they never attended happy hour had several reasons why they chose not to join in. Nine said they were too busy to attend. Five suggested that when they read the agenda, it did not seem that the meeting would be worth their time. Three reported that because the meetings were optional, they just opted out. Perhaps the best answer to any question I asked on this survey was in response to the question, "Is there anything that could have made happy hour more appealing, or made it more likely you would attend?" One student who had not attended any happy hour meetings replied with just one word: "Margaritas."

The students who reported that they watched the videos afterward likewise had varied reasons for not attending the synchronous meetings. Eleven students reported that they were too busy to attend, however none stated that the meetings did not seem they would be worth their time. Seven students reported that the times simply did not work for them, and seven noted that because the meetings were optional, they just opted out. When asked about what could make it more likely to attend, four students wrote comments expressing some version of "If the meetings were required, I would have found a way to make it, but because they were optional, I did not attend." Another student reported, "I found the videos to be easy to use... I oftentimes forgot about the happy hour sessions taking place, so I would just watch the video afterwards." Two students expressed gratitude for these recordings, because of their busy summer schedules due to coaching or a side job, and the recordings made things more flexible for them to feel they were fully participating in all aspects of the course.

Summary and plans for next steps

Overall, I was pleased with these results. I felt that my first attempt at re-imagining office hours as "happy hour" was largely successful. While there was certainly still room for improvement, a large majority of students participated, far more than had ever participated in my pre-makeover version of office hours. Further, the feedback they shared with me at the conclusion of the course was a healthy combination of affirmation and constructive criticism.

After this positive outcome to my first attempt, I decided to continue my happy hour experiment. I was scheduled to teach Issues in Education again in the summer of 2020, and I decided to reduce the number of meetings each week to three: a morning, afternoon, and evening meeting each week. This was mainly to help me balance my own teaching rhythm during the summer, and the evening meetings were the most sparsely attended in my experience during the summer of 2019. I made notes for myself after each week's meetings during the 2019 session about what worked well in the synchronous lesson presentations, and what did not work so well, and I used this information to revise the content of several of the lessons. Time will tell what the next iteration will look like after summer 2020, but I suspect I will continue to use the "happy hour" approach for office hours for the foreseeable future.

Conclusion

A major goal of this study was to illustrate ways that instructors might boost their presence in asynchronous online courses by incorporating synchronous sessions. In my experience teaching Issues in Education in the summer of 2019, this is just what happened. More students than ever before—both by percentage of the total as well as in sheer numbers—participated in office hours after this intervention was put into place. Students reported perceptions of positive benefits for their own learning, and many were actively engaged in first-hand connections with their instructor and colleagues alike. Speaking as the instructor, I too was greatly encouraged by the opportunities I had to build relationships with students, and to give them the opportunity to get to know me as a real person.

This study is a sort of replication study of the work done by Lowenthal, Dunlop, and Snelson (2017) with a few twists in the intervention, and a rather different approach in the reporting. As a qualitative case study, this study certainly has limitations; it will not generalize to every teaching situation. This is the story of just one instructor who is a participant-researcher taking an active role in this study. That said, I have attempted to position myself reflexively and provide a rich and clear description of the context of the research, the intervention, and the students' responses, but it remains for the reader to judge the trustworthiness of this report. It is my deep hope that examining this story prods the reader to consider ways that they might leverage synchronous web conferences as a means of boosting instructor presence in their own online courses. Further, I hope that the investigation of this case might inspire more contextualized research in a similar vein in the future. As Reeves and Reeves (2015) encouraged, more replication studies and explorations of problems of practice in Educational Technology will only strengthen the field.

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Appendix A: Survey items about happy hour

I really like the idea of happy hour (office hours) for online courses, and I'm working on refining the way I conduct them. Your input on the following is very helpful for me in this!

Did you participate in happy hour at all?

a. Yes – at least once.
b. No
c. I watched the videos afterward.

(Decision logic: If students answered "a" they were directed to section A, if "b" to section B, or if "c" to section C.)

A. I'm glad you were able to come to happy hour at least once! A few questions about your experience in happy hour...

What did you find beneficial about happy hour?

What could make happy hour better?

Were happy hours scheduled at times that worked well for you? Please explain.

B. No worries that you didn't attend, but I am hoping to have more students join us for happy hour in the future, so your responses to these questions will help me better understand why you might have opted out.

Which of these were reasons for not participating in happy hour? Check any that apply.

a. I was too busy with other things to attend
b. It did not seem like happy hour would benefit me
c. The times happy hour met did not work for my schedule
d. It was optional, and I just opted out
e. Other (please explain)

Is there anything that could have made happy hour more appealing, or made it more likely you would attend?

C. I'm sorry you weren't able to attend in person, but I am glad you watched the videos afterward! I am hoping to have more students join us for happy hour in the future, so your responses to these questions will help me better understand why you might not have been able to join in.

Which of these were reasons for not participating in happy hour when it was offered live? Check any that apply.

a. I was too busy with other things to attend
b. It did not seem like happy hour would benefit me
c. The times happy hour met did not work for my schedule

d. It was optional, and I just opted out
e. Other (please explain)

Is there anything that could have made happy hour more appealing, or made it more likely you would attend?

How Does Learning Instructional Design Theories Affect Instructional Designs of Pre-Service Teacher-Training Students?

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1. Introduction

1.1 Instructional Design and Technology in Japanese Teacher-Training Course

In Japan, the Central Council for Education (2016) considers the new curriculum guidelines, which are to take effect in junior high schools and high schools in 2021 and 2022, respectively, as based on the following three pillars: (1) what students will be able to do, (2) what they will be able to learn, and (3) how they will be able to learn it. Particularly, the last item implies improvements in giving instructions from an active learning point of view.

In response to these needs, the Ministry of Education, Culture, Sports, Science and Technology (MEXT 2017) summarized the skills required for the pre-service teacher-training courses of all Japanese universities in a document titled “A Core Curriculum of Pre-Service Teacher-Training Course.”

In this core curriculum, pre-service teacher-training courses are divided into four categories. Table 1 shows the categories of the curriculum and specific examples of the course at the Tokyo University of Science. For example, “Teaching Methods of Mathematics Course” falls under the category of “Subjects and Teaching Methods” and “Instructional Design and Technology Course” falls under “Teaching Method for Morals, Integrated Studies, Student Counseling, and Educational Consultation” at the Tokyo University of Science. The purpose of these subjects is to understand the fundamental theories and practices of instructional designs. There is a need to improve and gain understanding in instructional design theories in Japanese higher education.

Table 1. Categories of the Core Curriculum and Specific Examples of the Course in the Tokyo University of Science

Category		Specific Examples of Course
1	• Specialization Subjects and Teaching Methods	• Teaching Methods of Mathematics Course • Teaching Methods of Science Course
2	• Basic Understanding of Education	• Foundation of Pedagogy • Introduction to the Teaching Profession
3	• Teaching Methods for Morals, Integrated Studies, Student Counseling, and Educational Consultation	• Instructional Design and Technology (IDT) • Extracurricular Activities and Career Guidance
4	• Educational Practice	• Preparation for Teaching Practice • Seminar in Teaching Profession

1.2. Instructional Design in Lesson Plans

Katsuaki Suzuki (2005) states that Instructional Design is a model and a research field that combines methods to increase the effectiveness, efficiency, and appeal of educational activities. For example, Gagné's nine events of instruction and the ARCS model is an instructional design theory and a model, respectively, in this research.

In this research, participants designed lesson plans. A lesson plan is a design document that outlines the type of lesson to be taught, background, objective, and main contents (Ichikawa 2019).

In Japan, traditionally, the flow of a lesson has three parts, “Introduction,” “Body,” and “Summary.” However, Gagné’s nine events of instruction theory is divided into nine events, from “Gaining attention” to “Enhancing retention and transfer.” Considering these nine events, lesson planners may design a lesson in more detail (Table 2).

Table 2. Correspondence Table of a Lesson Flow and Gagné’s Instructional Events

Lesson Flow	Instructional Event	
Introduction	1	Gaining attention
	2	Informing the learner of the objective
	3	Stimulating recall of prerequisite learned capabilities
Body	4	Presenting the stimulus material
	5	Providing learning guidance
	6	Eliciting performance
	7	Providing feedback about performance correctness
Summary	8	Assessing the performance
	9	Enhancing retention and transfer

1.3. Today's Japanese Students' Motivation in Secondary Education

As a result of Programme for International Student Assessment (OECD 2018), Japanese high school students have the top level of mathematics literacy. However, according to the result of TIMSS (2015), Japanese junior high school students have low motivation toward Mathematics. Therefore, the problem lies in the gap between high literacy in mathematics and low motivation to learn.

To control students' mathematics motivation, we focused on the ARCS Model that stands for Attention, Relevance, Confidence, and Satisfaction. The ARCS Model is a problem-solving approach for designing motivational aspects of learning environments to stimulate and sustain students' motivation to learn (Keller 1987).

Table 3. Categories of ARCS Model and its Subcategories

Category	Subcategory
Attention	Perceptual Arousal, Inquiry Arousal, Variability
Relevance	Familiarity, Goal Orientation, Motive Matching
Confidence	Learning Requirement, Success Opportunities, Personal Control
Satisfaction	Natural Consequences, Positive Consequences, Equity

2. Purpose

We are not sure if the students can design the lesson plan more effectively through the Instructional Design and Technology Course. Do the motivations of Instructional Design change? Therefore, the purpose of this study is surveying how learning the Instructional Design theories affect the pre-service teacher-training students' Instructional Design and motivation.

3. Methods

3.1. Instructional Design and Technology Course in Our Field

The objective of the Instructional Design and Technology (IDT) course includes learning instructional design theories and practical methods. The participants were the students of Tokyo University of Science, specialized in Mathematics, Physics, Chemistry, and Biology.

Tokyo University of Science, founded in 1881, is one of the oldest private universities of science and technology in Japan. The number of students in this university is approximately twenty thousand as of May 2020. They have a pre-service teacher-training course for junior high school and high school. The students can get their teacher's license in Mathematics, Science, and Information. The number of teacher's license issuance is about 600 per year on average. Therefore, this course carries great importance.

Furthermore, they have Active Learning Classroom in the Kagurazaka campus, Tokyo. In this room, the students can use projectors with Electronic Blackboard. Also, desks and chairs are movable to make a group easily.

3.2. Flow of Research

Figure 1 shows the flow of the research that is composed of two Studies. Study 1 was held as a face-to-face lesson from September to November 2019. Study 2 was held as an online lesson from May to July 2020. In both studies, the participants answered the questionnaires and designed lesson plans twice through the course.

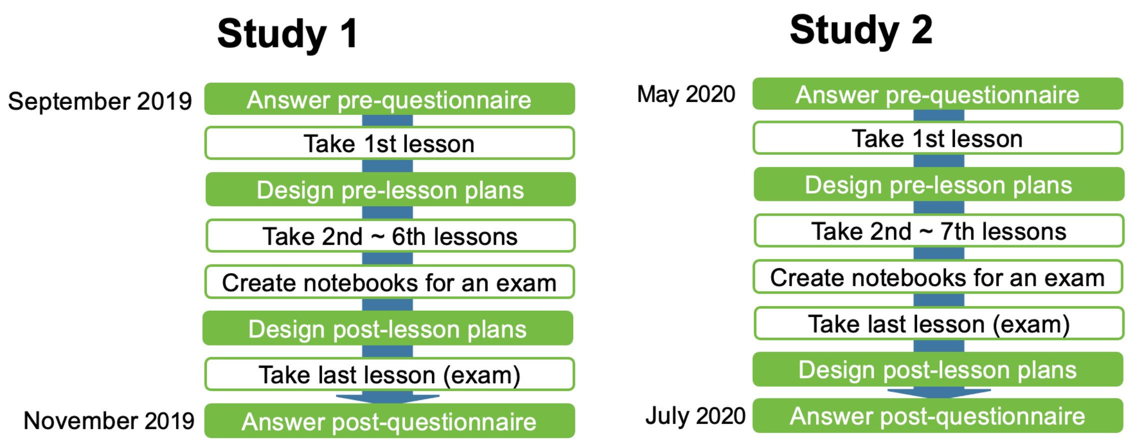

Figure 1. Flow of Studies

3.3. Learning Contents of IDT Course

Table 4 shows the contents of the course. They include fundamental instructional design theories and models.

Table 4. Learning Contents of IDT Course

Title of Lessons	Specific Contents
Introduction	• Educational Technology, Technological Pedagogical Content Knowledge
Designing Instructions	• ID, Gagné’s five types of Learning Outcome, Gagné’s Nine Events of Instruction
Active Learning	• 21st Century Skills, Active Learning
ID Considering Students’ Motivation	• ADDIE model, ARCS model
Learning Environment	• Learning Space, Activity, and Community
The Consistency of Objective and Assessment Method	• Teaching Objective, Way of Assessment
Instructional Media	• History of Instructional Media, Practical Use of ICT

3.4. Questionnaire of Studies 1 and 2

Instructional Design Motivation

We created 24 items of Instructional Design Motivation for pre-service teacher-training course students with reference to a six-level definition of learning experience (Parrish and Wilson 2008) using a 5-point Likert scale (1 = *I don't think so* and 5 = *I think so*). Each level has four items (e.g., "I am interested in the content of ID" for level 1). In this research, we use this value in Study 2 to focus on the difference between pre- and post-score.

Teacher Efficacy

We quoted 7 items related to subject instruction from the teacher efficacy scale for the Faculty of Education (Igarashi, Miyauchi, and Yamada 2018) using a 5-point Likert scale (1 = *I don't think so* and 5 = *I think so*, e.g., "I can teach in a way that is easy to understand").

Change of Instructional Design Motivation

In the post-questionnaire, we asked whether students changed instructional design motivation using a 5-point Likert scale (1 = *declined* and 5 = *increased*). Subsequently, we asked why they answered as they did both from the perspective of their own motivations and environmental causes.

Teaching Experience Level

We created 1 item of Teaching Experience Level for pre-service teacher-training course students with reference to a six-level definition of Learning Experience (Kawamoto, Watanabe, and Hidaka 2018) using a 6-point Likert scale ranging from 1 for "I am not interested in this class. I do not think this class is useful" to 6 for "ID is important in life. I am happy to design instructions assuming the environment of education."

Self-Regulated Learning Strategy

We quoted 24 items related to self-regulated learning strategy from the scale of self-regulated learning strategy for university students (Hatano, Oikawa, and Hanzawa 2011) using a 5-point Likert scale, ranging from 1 for "I don't think so" to 5 for "I think so." (e.g., "I take a lesson motivated whenever I am not interested in the learning contents.").

3.5. Assessment

To assess the participants' lesson plans, we developed checklists for two perspectives: Gagné's Nine Events of Instruction from 0 to 9 points and the ARCS Model from 0 to 4 points.

In study 2, we provided these checklists to the students so that they could check by themselves.

4. Result

In total, 141 participants answered both pre- and post-questionnaires and designed pre- and post-lesson plans (Table 5). To accomplish our goals, we checked qualitative changes in lesson plans and in students' motivations.

Table 5. Number of the Participants for Each Specific Course and Study

Study	Specific Course				Total
		Science			
	Math	Physics	Chemistry	Biology	
1	18	8	15	0	41
2	63	9	23	5	100
Total	81	17	38	5	141

4.1. Result of Lesson Plans

Gagné's Nine Events of Instruction

Table 6 shows the result of a three-way analysis of valiance (ANOVA) of Gagné's Nine Events of Instruction. The three factors in this analysis are "Study (Study 1, Study 2)," "PrePost (Pre, Post)," and "Course (Mathematics, Science)."

Table 6. Three-way ANOVA of Gagné's Nine Events of Instruction

Factors	*SS*	*df*	*MS*	*F*		η^2
Study	3.08	1.00	3.08	2.22		0.01
PrePost	41.67	1.00	41.67	29.97	***	0.09
Course	1.90	1.00	1.90	1.37		0.00
Study × PrePost	9.50	1.00	9.50	6.83	**	0.02
Study × Course	0.11	1.00	0.11	0.08		0.00
PrePost × Course	2.10	1.00	2.10	1.51		0.00
Study × PrePost × Course	0.34	1.00	0.34	0.24		0.00
Residuals	380.87	274.00	1.39			

$n = 141$, *SS:* Sum of Squares, *MS:* Mean Square ** $p < .010$, *** $p < .001$

As a result, there was a significant Study × PrePost interaction. Therefore, we conducted Tukey's Multiple Comparison of Gagné's Nine Events of Instruction. As a result, there were four significant differences. Especially, in Study 2, students' lesson plans improved from the perspective of Gagné's Nine Events of Instruction, $t\ (274) = 7.36$, $p < .001$, $d = 0.44$.

Then, we conducted McNemar's Test for the value of Gagné's Nine Events of Instruction in Study 2 (Table 7). As a result, almost all events improved. However, only about 10% of the students could design the summary part.

Table 7. The number of Accomplishment of Gagné's Nine Events

Event		n_{Pre}	n_{Post}	$\chi^2(1)$	
1	Gaining attention	14	37	23.00	***
2	Informing the learner of the objective	40	64	24.00	***
3	Stimulating recall of prerequisite learned capabilities	24	49	23.15	***
4	Presenting the stimulus material	84	86	0.50	
5	Providing learning guidance	1	9	8.00	***
6	Eliciting performance	42	57	10.71	***
7	Providing feedback about performance correctness	0	3	–	
8	Assessing the performance	1	13	12.00	***
9	Enhancing retention and transfer	1	9	6.40	*

$n = 100$ * $p < .050$, *** $p < .001$

ARCS Model

From the perspective of the ARCS Model, we conducted the same test as ANOVA (Table 8). As a result, there was a significant Study × PrePost interaction.

Table 8. Three-way ANOVA of the ARCS Model

Factors	*SS*	*df*	*MS*	*F*		η^2
Study	2.09	1.00	2.09	3.27		0.01
PrePost	10.02	1.00	10.02	15.68	***	0.05
Course	1.14	1.00	1.14	1.79		0.01
Study × PrePost	4.39	1.00	4.39	6.87	**	0.02
Study × Course	0.19	1.00	0.19	0.29		0.00
PrePost × Course	0.02	1.00	0.02	0.02		0.00
Study × PrePost × Course	0.01	1.00	0.01	0.02		0.00
Residuals	174.99	274.00	0.64			

$n = 141$, *SS:* Sum of Squares, *MS:* Mean Square   ** $p < .010$, *** $p < .001$

Therefore, we conducted Tukey's Multiple Comparison of the ARCS Model. As a result, there were two significant differences. Especially, students could use the ARCS Model for their specific course through the learning style of Study 2 compared to that of Study 1, t (274) = 3.13, $p < .05$, $d = 0.19$.

Then, we conducted McNemar's Test for the value of the ARCS Model in Study 2 (Table 9). As a result, all perspectives of the ARCS Model improved. However, all perspectives remain to be less than 50% of lesson plans.

Table 8. Number of Accomplishment of the ARCS Model

Perspective of the ARCS Model	n_{Pre}	n_{Post}	$\chi^2(1)$	
Attention	29	46	15.21	***
Relevance	6	20	12.25	***
Confidence	11	34	23.00	***
Satisfaction	1	17	14.22	***

$n = 100$ *** $p < .001$

4.2. Result of Questionnaires

Table 10 shows the result of Wilcoxon's Signed Rank Test for the value of Instructional Design Motivations in Study 2. As a result, the students could design instructions considering learning content. However, their specific course, such as Mathematics, is less useful in designing instructions.

Table 10. The Change of the Instructional Design Motivation

		Pre		Post		M_{post}- M_{pre}	W		r
		M_{pre}	SD_{pre}	M_{post}	SD_{post}				
1	I gain something through ID.	3.91	0.82	4.24	0.73	0.33	318.50	**	0.50
6	I know why I design instructions.	3.61	0.84	3.95	0.78	0.34	332.50	***	0.54
7	I grow through ID.	3.56	0.83	3.95	0.83	0.39	247.00	***	0.60
10	The other specific courses I take are useful to design instructions.	3.76	0.92	3.46	1.10	-0.30	1583.00	*	-0.27
11	The other teacher-training courses I take are useful to design instructions.	3.82	0.80	4.05	0.80	0.23	460.50	*	0.36
13	I spend a lot of time designing instructions in my school life.	2.82	0.90	3.19	1.09	0.37	526.50	**	0.42

15	Designing instructions are interesting.	3.65	0.82	3.91	0.90	0.26	760.50	*	0.31
18	I try to adopt various teaching methods when I design instructions.	3.41	0.82	3.68	0.84	0.27	591.00	*	0.33
19	I change my teaching methods depending on the learning contents.	3.30	0.77	3.56	1.01	0.26	889.00	*	0.28

n = 100, 5-point Likert scale * $p < .050$, ** $p < .010$, *** $p < .001$

5. Discussion

5.1. Discussion on Lesson Plans

Based on the above results, the positive effects of learning instructional design theories are as follows:

- In Study 2, students' lesson plans improved from the perspective of Gagné's Nine Events of Instruction.
- Students can use the ARCS Model for their specific course through the learning style of Study 2.
- Therefore, Providing Checklists of the Instructional Design theories may help design instructions.

On the other hand, there are a few limitations as well.

- Only 3 ~ 13% of the students could design a summary part of the lesson plan.
- All perspectives of the ARCS Model were less than 50% of the students' post-lesson plan.

Therefore, to ensure whether the students can design a summary correctly, peer review or other review systems might be helpful.

5.2. Discussion on Motivation

The positive effects on the students' motivations are as follows:

- By learning Instructional Design Theories, students can know why they design instructions.
- Students can design instructions considering learning content.

Therefore, they may consider instructional design not only as a single task, but also as a meaningful task.

However, there is a limitation in the perspective of students' specific courses being less useful for designing instructions. Therefore, their instructional design might only be useful for secondary education but not higher education.

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Gamifying College Academic Writing Class – A Case Study

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Gamification refers to the application of game mechanics to non-game settings in order to promote motivation and increase engagement (Brian, 2014; Li, Dong, Untch, & Chasteen, 2013). Many tools have been introduced to gamify learning in all kinds of educational settings. Among these tools, digital badges are considered as an achievement-based gamification tool (Grouling, Hedge, Schweiger, & Cinder, 2014) which have been gradually adopted in higher education for about 10 years (Abramovich, 2016; Grouling, et al., 2014). Although some researchers claimed using digital badges does not involve real game thinking, which includes competition, cooperation, exploration and storytelling (Kapp, 2012), most educators agree that gamification can involve using leaderboards, point rewards, achievements, and badges (Grouling, et al., 2014).

In educational settings, digital badges are used to deliver instruction and track learning outcomes and learning progress (Rimland, & Raish, 2019). Researchers pointed out digital badges can support self-regulation (Cucchiara, Giglio, Persico, & Raffaghelli, 2014) and increase self-awareness (Abramovich, 2016). Cheng, Waterson, and Newby (2018) stated that digital badges can help with goal setting in learning process. Other researchers claimed the implementation and use of digital badges not only motivates learners but also provides a new method for assessment and creates alternative credentials (Newby, Wright, Besser, & Beese, 2016).

Although the existing literature has discussed the advantages of using digital badges as a gamification tool, research on the effectiveness of using digital badges in higher education are still limited. Therefore, researchers have called for future studies on how to use digital badges and what instructional strategies should be used (Abramovich, 2016; Cheng, Waterson, & Newby, 2018). Other researchers called for investigations on using gamification tools in different contexts (Abramovich, 2016), such as in writing classes (Grouling, et al, 2014). In respond to these calls, this case study chose two digital badge tools to gamify a college level writing class at a Midwestern university. Through surveys and interviews, the study will investigate the effectiveness of gamification, student perception of gamification, and the impact of gamification on student learning behavior in the writing class.

Background and Purpose of the Study

The issues and problems of college writing class has been discussed throughout the last two decades. Poor preparation from high school is one of the biggest issues of college writing class, especially in first year class (Hughes, 2009). Some educators claimed students are less engaged in writing class than other subjects that directly related to their majors (Tantawi, Sadaf, & Alhumaid, 2018). Therefore, correcting negative behaviors and increasing engagement and collaboration should be considered in today's college writing class (Grouling, et al, 2014). On the other hand, traditional lectures and PowerPiont slides are not enough for today's writing class (Coffin, Curry, Goodman, & Hewings, 2003; Grouling, et al, 2014), and new strategies and tools need to be adopted in teaching academic writing to accommodate millennial students (Coffin, et al, 2003). Other researchers addressed using technology in academic writing classes has multiple advantages, such as improving students' responsibility for their own work (Levine, Ferenz, & Reves, 1999) and encouraging peer responses (Jin, 2007).

Among these technologies, gamifications and digital badges gained increasing attention. Grouling, et al (2014) reported using digital badges in a college writing class improved perceived enjoyment of collaboration and student self-reported attendance. Similar results were reported form multiple subject areas in other universities/institutions (Abramovich, 2016; Rimland, & Raish, 2019). Some universities even developed their own digital badge platforms to embrace gamification in teaching and learning, such as University of Central Florida (Cheng, et al, 2018), UC Davis, and Purdue University (Newby, et al., 2016). Purdue University reported more than 10,000 students has been using Purdue self-designed digital badge tools, and these tools become one of the most commonly used educational tools on campus. To improve the effectiveness of college writing class and explore potential gamification ways using digital badges, this case study investigated student perceptions, learning behavior, and the effectiveness of these gamification tools in a college-level academic writing class.

Research Design

An undergraduate-level first-year composition class at a Midwestern university was chosen for this case study. The course was delivered face-to-face in the spring semester of 2019. The academic writing course emphasizes writing as a process, and writing projects assigned to students throughout the semester traditionally consist of five papers, each with multiple drafts, and only the final drafts are graded. Following this assessment and instructional approach, and in line with the literature, the instructor realized the challenge in engaging students in writing drafts for each assignment and in class collaboration. In order to improve teaching, the instructor incorporated two university self-designed digital badge tools to gamify the course.

Specifically, one of the tools was used to demonstrate students' competencies and record their achievements with badges. A total of 18 badges were linked to the five assignments and the corresponding drafts. Students received a badge once they submitted one part of the assignment on time and met all the requirements. Students who received all of the 18 badges were awarded extra 20 points on their final course grade. In addition, students can choose to show the earned badges to their peers or make it private.

The other tool was used to deliver gamified online quizzes in class to improve collaboration. To take the quizzes, the class was divided into multiple groups. Each group were asked to access to this tool and choose an avatar before taking the quiz. The whole group received a badge once they completed a quiz. The instructor showed the quiz results leaderboard on the big screen. The top 5 scored groups' avatar were displayed on the leaderboard. A total of 3 online quizzes were designed for this class.

The class contained 19 students aged from 18 to 20. All of the participants were trained to use these tools at the beginning of the semester. Technology support was provided when the course was delivered.

Research Questions

This case study will be conceptualized to answer the following two questions:

1. How do students perceive the effectiveness of gamification tools in the writing class?
2. Do gamification tools improve collaboration between students?
3. Is there any relationship between student perception of gamification and their academic performances?

Data Collection and Analysis

This study collected two types of data. One is the number of badges and the course final grades that each of the participants earned, which is collected by the instructor. The other type of data comes from the online survey and face-to-face interviews, collected by the first author.

Before the end of the semester, the participants were invited to take an online survey that evaluated student perceptions of the two gamifications tools respectively. The survey included two sets of 5-point Likert scale with 13 statements. As a cross-check, they were also invited to participate in an interview which included 10 questions about the overall perceptions of gamification tools and the learning strategies that were used in the class. To gain better insight into the effectiveness of the gamification tools in instruction, we also interviewed the instructor at the end of the semester.

Research Question 1

A total of 18 students took the online survey. The responses of the statements were summed up to get the overall perceptions of the two gamifications tools. The points that each statement received ranged from 1 to 5. The average points that each statement received ranged from 2.58 to 3.5. Table 1 shows the descriptive statistics of the survey results.

Table 1

Descriptive Statistics of Online Survey

Statements	**Min**	**Max**	**Mean**	**Median**	**Mode**
Q1.1 Earning badges makes me enjoy academic writing.	1	5	2.58	2	2
Q1.2 Earning badges makes academic writing easier.	1	4	2.58	2.5	4
Q1.3 Earning badges helps me complete my assignment on time.	1	5	3.33	4	4
Q1.4 Earning badges helps me understand assignment requirements.	1	5	3.33	4	4
Q1.5 Earning badges helps me to value writing as a process.	1	5	2.75	3	1
Q1.6 Earning badges ensure efficiency of peer editing.	1	4	2.41	2.5	1
Q1.7 The digital badge tool is easy to use.	1	5	3.5	4	4
Q1.8 I enjoy using the digital badge tool.	1	5	2.75	3	3

Q2.1 Taking quizzes using the gamified online quizzing tool is fun	1	4	3	3.5	4
Q2.2 Taking quizzes facilitates in my learning of academic writing concepts	1	4	3.17	3.5	4
Q2.3 Taking quizzes using the gamified online quizzing tool improves my class participation	1	5	3.33	4	4
Q2.4 The gamified online quizzing tool is easy to use.	1	5	3.25	4	4
Q2.5 I enjoy using the gamified online quizzing tool.	1	5	3.25	3	3

The top ranked statements for the digital badge tool are: “earning badges helps me complete my assignment on time”, “earning badges helps me understand assignment requirements”, and “the digital badge tool is easy to use”. The top ranked statements for the gamified online quizzing tool are: “taking quizzes using this tool improves my class participation”, “the gamified online quizzing tool is easy to use”, and “I enjoy using the gamified online quizzing tool”. The following screenshot image shows the badges on the instructor’s dashboard. Student dashboard only shows the badges they earned.

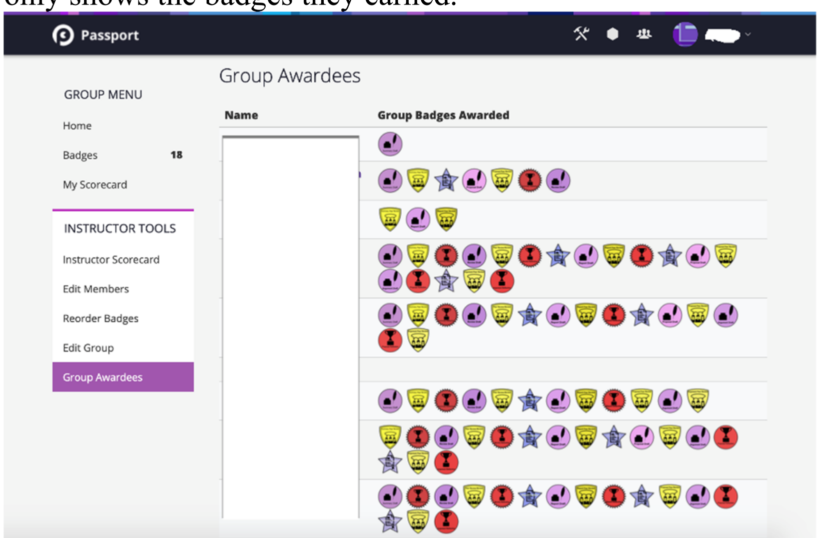

Figure 1. Instructor Digital Badges Dashboard
(Note: students’ names are deleted from the image)

The interviews focused on the students’ specific experience of gamification tools. A total of 12 students participated the interview. Overall, the students gave positive feedbacks on the gamification tools and the class activities that were designed with the tools. Students claimed digital badges helped them track their work and remind them to finish the assignments on time. Such comments include: “the digital badge tool is a checklist for me. It’s very helpful to remind me submit my assignments on time”, “The digital badge tool keep me more organized. The listed due dates make it easier”, “Digital badge is helpful because it monitored my progress”, and “This tool helps me track what I did and reminded me to finish the assignments”.

When asked about their opinions on the activities that are designed using the online quizzing tool, more than half of the participants mentioned using the gamified tool is a fun way to take quizzes. One students mentioned “we only used this tool three times in the class. I wish we used it more." When asked if they would like to use these two tools again in the future, all of the interviewees said yes except for one who commented "not sure". Most students are expecting to use these tools in other classes as well.

On the other hand, some students offered negative feedback on these tools. One said the tools were very confusing and hard to use. The other one thought the tools didn't help with his/her study at all. One students claimed that submitting assignments through a digital badge tool creates confusions because other courses use learning management system to collect assignment.

Research Question 2

Research question 2 is specific to the online quizzing tool. The whole class was divided into several groups to take the online quiz in class. The top 5 groups showed up on the leaderboard of the tool. At the end of the quiz, the instructor showed the leaderboard on the big screen in class. Both of the survey responses and the interviews results were used to answer this question.

As aforementioned, in the Likert scale, the statement "Taking quizzes using the gamified quizzing tool improves my class participation" is among the highest ranked statement. Based on the interview, more than half of the participants mentioned that the tool made group work interesting. One student mentioned "using this tool get everyone involved in the team work". The other students claimed "I communicated more with other members when using this tool". Some students claimed that group work was helpful and this tools should be use more often. An interesting finding from the interview is that almost 1/3 of the students claimed they would like to use this tool individually rather than using it for group work

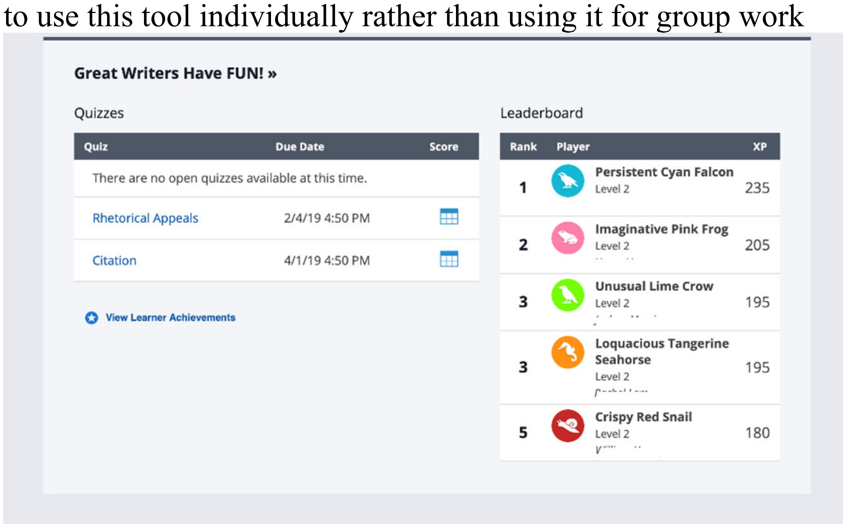

Figure 2 Quiz 2 leaderboard.

Research Question 3

To answer research question 3, students' final grades and the online survey results are analyzed. For the final grades, the total points that students received ranged from 589 to 1000. About 88% of the participants received more than 80% in final grades. One students received 60%, and one student received 58%.

Correlation test didn't show linear relationships between students overall perception of gamification tools and their final grades, which is likely because of the small sample size. Another possible explanation is that the final grades also included students' attendance and presentations, so they did not perfectly represent students' writing performances.

We found 5 out of 18 students received all the 18 badges and were awarded 20 points to add on their final grades. Based on the survey results, these 5 students gave very positive comments on the tool. One of the students stated: "I like to use the digital badge tool. It keeps me from been lazy. I'm motivated to do the quality work instead of getting extra credit." The other students claimed "I like the idea to earn each badges when I work on the essay. Helped me catch up. I like the gamified online quizzes. It was good to test knowledge. Taking the quiz in group is also helpful".

An interesting finding is that the three students gave lowest ratings on the online survey statements actually received 88-90% in final grades. Two of them did not attend the interview. The student attended the interview gave almost opposite feedback on the effectiveness of the gamification tools that were used in class. The student mentioned "the digital badge tool helps the teacher organize the materials and it motivated me in a better way." The students also claimed "using the digital badge tool is better than nothing. It make the class easier."

Findings and Discussions

This case study looked into the impact of gamification tools in a college level writing class for the purpose of finding an innovative way to improve this class. Student perceptions, achievement, and learning behavior were analyzed. Our findings can be concluded into the following five aspects:

First, overall, 67% participants agreed that earning badges helped them understand assignment requirements and complete assignment on time. About 60% students agreed that the gamified quizzes improved their class participation and facilitated learning. However, the survey results also shows students perceptions on the gamification tools were highly varied. The rating range for each of the survey statement is from 1 to 5. Based on the interview, this is likely because students had different technology experience.

Second, the perceptions and effectiveness of the gamification tools are impacted by the teaching strategies that are designed by the instructor. Table 1 shows students have more positive perceptions on the gamified online quizzing tool over the digital badge tool. This is likely because the quizzing tool not only provided digital badges and leaderboard, but also because it was used in group works. Class discussions and collaborations were greatly improved by using this tool.

Third, student learning behavior impacted their opinion on using the gamification tools. More than half of the participants claimed they enjoyed the group work. They also addressed the gamified online quizzing tool made the group work fun. The instructor observed increased class discussions and collaborations. This verified the previous studies on improving class collaboration (Grouling, et al, 2014). On the other hand, a few students claimed they would like to use the tool individually instead of in groups because they prefer to work by themselves. In regard of this issue, we suggest future study focus on engaging students with different learning behaviors.

Fourth, from the instructor's perspective, using digital badges motivated the instructor to redesign the course in a better way. The instructor of this class pointed out that using the gamification tools helped her rethink the course structure, update the instructions for each of the assignment, revise assessment plan, create class activities, and create new rubrics to help students understand the requirements of the assignments. The instructor also claimed using the gamified online quiz tool created fun times in class and greatly helped her engage students in class.

Last, using gamification tools and learning management system at the same time could cause confusing. Although students were trained to use the tools at the beginning of the course, they were expecting a simpler way to earn the badges and take the gamified online quizzes. For the instructor, tracking students' achievement across systems took a longer time than focusing on one system. For this reason, we call on future studies in bridging the LMS and the gamification tools, especially for fully online classes.

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Flipped Classrooms for One-Shot Library Instruction: A Pilot Study with Psychology Students

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Abstract

This paper presents an action research study that used a flipped approach for "one-shot" library instruction. Lack of time for delivering effective library instruction is a common issue academic librarians face when invited to provide one-shot sessions for students. This study compared student's responses across three levels of "flipped" instruction, as well as examining student reactions to the library instruction experience. Animated video lectures were used for instruction prior to in person sessions with the librarian. Exercises in the live session provided practice for students on searching for articles as well as data on students searching behaviors. Surveys after the session gave additional data about the flipped and in person instruction. Students with greater exposure to the videos showed a higher degree of assignment completion. Results were viewed as a helpful basis for structuring and developing library instruction.

Keywords: flipped classroom; library instruction; action research

General Background

In conventional introductory college or university library instruction, librarians are invited to class to present an overview of library services and resources. By working with the class instructor, librarians customize the content based on class needs. Instruction topics can include describing and showing overall library services as well as basic database searches. Distinguishing scholarly work from trade publications, and explaining the use of library resources for literature reviews are other topics.

As with other academic institutions in higher education, library instruction services Kent State University strives to educate students on finding and using information effectively and ethically. That instruction involves not only the skills and critical thinking associated with Information Literacy, but also the skills and reasoning related to technology and media fluency. Each librarian is assigned to a limited set of colleges and disciplinary departments across the university, and a goal is to support student learning appropriate for where students are in their understanding and skill levels. Traditionally, in-class library instruction has involved lectures or "show and tell" type presentations. Students have been given a lot of information and librarians have regularly been invited back to provide instruction. Overall, the comments received from students and instructors in the past have been positive at Kent State. A common comment has been “the session was useful and very informative”, and records indicate that more than 3,400 undergraduate students were provided in-class library instruction during 2019 at Kent State.

“One-Shot” Instruction Sessions

Although the usual presentation type of instruction has been well received, there have been concerns with ““one-shot”” library instruction approaches (Artman et al., 2010; Mery et al., 2012). It is challenging when librarians are expected to pack all the essentials of information literacy into a 45-60-minute class time limit, and often these instruction opportunities for a course are one time only. Also, timing is important; students learn what they care about and remember what they understand (Ericksen, 1984). So, if the session is not offered when students feel a need, the effectiveness of library instruction sessions is challenged. Based on our experience with traditional instruction, as librarians and instructional designers we sought to address concerns about “one-shot” presentations.

Action Research and Active Learning

We saw action research (Efron & Ravid, 2020) as a means to understand our current instruction and to work toward improvements. We also hoped to incorporate more active learning approaches to move the student learning experience beyond just (passively) receiving information in the traditional one-shot session (LeMire et al., 2019; Wegener, 2018). Learning by doing would be a guiding principle.

The traditional lecture-centered instruction is a content-oriented approach, which mainly involves verbal information delivery. This delivery can use instructor presentation, videotape demonstration, class discussion, and textbooks and worksheets as the primarily curriculum material (Mastropieri et al., 1999; Scruggs & Mastropieri, 1993). Activity-oriented approaches promote a depth of understanding through learning process that emphasizes hands-on experience, (Mastropieri, Scruggs, & Magnusen, 1999; Scruggs & Mastropieri, 1993). In response, for this study, instead of only presenting information (i.e. lecture, demo), we sought to incorporate structured instruction involving in-class hands-on practice and project-based Q&A for the in-class session.

Flipped Classrooms

Additionally, for this study we focused on a flipped classroom approach (Minuti et al., 2018; Murray et al., 2015). These approaches can be viewed generally as involving work by students outside of class (frequently before class) which is reinforced with activities in class (Bergmann & Sams, 2012). Recent studies have indicated that using flipped approaches can have value for library instruction, including more motivated students (Karabatak & Polat, 2019) and having students come to class better prepared to engage and experience higher level learning (Loo et al., 2016). Other work indicated that while challenging, flipped approaches could be used for information literacy instruction (Rodriguez, 2016). Additionally, in their background review of the literature, a recent meta-analysis also noted that flipped approaches have become widely utilized, supporting both active and self-regulated learning, both potentially positive for students (Strelan et al., 2020). While some have concluded that a flipped approach did not improve learning outcomes (Miller, 2017), to us it seemed overall that the literature suggested that a flipped approach could be a good strategy to meet challenges of “one-shot” instruction.

To briefly summarize, given our understanding of active learning and flipped approaches, the current authors sought to pursue the study described below to help determine the efficacy of such approaches for library instruction at Kent State. Results would help guide planning for future library instruction development. Specifically, the current study had two objectives. First, we sought to examine the use of a flipped approach with students in a psychology writing class by comparing students' responses across three levels of "flipped" settings. A second objective was to examine student experiences with how the librarian flipped the classroom.

Research Design

An undergraduate psychology research writing course was chosen for this study[1] because the subject librarian had an existing relationship with the psychology department and was invited to give library instruction for the course.

Students and Classroom Setting

There were three instructors for the writing course involved in the current study, and, across the three classes, a total of 149 undergraduate students were enrolled in the course received library instruction (Class A: 50 students, Class B: 50 students, and Class C: 49 students.) All library sessions took place in a classroom with desktop computers located in the library. The different teaching styles of the three instructors resulted in the varied levels of students' preparation for the in-class library instruction session.

Instruction Provided Before In-Class Instruction

Five library tutorial videos were provided in advance, so students would have opportunities for instruction prior to coming to the library session. The videos on search strategy covered topics including choosing keywords from a topic, developing search strategy, using databases, and accessing full text articles. The instructor in class A incorporated our pre-class materials into her course plan by designating time for students to watch videos together, while the other two instructors in classes B and C were more "laid back". Those two instructors mentioned the pre-class materials for library instruction session to students. However, they did not require students to watch the videos.

In-Class Library Instruction

Each of the three classes had two in-class exercises and the same total class time (45 minutes). The in-class library session had two components: in-class exercises and librarian-led instruction. The librarian-led instruction involved a varied amounts of "hands-on" activity. As shown in Figure 1., the librarian-led instruction was provided between two exercises. The exercises served as a pre-test (Exercise 1) and post-test (Exercise 2) from data collection standpoint. The type of librarian-led instruction for the class C was similar to the past, which consisted of standard lecture and demonstration, while there was more time devoted to hands-on practice in Classes A and B.

[1] The Kent State University Institutional Review Board reviewed and gave the required approval for our study.

In-Class Searching Exercises

Exercise 1 (pre-test) was used at the beginning of the library session, and Exercise 2 (post-test) was used after the library instruction. Each exercise involved searches for scholarly articles. Students were asked to find a full-text article on a topic given to them, and to complete a worksheet as follows. In response to a psychology topic given to them, they searched for a full text article, and record the selected keywords and the article title they found on the Exercise 1 and 2 worksheets, respectively. Additionally, on Exercise 1 worksheet students were asked to record the number of videos they had watch prior to the in-class library instruction session. Each of the keywords that students recorded on the worksheets was counted as one-point, with a maximum of two points (at least two keywords were recorded), and a point minimum of zero (i.e., no keyword was selected). After coding, the collected data were analyzed through descriptive statistics (e.g., means, frequency, and percentage) to represent the participants' performance on the article search activity as well as their experience of the library instruction session. All student participation and recorded responses in this study were voluntary and anonymous, including surveys and worksheets.

Survey After the In-Class Instruction Session

Also, following the in-class sessions, a brief survey was used with students. A 4-point Likert Scale question was used to assess students' overall experience in the instruction session, and a 10-point rating scale question was employed to assess participants' perspective on the usefulness of library instruction content. Additionally, a follow-up communication was used with the instructors regarding the student assignment that involved searching full-text scholarly articles on the "testing effect" (Testing Effec*t*, n.d.).

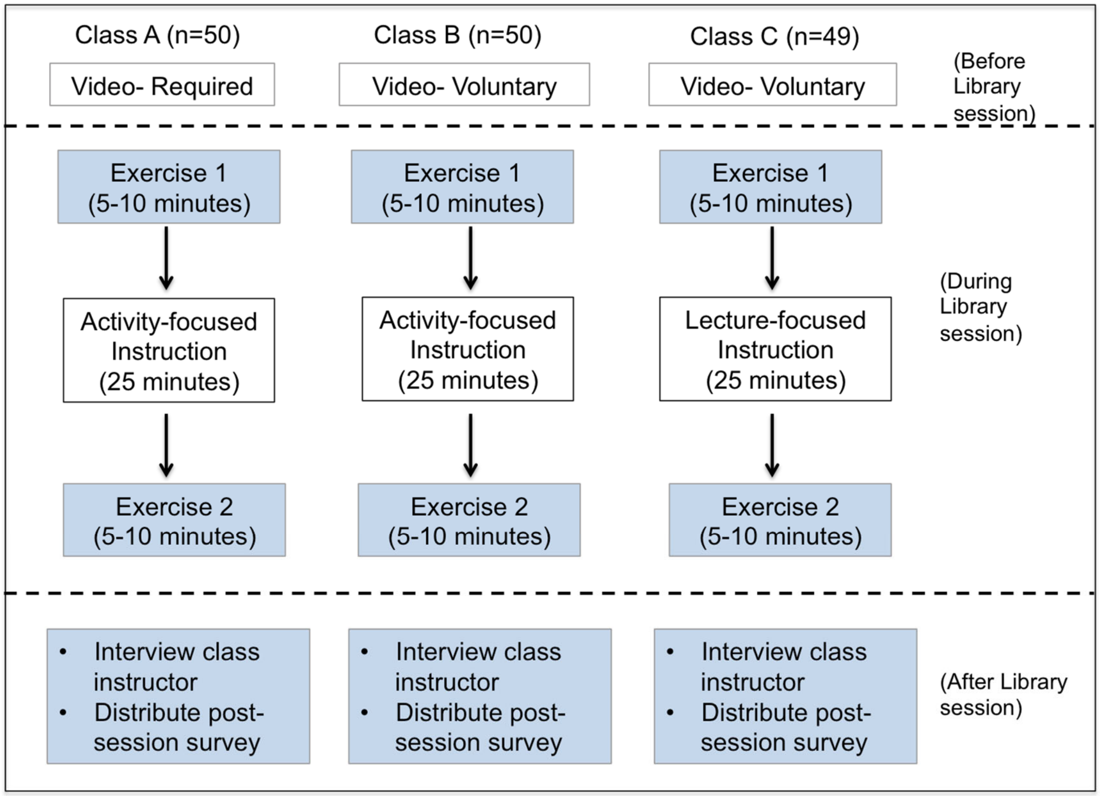

Figure 1. Research Process Flow

Results & Discussion

A total of useable 116 worksheets were collected from all three classes: 40 from class A, 35 from class B, and 41 from class C, for a response rate of 77.8%. One reason for the missing worksheets may be that students did not return their worksheets to the librarian. Forty worksheets (80% response rate) were collected from Class A, thirty-five worksheets (70% response rate) were collected from Class B, and 41 worksheets (84% response rate) were collected from Class C. We looked at the number of pre-class videos watched, in-class exercise worksheets, and the assignment completion rate for overall student performance. We also looked at students' response/feedback about their overall experience. There were 55 students who responded to the survey invitations: 23 from A, 10 from B, and 22 from class C.

Results showed that students who watched more videos before the library session had higher assignment submission completion rate. As shown in Table 1, Class A had the highest average number of videos watched (4.85 out of 5 videos), because the instructor designated time for group watching. Importantly, that class also had a 100% assignment completion rate, which was very positively noted by the instructor. The assignment completion data were different for class B (1 late submission) and class C (5 missing submissions). The average number of videos watched and exercise scores were also lower than class A (average 1.97 videos watched by class B, and 0.32 videos watched by class C.)

Table 1

Videos watched, mean scores exercise 1 and 2, & assignment completion rates

	# of video (total =5)	EX 1 (total=2)	EX2 (total=2)	Assignment submission
Class A (n=40)	4.85	1.83	1.95	100% completion (0 missing submission)
Class B (n=35)	1.97	1.8	1.57	98% completion (1 late submission)
Class C (n=41)	0.32	1.76	1.34	89.8% completion (5 missing submission)

Table 2

Overall experience with the library session

	Disappointing	As Expected	Better than Expected	Much better than Expected
A (n=23)	0	4	11	8
B (n=10)	0	0	3	7
C (n=22)	0	3	11	8
All (n=55)	0	7	25	23

Table 3

Overall usefulness of the library instruction (scale 1-10, 1= least useful)

Class	A (n=23)	B (n=10)	C (n=22)	All (N=55)
Mean	9.0	8.37	8.36	8.48

The results for keywords selection showed that the majority of students recorded at least one keyword from the given topic; the average keywords recorded for Exercise 1 (pre-test) was 1.79, and the average keywords recorded for Exercise 2 (post-test) was 1.62. Looking closer at the results for each class, results showed that for Exercise 1, Class A students recorded the most keywords (1.83) from the given topic, followed by Class B (1.8) and Class C students (1.76). A similar range of results was seen for Exercise 2; Class A students had the highest mean of keywords recorded (1.95), followed by Class B students (1.57) and Class C (1.34). Interestingly, the results are in line with the average number of videos watched before the instruction session, and the assignment completion rate. A possible reason for that pattern is that students who watched more library videos developed a better understanding of the research article search, including selecting proper keywords for conducting the article search. However, with the current data we have, that possible effect of watching videos would need additional confirmation.

Fifty-five of the 116 students who attended the library instruction session completed the online survey. The response rate was 47.8%. Based on survey responses, overall the students considered the library session helpful and better than expected, which suggested a positive experience (see Table 2 & 3). When examining students' overall experience with the library session, results showed that 41.8% of the participants indicated their experiences were much better than expected, 45.5% of the students reported better than expected experience, and 12.7% of the students reported their experience was as expected. None of the participants reported disappointing experiences.

Conclusion

For our current action research study, we implemented a flipped approach with a one-shot library instruction session. And we came away from our study with a modestly enhanced view that combining flipped and active learning approaches for library instruction is valuable, and may be preferred to the "one-shot" instruction we have traditionally developed and used. Of course, students' perceptions and affective factors are important for learning, and the results of our pilot study suggest that overall the student's experience with this new approach was positive. Additionally, the positive assignment completion rate results might reflect a possible combined impact of repeated exposure to searching techniques and practice. Students involved in "more active elements" (class A) did better in on their assignments. Instructor comments indicated appreciation for using videos prior to the library session. Varied and repeated exposure to and practice with content seemed useful. Going forward, we will be recommending the kind of combination we used. That is, to provide students with learning materials that cover key concepts prior to in-class instruction so some in-class time can be used for more hands-on activities that assume and build on what the students are provided prior to the in-class instruction.

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Understanding Article Search Behavior through Screen Recording Analysis: A Case Study with Psychology Students

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Abstract

Performing effective library database or internet searches are key skills for student academic success. It can be challenging for students when working in unfamiliar domains, and psychology may be unfamiliar for many students. Even with some psychology coursework completed, ineffective approaches, such as "Just Google it", can be common for students when searching for articles. They can end up scrolling through hundreds of hits or simply picking a few from the top. This pilot study analyzed 39 screen recordings of searches conducted by students for an in-class search activity at the beginning of a library instruction session for their psychology writing class. Most students completed the activity within 3 minutes and reported they found a full-text article on the worksheet. Some also utilized advanced features provided by the databases, such as the Boolean operator "AND" and limiters (e.g., publication year, peer-review, etc.). However, evaluating the worksheets showed that only about half of students found a full-text article. Additionally, utilization of advance search features did not necessarily lead to better search outcomes, possibly due to poor choice or misuse of keywords while searching databases. Our data will help with planning for more relevant and effective library instruction.

Keywords: information seeking behaviors; video analysis; action research

Introduction

Performing effective library database or internet searches are key skills for student academic success. However, it can be challenging for students when working in unfamiliar domains, and psychology may be unfamiliar for many students. However, even with some psychology coursework completed, "just Google it" can be a common approach to searching for information for students. The general goal of our current study was to assess student searching.

Although research on student search strategies has been pursued for years, this kind of studies continues. For example, significant work has recently looked at student use of federated search resources (Dalal, Kimura, & Hofmann, 2015; Dempsey & Valenti, 2016), and others have looked at discovery layers and research databases (Evelhoch, 2018). Related work has compared student searching on Google and federated search resources (Asher, Duke, & Wilson, 2013; Georgas, 2013, 2014, 2015), while another research has looked solely at Google Scholar (Schwieder, 2016).

As is common in many university settings, a regular service at the authors' institution involves librarians providing instruction for writing intensive courses. A goal expressed on a sample course syllabus states that one learning outcome of the course is that the student will be able to conduct "…literature searches using online research databases to find and access topic-relevant published research."

Of course, a significant goal is to make sure that students use databases specific to a discipline; and PsycInfo is a top choice for topics in psychology; PsycInfo is a database for scholarly research in psychology and related disciplines, produced by American Psychological Association (American Psychological Association, n.d.-a). Also, a key strategy in searching has been and continues to be Boolean searching, although when to focus instruction on that may be changing (Lowe et al., 2018). Another basic goal for student success in searching is the accessing of full text (Evelhoch, 2018).

Our general goal has been to assess student' learning needs and to develop library instruction with effective content and teaching strategies. To that end, the purpose of the current qualitative study was to explore undergraduate student's online searching behavior, and we focused on a common class task, finding full-text scholarly articles for research assignments. The primary research question was this, "how do students conduct searching to find full-text articles using the Internet?" Also, and more specifically, "What sources and search strategies did student use to find full-text articles on a given topic?" The findings from this kind of study can indicate for us what students know, giving us a basis for designing and developing instruction that is built on the existing skill sets of students.

Method

Exploratory research can facilitate the description of or insight into a situation or an area of social life; it has been employed in research aiming to deepen understanding of a phenomenon (Edgar & Manz, 2017; Stebbins, 2001). In the present study, screen recordings of in-class search activities and search activity worksheets were used to see how students search, to gain a better understanding of students' knowledge and ability to effectively search for research-oriented information.

Participants

Participants in the current study were students enrolled in a psychology writing intensive class at a public research university in the United States. The students, second year students, had also either completed a research methods course in psychology or were currently enrolled in that course.

Data Collection

Data were gathered from screen recordings of students' hands-on search activities during the library instruction session in a computer lab located in the library. Prior to delivering the library instruction, students were asked to complete a hands-on search activity, which involved students searching for a full-text scholarly article on the topic given to them and taking steps they would normally use. The students were also asked to write down the title of article they found. After the library instruction, students were asked to do a similar exercise again with a different topic. Both worksheets were collected at the end of the library instruction session and the computer screen of searching process was recorded.

Data Analysis

Students' searching behavior patterns in the screen recordings were analyzed with open coding and descriptive statistics to gain insights and identify patterns of student searching behaviors. Open coding refers to identifying concepts based on its dimensions, this was used for establishing overarching themes (Merriam, 2002; Corbin & Strauss, 2008). The recurring behavior patterns identified in the screening recordings were viewed as themes and subthemes. The coding process facilitated a deeper understanding of the behavior patterns being studied. Coding was used for the following factors: 1) time spent on the activity, 2) number of sources used for their search, 3) the sources they used, 4) whether or not they found a full-text article and 5) search strategy used. The data was coded by two independent coders to ensure the validity and reliability. The process also ensured that the emerged themes corresponded to and informed answers to our research questions.

Results

A total of 39 screen recordings of search activity were collected and analyzed. Results showed that the average time the 39 students spent on this search activity was 2 minutes 40 seconds, the maximum time was 7 minutes 27 seconds, and the minimum time was 24 seconds. The majority of students (84.6%) used one source to conduct searches for this activity, four students (10.3%) used two sources, and two students (5.1%) used three sources. The results showing students completing the hands-on search activity quickly and using one source suggested that the search activity was easy for the most of students.

Looking at the sources that students used for searching, results showed that the sources most used was Discover at Kent State (DKS), accounting for 61.7% of searches. DKS is the university's library search tool conducting searches across multiple library databases. Alternative sources used included Google Scholar (19.1%), Google (6.4%), PsycInfo (6.4%), and other sources (6.4%). Google Scholar identifies scholarly literature in many subjects and sources such as books, peer-reviewed papers, abstracts, and reports (Google Scholar, n.d.). As noted before, PsycInfo is a database for scholarly research in psychology and related disciplines. Two related sources used for searching were PsycNet and Psychology and Behavioral Sciences Collectio*n*. PsycNet is a platform designed for searching APA databases (American Psychological Association, n.d.-b). Psychology and Behavioral Sciences Collection is an EBSCO database that includes full-text scholarly journal articles of psychology and behavioral sciences related subject areas, such as psychiatry and psychology, anthropology, and behavioral and mental process (Psychology and Behavioral Sciences Collection, n.d).

Table 1

Search Behavior Characteristics (N=39)

	n	%
Number of sources used		
1	33	84.6
2	4	10.3
3	2	5.1
Full-text found		
Yes	19	48.7
No	20	51.3
Advanced search feature used		
Yes	13	33.3
No	26	66.7

Importantly, 19 of the 39 screen recordings displayed a webpage with a full-text research article, which suggested that 19 students found a full-text research article. On the other hand, 20 recordings displayed no webpage with a full-text scholarly article, which suggested the 20 students "thought" they found a full-text scholarly article or at least they reported that they found one on the worksheet.

With respect to the search strategies, all the 39 screen recordings showed that typing a search phrase in a search box was used for conducting searches. In addition to typing a search phrase in a search box, thirteen of the 39 recordings (33.3%) showed that advanced search features were applied, while 26 of participants (66.7%) did not use advanced search features. More discussion of advanced search strategy data is given below.

The above results provide an overview of our general themes. When we looked further, more on search behavior patterns emerged, and the following sections present more detail. In addition, it will be seen that some similarities and differences in search behavior patterns emerged between students who found a full-text article and those did not.

Advanced search features

Results showed that among the 13 people who used advanced search features, 11 students used one advanced search feature to conduct a single search, and two students used two features. The advanced search features used included the Boolean operators AND, OR, and NOT (46.7%), special characters such as asterisk mark for truncation (46.7%), and search filters (6.7%). The search filters used were one or more of the following to limit the search results: 1) full-text, 2) scholarly journals, 3) academic journals, and 4) language English.

Table 2

Advanced Search Feature Used and Full-Text Found (N=39)

	Advanced search feature used			
	Yes		No	
Full-text found	n	%	n	%
Yes	5	38.5	14	53.8
No	8	61.5	12	46.2
Total	13	100	26	100

A number of patterns emerged on the relation between advanced search feature use and whether or not a full-text article was found. For example, among the 13 students who used advanced search features, eight (61.5%) did not find a full-text article, and five found it (38.5%). On the other hand, among the 26 students who did not apply advanced search features, 14 (53.8%) found a full-text article, and 12 did not find it (46.2%). Interesting patterns were also seen in the use of search filters used and finding full-text scholarly articles. Among the eight students (8) who used advanced search filters but did not find a full-text article, six students used Boolean (AND), and one (1) used search filters, and one (1) student used/tried both Boolean logic and search filters. Moreover, among the five participants who applied advanced search features and found a full-text article, four students tried search filters and one student used both search filters and special search characters. Although using advanced search features properly to conduct an effective search seems important, the results suggested that using advanced search features does not necessarily lead to finding a full-text article.

Search strategy

As mentioned above, the use of search phrases in the search box search box was the strategy applied by all the participants. However, different behavior patterns emerged from the way that search phrases were keyed in the search box. Discrete behavior patterns showed how students use keyword searches for searching academic full-text articles. As we viewed and analyzed screen recordings, we found and used four coding patterns of search phrases:

1) Typing in the whole sentence in one search box,
2) Typing multiple keywords in one search box,
3) Typing multiple keywords in multiple search boxes, and
4) Typing single keyword in one search box.

Typing in the whole sentence in one search box, the first category, is considered a relatively inefficient search strategy when using academic databases. Next, typing multiple keywords in one search box to search for scholarly full-text articles is regarded slightly better but similar to the first category. People who apply this type of search strategy may indicate not knowing how to use advanced search strategies. Typing multiple keywords in multiple search columns generally leads to more precise search results when using academic databases.

The coded data (see Table 3) showed that during the searching process, typing multiple keywords in one search box was the most common search method (34.6%), followed by typing a sentence in one search box (32.7%), typing multiple keywords in multiple search columns (28.8%), and typing a single keyword in one search box (3.8%).

Table 3

Search Strategy Used in the Whole Search Process

	Frequency	%
Whole sentence in one box	17	32.7
Multiple keywords in multiple boxes	18	34.6
Multiple keywords in one box	15	28.8
Single keyword in one box	2	3.8

When we further analyzed the search strategy that the 39 participants used on their first attempt (see Table 4), we noticed that typing multiple keywords in one search box (14 students), and typing a sentence in one search box (14 students) were the two common methods students applied to begin their search. Nine of the 39 students typed multiple keywords in multiple search box and two students used a single keyword. The results suggested that most participants conducted searches with inefficient strategies.

Table 4

Search Strategy Used at the First Search Attempt (N=39)

	n	%
Whole sentence in one box	14	35.9
Multiple keywords in multiple boxes	14	35.9
Multiple keywords in one box	9	23.1
Single keyword in one box	2	5.1

Some other interesting patterns were seen as we compared the time spent on search behavior completion for students who found a full-text research article and for those who did not. Results showed among students who did not find a full-text article, the average time they spent on the task was 2 minutes 27 seconds, the range of time from 24 seconds to 6 minutes 26 seconds. In comparison, the average time for students who found a full-text article was 2 minutes 54 seconds. The maximum time spent searching was 7 minutes 27 seconds, and the minimum time spending was 36 seconds.

Discussion

The purpose of our research was to qualitatively explore the online searching steps used by undergraduate students when they need to find full-text scholarly articles for research assignments. We wanted to get a sense of student knowledge of (and skill set for using) library sources and tools before delivery of this particular in-class library instruction for a writing intensive course in psychology.

Although time consuming, analyzing screen recordings provided valuable information and potentially useful insights regarding undergraduate students' knowledge and abilities for conducting scholarly article searches for course assignments and research projects.

The coding themes that emerged gave us a picture of participants' search behaviors. Those results were helpful for addressing our intended goal for of this hands-on activity. Interestingly, the university library's search tool, DKS, was used by most of students to conduct their scholarly article search. This is interesting; most of these students in a psychology research writing class, who had other psychology course instruction, who were asked to find a psychology research article, did not use PsycInfo. One likely explanation for that result is the convenience of accessing DKS. The university library's homepage is the default setting for all the web browser software installed in the library's computers, and DKS is prominently located on the library's homepage. Future studies should consider altering the default setting of web browser from university library's homepage to other webpage to reduce potential bias. At the same time, as librarians we perhaps should not assume that students are inclined or able to use PsycInfo on topics in psychology, even after one or two courses in psychology.

In addition to initial search resource choices, other search patterns allowed us to see what students know, and where understanding of strategies for effective database searches might be improved. For example, we found that most students (28 students) typed the whole search topic given to them or almost the whole topic in one search box. Two possible explanations for our results are: 1) these students do not know how to pick keywords for their search, and 2) some students may not know how to conduct efficient search with multiple search boxes (Boolean logic) as found in the EBSCO advanced search interface for PsycInfo.

We also were interested in what students might do after not finding anything or after not being satisfied with their search result. Our results showed after the first attempt fails, five of 14 students who use multiple keywords in one search box changed their strategies to multiple terms in several search boxes. They did move some of the keywords into other search boxes. More research is needed to learn more about students' thinking process or decision making when conducting an internet search for scholarly articles.

In addition to ineffective search strategies, an interesting finding deals with full text. More than half of the 39 students (20) did not end on a web page displaying a full-text scholarly article during the process of search activity, even though they considered themselves to have completed the search successfully. One possible explanation is that students do not know what do full-text scholarly articles look like. Additionally, our results showed students who use the advanced search features might not find a scholarly full-text article.

Another possible reason that of students did not find a full-text scholarly article is that students did not care about the correctness of search results. This could be one of the limitations of the current study since, of course, participating in the library instruction session and, specifically, taking part in the hands-on search activity is voluntary. Students did not receive an incentive (i.e., course credit or grade) for participation or a consequence for not participating seriously. Or it may be possible that students are not interested in the given topic of search activity, so they picked the keywords cursorily to complete the hands-on activity without careful consideration.

In summary, the above results for undergraduates suggests a lack of knowledge and library skills related to searching for academic research. For example, what full text scholarly articles are, what it means to conduct searches for academic research, and how to use searching resources to find academic sources.

Although, as noted above, we gained insights that are suggestive for planning of instruction, a limitation of this paper is that the screen-recording results analyzed only include students' in-class searching performance before the library instruction session began. Future screen recording research should examine and compare the student's scholarly article searching behavior before and after the library instruction session.

Conclusion

As librarians we prepare and develop our instruction each semester, and we hear positive feedback. However, we hoped to see about making improvements to library instruction based on data, instead of guessing what students should or do in fact know. Our qualitative assessment of student search behaviors in a writing intensive course in psychology gave us data to support our planning and development of library instruction. Focusing on what we learned from screen recordings of student searches, our assessment of the data indicated that many undergraduates (even in their second year in a major) did not have searching routines that involve choosing key searching terms from a research topic and then using basic Boolean search strategies effectively with search interfaces such as EBSCO's advanced searching. It also seemed that we should not assume that second year students would be inclined to use a discipline's database for finding research articles. We also saw that many students did not know what a full text research article is. We will be sharing our findings with colleagues as we collaborate with them to develop instruction that incorporates relevant and effective teaching strategies.

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Effects of Screen-recording and Conversational Cartoon Animations on Learning Performance and User Experience: A Pilot Study

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Abstract

Videos are one of the most common media formats for online learning. The impacts of different presentation styles on student performance and experiences have not been widely studied before. Therefore, this study explores how two commonly used video types, screen-capture with narratives vs. cartoon animation, can affect student performance and experiences. A user study with first-year college students (n=56) was conducted to examine the effects of both types of videos on learning performance and experiences. The study results suggested that both the screen capture videos and the conversation-based animation videos were equally effective for the immediate learning outcome. However, there was a qualitative difference in the student responses. More students who watched the cartoon animation videos included more specific library terminology or lingo in their responses.

Keywords: action research; story-based learning; user study; library instruction; tutorial video

Background

The front-line educators, including academic librarians, constantly encounter the challenges of selecting proper instructional techniques or media in the various learning environments; especially in an asynchronized online environment. Some methods have been traditionally applied to compose learning materials, including text, graphic, video, and audio (DeVaney, 2009; Lusk & Atkinson, 2007; Mayer, 1999, 2001, 2002; Ploetzner & Lowe, 2004). In broad definition, technology for video alone includes films, animations (Rieber, 1990; Tversky & Morrison, 2002), and screen-capture instructional technology (Smith & Smith, 2012; Walker, 2010; Yuen, 2004). The development of multimedia technology enables educators to respond to the challenges and the needs that arise from the evolving circumstances. Incorporating animated pedagogical agents is a relatively newer instructional delivery method that facilitates learners to obtain information and skills using lifelike characters within a multimedia-learning environment (Lusk & Atkinson, 2007). All these pedagogical technology techniques are considered as a means to integrate different modalities together to aid learning (DeVaney, 2009; Lusk & Atkinson, 2007; Mayer, 2001).

Attending college is one of the most critical life transitions for a lot of people. In the first year of college, students encounter various changes and challenges during their transitions and adjustments to a new life. Research suggests that first-year undergraduates had higher levels of ongoing and chronic stress when compared to other academic years (Misra & McKean, 2000;

Towbes & Cohen, 1996). Additionally, Trautwein and Bosse (2017) pointed out the difficulties related to: 1) personal aspect, such as balancing studying, part-time work, and family time, 2) studying aspect, such as high-curricular demands and pace, 3) organizational aspect, such as adjusting to new teaching and learning environments, and 4) social aspect, such as building new peer relationships. With further respect to a student's study capacity, study results showed that first-year students tend to have limited information on literacy or research skills (Gross & Latham, 2012; Montgomery & Wray, 2020; Zimu, 2020). Gross and Latham (2012) further indicated a deviation between the information on literacy skills of first-year students and their self-perceptions of their abilities, which means that they have an exaggerated understanding of their own abilities (i.e., they "think" that they possess sufficient information literacy skills, but in fact they do not).

Without proper support to manage the college transition, these challenges and difficulties may further impact students' health and may result in other mental health concerns and behavioral issues. These issues included sleep disturbance, binge drinking (American College Health Association, 2014; Jensen, 2003; Mallett et al., 2013), and ultimately, affected their academic performance and well-being (Singleton & Wolfson, 2009).

The university library is a helpful resource for students to develop study skills, which supports their academic performance. For example, researchers indicated that first-year students' use of library services were positively associated with academic outcomes, engagement, and skills (Soria, Fransen, & Nackerud, 2013, 2017). Similarly, Hughes, Hall, and Pozzi (2017) reported that the use of library services supported the students' information needs for academic purposes. The above suggests the important role of the university librarian who could play a part in the lives of the first-year students. They may stimulate the students' learning interests, respond to their learning needs, and ultimately, support their academic success.

In response to the rapidly changing learning environments, new instructional strategies like story-based animations were employed to redesign a set of library video tutorials. Storytelling is an effective form of communication and it has been used for learning for decades, if not centuries. In contrast to the conventional screen recorded video tutorials with narratives, story-based animation videos convey content information through a conversation style between two cartoon characters. In particular, the same content was carried out with an animated story. For example, instead of using a librarian's voice telling how to search a database with screen recording, the video was set up as a conversation between two students. The scenario is one student would tell another student who was having trouble finding information how to search an article from the library's website. These kinds of situations are real-life stories.

In this paper, we describe the pilot project, our assessment study on the students' reactions to both types of video presentations and opportunities for future development. Specifically, the study explored the following questions:

(1) What is the impact of a story-based strategy on the user experience when using online video tutorials?
(2) What are the learning outcomes from such a story-based approach?

Research Design

According to Merriam (2002), basic interpretive study can be used to understand the way people interpret and attribute their experiences and construct their lives. Therefore, the approach was deemed appropriate as the author attempted to learn more about students' experiences of watching library video tutorials in two different styles (screen recording with a single voice narrative vs. animation with two voices/conversations). Particularly, this approach allowed the study to gain a better understanding of the potential influence of presentation styles on learning outcomes. Specifically, the content information they received from the two videos and how they received the information was interpreted.

The Videos

Two library video tutorials with different visual/presentation styles were displayed to 56 college freshmen in two separate times. One video was a "conventional" show-and-tell screen capture video narrated by a librarian. The other video was conversation-based animation video with cartoon characters. The content of both videos were the same, which involved: (1) finding a specific database (in this case, PsycINFO) from the library homepage, (2) conducting a keyword search for journal articles on given topics, and (3) refining a search to peer review journal articles. The lengths of time for the two videos were approximately the same (2 minutes) with only a few seconds difference.

Participants

The population of the current study is the first-year undergraduate students, who are normally the target audience of library instruction. After obtaining IRB approval, an email invitation was sent to all the first-year students at a public research university in the Midwest region. Interested participants contacted the researcher to schedule a session in a lab to watch the videos. Fifty-six students were recruited and were randomly assigned into two groups: one was a story-based group. Participants in this group watched the animated video with two characters in conversation style, while the other was a non-story-based group. Participants in this group watched the screen recording video with single voice narrative.

Procedure

In each individual session, the participants were greeted and given a consent form with the study information that was being presented. The study information was explained both orally and in print (the study information sheet). Participants were allowed time to read through it and ask questions if they had any. The research was voluntary-based. The participants could have left at any time if they did not wish to participate. For the study, the participants were asked to view the video, perform tasks with a worksheet, and then fill out a survey. The primary task was to conduct a database search with the given information, which was covered in the tutorial, and to then write down the bibliographic information of their choice, specifically the title and author(s). In addition, students were asked to recall what the video was about.

Data Analysis

The primary data include students' performance on the tasks and their responses to one open-ended question: what was the video about? Both quantitative and qualitative analysis methods were applied in the study. Descriptive analytics and coding were applied to provide the insight and the patterns of the students' performance.

Interpretation was the general approach to analyze data. Interpretation means producing reasonable meaning, which is created by researchers with their best efforts from the social phenomena they studied (Hatch, 2002). The goal was to explore the experiences of watching different presentation style videos among first-year students. Interpretation helps to understand what information the students perceived from the two library video tutorials and how they applied the perceived information.

Descriptive statistics (i.e., mean, frequency, and percentage) and open coding were the primary methods for data analysis, which provide insight and discovery to the patterns of the students' performance. Opening coding is a systematic process of sorting the collected data through identifying concepts, naming, and categorizing them based on its dimensions in order to establish major themes (Corbin & Strauss, 2010; McCaslin, n.d.; Merriam, 2002). Themes and sub-themes were produced from the analogous responses of worksheets and recurring behavior patterns of the article-search task. The responses recorded in the worksheets were coded from the following aspects: the level of detail and the completion of the article-search task. The observation notes provided the information on the participants' performance.

Coding results were present in the following results section, consisting of students' article-search task performance and their responses of an open-ended question. Peer debriefing was used in the study to ensure the validity and credibility of the study and to make sure the themes and research questions were aligned.

Results & Discussions

A total of 56 students participated in the current study, thirty of them watched a screen capture with single voice narrative video, and the others watched a conversation-based animation video. Results showed that there was no significant difference in immediate learning outcomes between the two types of videos, generally. Coded data from the observation notes and worksheets showed that all participants recorded bibliographic information of their article-search results. It suggested that they performed a successful database search after watching the tutorials. Furthermore, coded data from the worksheets showed that all the students were able to describe what the videos were about.

The level of detailed responses on the worksheets was coded from two aspects, including the number of word counts and the degree of key points covered. Results showed that the average word counts of the participants' written responses were 17.7 words. Participants who watched the screen capture video used an average of 18.1 words in their answers, and those who watched a conversation-based animation video used an average of 17.2 words. The results suggest that there were no significant differences in the number of word counts the students wrote regardless of the types of videos the students watched.

Table 1

Average Word Count of the Open-Ended Question (n=56)

Watched Video	Frequency	Average word counts
Screen capture Video	30	18.13
Conversation-based animation video	26	17.23

However, some qualitative differences in the degree of key points covered in the students' responses emerged from the coded data. The level of details of key points covered in the students' responses were sorted into five categories/levels. The first category is regarded as a very general response, which included the least amount of information related to the video watched. Responses that fell into this category meant that no key points (i.e., specific purpose, tool, databases, library jargon) were included. A sample response was: "*It was a tutorial video on how to complete a certain task*." Responses that fell into the second category included only one key point mentioned in the video. A sample response of the second category was: "*The video I just watched was about how to navigate and use PsychINFO.*" Responses of the third category included two key points covered in the videos. A sample response of this category was: "*The video showed how to research articles on the university library website*."

Responses that fell into the fourth and fifth categories included more detailed video information. Responses of the fourth category consisted of three key points relevant to the videos. A sample response of the fourth category was: "*The video showed how to get to the PsycInfo site and how to narrow your search*." Similarly, responses in the fifth category consisted of three key points, but further included library jargons (i.e., keywords, quotation point). A sample response of the fifth category was: "*The video was an informative video, that showed us how to utilize keywords and databases in order to find the resources to write a paper*."

As shown in Table 2, results suggested that more than half of the worksheet responses included video information with a medium degree or less. Twenty of the fifty-six students' responses (37%) fell into the third category, eleven of the fifty-six worksheet responses (20.4%) accounted for the second category, and one student (1.9%) response accounted for the first category. Additionally, results showed that twenty of the fifty-six responses (37%) accounted for the fourth category, and four of the fifty-six responses (7.4%) accounted for the fifth category. The results suggested that two in five students could provide the detailed video information, and a small portion of the students further used library jargons in their responses. Additionally, twenty of the fifty-six worksheet responses (44.4%) covered more detailed information from the videos, and four of them further used library jargons in their responses.

Table 2

Level of Key Points Covered in Students' responses *(n=56)*

Groups/types of videos watched	Frequency	%
Category 1	1	1.9
Screen capture Video	0	
Conversation-based animation video	1	
Category 2	11	20.4
Screen capture Video	9	
Conversation-based animation video	2	
Category 3	20	37.0
Screen capture Video	9	
Conversation-based animation video	11	
Category 4	20	37.0
Screen capture Video	11	
Conversation-based animation video	9	
Category 5	4	7.4
Screen capture Video	1	
Conversation-based animation video	3	

An interesting theme emerged when further looking into the level of details from their recall about the video content, and the types of video watched. Results showed that three of the four responses in the fifth category (i.e., responses that covered the most video details and library jargon) were from students who watched the conversation-based animation video, and one was from those who watched the screen capture video. On the other hand, nine of the eleven responses of the first category came from students who watched the screen capture video, while two came from those who watched the conversation-based animation video. It is uncertain if the students were more impressed with the conversation-based animation video or if they had already known the video content very well. Further research is needed to explore the association between the presentation types of videos and students' responses and to clarify the students' background knowledge in research skills and library resources. Furthermore, the one response of the first category came from a student who watched the conversation-based animation video. The result implies that the student may not have paid attention to the video or did not understand the video content.

The author acknowledges the limitations of the pilot study. For example, the level of difficulty on the article-search task may be too easy for the students. Its simplicity may disguise the possible impacts of the different presentation style videos on the students' learning experiences.

Conclusion

The pilot study explored the library video viewing experience with actual users, first-year students who have relatively few or no university library experience or research skills. In summary, the results show that there were no significant differences on the immediate learning outcomes between the two types of videos (i.e., screen capture with single voice narrative vs. conversation-based cartoon animation). All participants performed a successful database search after watching the tutorials. Most of the students were able to describe what the videos were about and how they would teach their peers on how to conduct a library database search. Coding results of the first open-ended question showed that the majority of the students were able to describe what the video was about.

In conclusion, the study results suggest that both the screen capture video and the conversation-based animation video were equally effective. However, there was a qualitative difference in the students' responses. More students who watched the cartoon animation video included more specific library terminology or lingo in their responses.

The unique aspect of this study was to investigate the questions with multiple perspectives and with actual first-year students who have relatively few or no university library experience. We believe that the conversation-based cartoon animation approach for video instruction has great potential to enhance student engagement as well as learning in online and blended settings. This study explored the approach in an academic library setting with first-year college students. The results of the study can potentially lead to improvements in information literacy programs and to improve library practices, especially those pertaining to designing, developing, and implementing better, more high-impact and innovative story-based approaches.

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Teaching with XR (Extended Reality) in Higher Education: An Analysis of Student perceptions

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&

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Abstract

With the increasing rate of shifting the educational methods to the online format, immersive technologies such as XR (Extended Reality) can help create a unique active learning experience in the new online/hybrid format and take it to the next level. This qualitative study explores the potentials of XR— particularly the Virtual Reality (VR) technology in higher education to enrich student's experiences. The perspectives of students at a public university were collected during the Spring 2019-2020 semester. The findings suggest that VR technology provides positive opportunities to enhance student learning experiences, including, but not limited to, promoting creative thinking, offering effective learning, encouraging learning by doing, creating motivating, entertaining, and intriguing learning environments, in spite of its high costs, potentials physical hazards and accessibility challenges. Recommendations for effective implementation were identified. Directions for future research on XR in online and hybrid learning were also discussed.

Keywords

XR (Extended Reality), Virtual Reality (VR), Immersive Technology, Emerging Technology, Higher Education, Technology Innovation.

Introduction

The use of immersive extended reality (XR) is proven to be an effective way to augment traditional forms of pedagogy (Brown et al., 2020). XR education evolves widely in higher education in the past few years as a field that provides unique hands-on experiential learning and helps motivate students to achieve the desired skills and knowledge. Research studies revealed a link between the usage of XR technologies and improvements in students' academic performance and motivation, students' social and collaborative skills, in addition to students' psychomotor and cognitive skills. With the transition to an online format, XR technologies can help bridge the gap between the in-person and online courses and create a space for more collaboration and presence opportunities. However, empirical research on its applications in higher education is still inadequate (Radianti, Majchrzak, Fromm & Wohlgenannt, 2020).

With the recent development, the ease of use, the proven dramatic impact on pedagogy and the noticeably decreased cost of the XR equipment, implementing XR technologies as learning tools becomes one of the most active fields of innovation and research among the various higher education institutions (Pomerantz, 2019). XR technologies offer learners a unique learning experience that may be unattainable in a traditional educational format. This paper reveals the perspectives of students, who were pre-service teachers at the Faculty of Education at a public university, of their VR experience in the several courses they studied during the spring semester of the 2019-2020 academic year to develop a deep understanding of the usage of VR in higher education within its various modalities. The findings discuss the effectiveness of VR technologies in creating unique learning experiences to meet the learning goals and how these technologies can help achieve them to enhance student learning and engagement.

Methodology

Research Design

A qualitative research method was employed to examine the opinions of pre-service teachers of utilizing virtual reality (VR) applications for educational purposes at a public university. The aim of using a qualitative research method was to obtain a deep understanding of the participants' perspectives about using virtual reality in educational environments. Yıldırım and Şimşek (2008) indicate that this method allows researchers to gain in-depth information about the subject holistically.

Participants

The research participants were 17 university students who took an elective course during the spring semester of the 2019-2020 academic year. Participants were sophomores at the Faculty of Education in a public university, studying different academic programs, including Mathematics, Turkish Language, Counseling and Guidance, and Psychological Counseling.

Data Collection

A semi-structured interview form was developed and employed by researchers to determine the opinions of preservice participants in utilizing VR applications in higher education. Experts in the learning Design and Technology field assessed the interview questions, and based on their revision and suggestions, the interview questions were modified and finalized.

Data Analysis

Thematic analysis method (Hsieh & Shannon, 2005) was used to analyze the collected data. Data from in-depth semi-structured interviews was analyzed after transcription through manual coding using the inductive approach.

In order to interpret the participants' perspectives in an understandable manner, specific themes were developed by grouping the codes and then interrelating them to establish categories. Meaningful integrations are made in the analysis to describe the findings (Yıldırım ve Şimşek, 2013). For the coding process, thematic coding was used to identify the main themes emerging across the 17 interviews. Codes were grouped under themes and sub-themes and interrelated to develop the findings categories. The validity of the qualitative results was constructed by applying three validation strategies (Creswell and Clark, 2017), including member checking, triangulation of the data from several resources, and asking other researchers to examine the data and review the results. To check the coding reliability, the formula (number of codes agreed by researchers / total number of codes) by Miles and Huberman (1994) was used. The reliability percentage of the coding between coders was determined as %89.

Findings

Pre-service teachers' opinions about the use of virtual reality were analyzed through thematic coding in accordance with the aim of the research. The themes and sub-themes that emerged as a result of examining their opinions of using virtual reality applications for educational purposes were identified. The findings from this study were organized into four themes: usability, benefits, uniqueness, and drawbacks, as presented in Table 1

Table 1. Students' Views of Virtual Reality Experiences

Themes	***Sub-Themes***	***Number of Students***	***Examples of Participants' Opinion***
Usability	Easiness	1	P-6 "Experiencing VR is easy to use and entertaining. I did not encounter any negative aspects of using VR".
	Difficulty	4	P-10 "Those who will use VR applications should have knowledge about the use of technological equipment". P-11 "The downside is that VR is difficult to use; sophisticated equipment is needed to use it".
Benefits	Creative Thinking	4	P-8 "The use of VR can inspire creative learning". P-11 "VR inspires creative learning. It provides opportunities for the development of new understandings and perspectives… It offers different perspectives and creativity".
	Effective Learning	5	P-1 "VR increases the retention of learned information". P-3 "VR offers better learning opportunities for students by creating visual memories".
	Abstract to Concrete	8	P-5 "A student cannot fully visualize the shape of geometric objects in his mind so he can often give incorrect answers in response to questions related to 3D objects. However, this problem can be solved with VR applications". P-16 "VR can make the abstract concepts tangible, which cannot be done with other technological tools".
	Motivation	6	P-12 "VR can play a more instructive, attractive and encouraging role for students in their learning". P-16 "I can use VR to motivate students who are preparing for the national exam".

	Active Learning	4	P-9 “VR encourages passive students to actively participate”. P-13 “VR provides experiences of learning by doing, which promotes the retention of learned knowledge”.
	Reinforcement	1	P-9 “VR can be used in areas where students have a lot of misconceptions about a subject to correct them or it can be used in lessons in order to reinforce the topics they learned”.
	Entertainment	7	P-2 “More enjoyable learning can be achieved with 3D animations”. P-11 “Interesting and entertaining games can be created with VR for solving mathematical problems such as four operations”.
	Intriguing	7	P-10 “VR can be used to attract attention in the introduction part of the lesson and provide detailed information in the development part”. P-14 “I can use VR because its applications are attractive”.
Uniqueness		14	P-4 “By implementing VR, I can take a student to a more comfortable environment which can be supportive of the treatment process instead of taking the student to a usual guidance service room”. P-7 “It is possible to have students enter a virtual room with geometric objects”. P-8 “We can watch famous painters who lived in the past while drawing in their painting room as if they are still alive”.
Drawbacks	Cost	11	p-13 “Various necessary technologies such as processor, sufficient memory and graphics are highly expensive for VR”. P-15 “There are a lot of advantages, but the VR headsets are expensive to purchase, which seems to be a disadvantage”.
	Conditions	5	P-2 “VR technology can be affected by environmental conditions very quickly, thus affecting its efficient operation”. P-13 “There are certain conditions such as having suitable light and quiet environments to experience”.
	Accessibility	6	p-9 “VR devices cannot be accessible to everyone”. P-12 “In the current economic situation, VR usage causes the inequality of opportunity because of the difficult accessibility of VR”.

	Physical hazard	4	P-8 "VR may have harmful effects on our eyes such as visual impairment, strabismus and so on". P-11 "You may drop and hurt yourself while experiencing VR on your own".

Table 1 showed 14 sub-themes under the four main themes— usability, benefits, uniqueness, and drawbacks.

Usability This theme refers to pre-service teachers' thoughts if they were able to use VR applications easily. Although one student emphasized the ease of using VR applications, 20% of the students (n=4) indicated that integrating VR in education was difficult and required lots of technical support and knowledge.

Benefits: This theme refers to the advantages that VR offers when it is utilized for educational purposes, and it's classified into eight sub-themes consisting of creative thinking (23%), effective learning (23%), abstract to concrete (47%), motivation (35%), active learning (23%), reinforcement (6%), entertainment (41%), intriguing (41%). **Creative thinking** refers to students' ability that is promoted by the VR technologies to find a solution in an original way. 23% (n=4) of the participants identify creative thinking as one of the main benefits of adopting this technology in education. VR presents students with personalized, hands-on learning activities and plays an important role in helping students to think critically. The collaboration and immediate feedback can help students to improve their critical thinking and their learning outcomes. 23% (n=4) of the participants also believed that VR has the potential to encourage **effective learning**, which refers to accommodation and assimilation of new knowledge and ideas permanently and concretely. Moreover, about 50% (n=8) of the participants believed that VR helps students enhance a tangible understanding of **abstract concepts**, which we refer to by Abstract to concrete. The terms **motivation** refers to the use of VR to motivate students to learn enthusiastically; 36% (n=6) of the interviewees identified this benefit. **Active learning** refers to student engagement in the learning process in an active manner by VR; 23% of participants found active learning important, whereas only 6% of the participants (n=1) only identified the **reinforcement**. Reinforcement refers to the VR effects to strengthen student learning or to make their misconceptions corrected. Both **Entertainment & Intriguing** were identified as the most important benefits of VR. Entertainment refers to the VR effects in making the learning fun. Whereas, Intriguing refers to the fact that VR induces students to know more. 80% (14 out of 17) of the participants claimed that VR offers a unique learning experience.

Uniqueness: It refers to the unordinary learning opportunities that VR provides students with. VR can offer an authentic, exhilarating, and lifelike learning experience.

Drawbacks: This theme refers to the disadvantages that students might encounter when utilizing VR in the educational process. Four sub-themes emerged under this category, including the high cost of VR technologies, accessibility, physical hazards, in addition to the environmental context.

More than 60% of the participants found the high cost of the VR technologies, including the cost of its headsets, powerful computer peripherals, and the VR applications, was one of the biggest challenges that encounter the higher education institutions. The cost refers to the amount students have to pay to obtain a VR headset and buy its software. 30% of participants identified providing the environmental conditions is important to create an effective learning experience. Conditions refer to the inside or outside environmental context. VR can be utilized best when certain inside or outside environmental conditions occur. 35 % of the participants identified accessibility as a challenge for implementing this technology in education. Accessibility refers to VR access challenges in which access to this technology cannot widely be acquired because of its availability and cost. And a little more than 20% of participants found the Physical hazards resulted from the implementation of this technology help prevent this technology spread. Physical hazards refer to the possibility that students might accidentally hurt themselves because they cannot be aware of their surroundings while using VR technologies.

Discussion

This research was carried out to reveal the opinions of students who were pre-service teachers about utilizing VR applications for educational purposes at a public university. Based on the data analysis, VR has its unique benefits as well as drawbacks when used in educational settings. According to their perspectives, the use of VR applications provides opportunities for students to learn by doing. It creates an effective virtual learning environment where students are engaged in learning activities that are interesting, entertaining, and informative. This kind of learning environment motivates students to become active knowledge seekers. Besides, students easily comprehend abstract concepts in these virtual learning environments where abstract concepts become concrete objects. It can be stated that the use of VR offers instructive, attractive, and encouraging learning experiences for students. In parallel with these findings, Hussein, and Natterdal (2015) identified the benefits of VR in geology, medical studies, history, engineering, and so on. They showed that VR offers interactive learning environments in which students are active in their learning, such as performing an experiment in a virtual science lab or exploring the ancient world by traveling to places. Also, they indicated that students are encouraged to be creative in virtual learning environments where they can find opportunities to demonstrate their creative abilities in architecture and other fields. Furthermore, Kamińska et al. (2019) identified several advantages of using VR in educational settings, including increasing student engagement, providing interactive and attractive learning opportunities, maximizing the effectiveness of the learning environment, and encouraging students to be active in their learning. A study conducted by Makransky and Lilleholt (2018) revealed that the use of VR makes the learning environment enjoyable, engaging, and motivating with great features of VR. Ustun, Yilmaz, and Karaoglan Yilmaz (2020) found that students' performance and motivation can be maximized by utilizing VR applications. Besides, pre-service students also indicated that VR offers unique learning experiences. Providing unique learning experiences can be considered as a significant advantage of VR (Kamińska et al., 2019). Pre-service students emphasized the ability of VR as an educational tool that provides a 3D virtual learning environment. It cannot be possible to create such a virtual environment and promote learning without VR technology. They indicated that students could go to historical places regardless of their locations, meet famous scientists, artists, and any person who left a mark in history, and experience anything that we can't partake in the real world.

On the other hand, the study findings identified the disadvantages of VR. The main disadvantage was its cost. Pantelidis (2010) highlighted the high costs of VR as a primary drawback. The VR high cost is one of the main factors that prevent utilizing VR as an educational tool. The findings also indicated that the accessibility of VR technology might cause inequalities in technology usage because many students cannot obtain these technologies. The use of technology in education is supposed to promote educational equity (Warschauer & Matuchniak, 2010); however, VR usage deepens the educational inequity in the society, especially in underdeveloped countries. Moreover, studies revealed that the extensive usage of VR might have harmful effects on human health such eye disorders, including visual impairment or strabismus, in addition to the potential dizziness and nausea after using the headsets.

Conclusion

Extended reality (XR) immersive technologies have massive potentials to enrich teaching and learning in Higher education through their abilities to offer a unique hands-on experience that might be unattainable previously with other educational technologies. The latest generation of XR technologies such as Oculus Quest 2 showed great improvement and enhanced performance; they are relatively affordable, wireless, less nauseating, and provide a safer experience.

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Design Considerations for Learning, Abilities and Cultures: Progress Monitoring Software for Learning English or Sign Language

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Introduction

As researchers, we rely on good empirical evidence to design educational technology for schools. However, when educational technology is implemented in schools, challenges may arise depending on technology considerations, people's background or expertise, and cultures (Blumenfeld et al., 2000). Further changes may be needed after technology is validated with theory or empirical evidence to ensure that they are suitable for use in the schools where such technology is deployed. This paper discusses some of the changes that were made to a progress monitoring software, AvenuePM, to ensure that the software is suitable for teachers to use in classroom settings.

AvenuePM is a web-based progress monitoring tool that was developed with the aim of helping teachers to track the literary progress of students who are learning either American Sign

Language (ASL) or English. Originally, the software was developed as a digital tool for teachers who were monitoring the progress of students who were Deaf or Hard or Hearing (DHH). Over more than a decade, the software has gone through many design iterations (Hooper et al., 2013; Miller et al., 2008) to make it more useful to schools – teachers, students, parents, and others. Today, the software is used in elementary schools across the United States that have diverse student populations with different abilities.

In this paper, we discuss two studies related to the design and development of the software. The aim was to gather usability feedback from participants and make design changes so that teachers find the software easy to use and easy to learn. The first study was a pilot study with undergraduate students as participants. The pilot study was used to verify the research protocols and the use of usability metrics, such as System Usability Scale (SUS) (Brooke, 1996) and Singe Ease Questionnaire (SEQ) (Sauro, 2012), to evaluate the software. Feedback from the study was used to make design changes before the second study. Teachers participated in the second study and further evaluated the software. Findings from the studies, along with the design changes, are presented in this paper.

Progress Monitoring and Design

Progress monitoring is a form of formative assessment where the goal is to improve student learning (Pellegrino, 2019). Formative assessments are used with the aim of helping students to learn and achieve learning goals. Depending on the learning goals and the instruction strategies, assessments are designed so that students can perform assessment tasks, and data from the assessment tasks are interpreted against expected progress levels or learning goals (National Research Council, 2001). Data from assessment tasks can be useful to both teachers and students as feedback to improve learning (Bransford et al., 2000). In this article, the focus is on making design changes so that teachers can easily administer assessments and interpret assessment data.

AvenuePM consists of eight assessments that are designed using principles of Curriculum-Based Measures (CBM; Deno, 1985, 2003); CBM assessments are designed to be easy to administer, brief (1 to 5 minutes), reliable, and valid. Teachers administer the assessments in the classroom and assessment data are used to monitor student progress against expected progress or learning goals. Teachers interpret assessment data to assess student progress levels and decide if students are making adequate progress to meet learning goals. To understand whether teachers can interpret data, aspects of graph comprehension (Friel et al., 2001) are relevant – identifying data, recognizing patterns, and making decisions. Interpretation of such assessment data are also dependent on contextual factors such as the purpose of interpretation, background, expertise, task characteristics, area of expertise, culture, etc. (Coburn & Turner, 2011; Friel et al., 2001; Pellegrino, 2019). Many of these contextual factors contribute to the challenges of ensuring that technology is useful in schools (Blumenfeld et al., 2000). Feedback from teachers can help in making suitable design changes for teachers.

AvenuePM supports many tasks that help teachers with classroom management, assessment administration, assessment scoring, and assessment data interpretation. As we make changes to the software, the purpose of design changes is to make better software for schools and teachers – to design a better alternative (Simon, 1988). The research team is trying to make changes so that teachers find the software easy to use and easy to learn. The studies below describe the process of getting feedback from participants and making design changes.

Study 1: Pilot

A pilot study was conducted to assess whether study materials and procedures are feasible for evaluating the software. Since participants were undergraduate students, and not teachers, the objectives of the study were limited to ease of use and ease of learning; assessment data interpretation tasks were not included.

Method

Participants

27 undergraduate students (25 female, 2 male) from a large university in North East United States completed the pilot study. Participants received an extra course credit in lieu of participation. All participants were unfamiliar with CBM assessments and AvenuePM software.

Materials

A web-based survey contained brief instructions on the tasks to be completed with no details or steps. The survey contained sections about the study, the institutional approvals, consent for participants, participant profile information, a simple one-line instructions for the tasks to be completed, comments and ratings of ease of use for each task, and ratings for the overall system usability.

A task analysis was conducted to identify important tasks in AvenuePM related to progress monitoring: 6 class management tasks, 5 assessment tasks, and some essential tasks for using the software. The complete list of tasks is included in Table 2. A seven-point Likert rating, Single Ease Questionnaire (SEQ; Sauro, 2012) was used to collect ease of use ratings for each task. System Usability Scale (SUS; Brooke, 1996) was used to collect ratings for the overall system usability; SUS is a 10 item questionnaire that is reported on a 0-100 scale. Data on both SEQ and SUS allow for comparisons between sample data and other larger data sets (Bangor et al., 2008; Sauro & Lewis, 2016). The recommendation is that sample ratings should have a mean score that is higher than the median scores reported for SUS or SEQ; the median scores for SUS and SEQ is 68 and 5.5 respectively (Bangor et al., 2008; Sauro, 2018). Lewis & Sauro (2018) suggest that the desired SUS scores should be 80 or more, which corresponds to a score in the top 15 percentile.

Procedure

All participants completed the study in the presence of a moderator. The moderator used a scripted protocol to maintain consistency across the study sessions. Participants were informed of their rights, including their ability to quit at any time, and consent was recorded for participation and video recordings. A laptop with internet connection was provided for completing the tasks. The moderator took notes during the study and the session was recorded with the consent of participants. The study was designed for 1 hour; all participants completed the study in 45 minutes or less. The study time includes the initial briefing session, or other related activities.

Results

All participants completed each of the assigned tasks within 5 minutes. The mean SUS scores for the overall AvenuePM system is 74 (Table 1), which is more than the recommended median score of 68 and falls in the 3rd quartile of SUS scores (Bangor et al., 2008).

SEQ ratings for ease of use corresponding to individual tasks are included in Table 2. SEQ ratings suggest that common tasks such as logging in, logging out, and finding items were rated as easy. However, tasks such as ‘Creating a Teacher Account’ and assessment-related tasks such as PictureNaming and Slash were rated as difficult.

Design Changes

Results suggested that the AvenuePM system meets the minimum recommended SUS score but not the desired score of 80, or more. Based on feedback, labels and instructions for assessments were added or simplified. Some participants had asked for practice sections even though practice sections were present; labels for practice sections were changed to make them clear and easy to find. Short demonstration videos of the assessments were added as help materials. However, the label for creating a new account, ‘Request an Account’ (see Figure 1) was not changed though the label ‘Create an Account’ is the more widely used. The research and design team thought that teacher feedback in a later study will be useful to confirm such details for ease of use, and to compare feedback from undergraduate students and teachers.

Study 2: Remote Study

The follow-up study was a remote study conducted after the design changes described above. Teachers participated in the second study, so data interpretation tasks were added as they are important for progress monitoring (Coburn & Turner, 2011; Friel et al., 2001; Fuchs, 2016). A conceptual data chart concept was also used in the study to gather feedback from teachers.

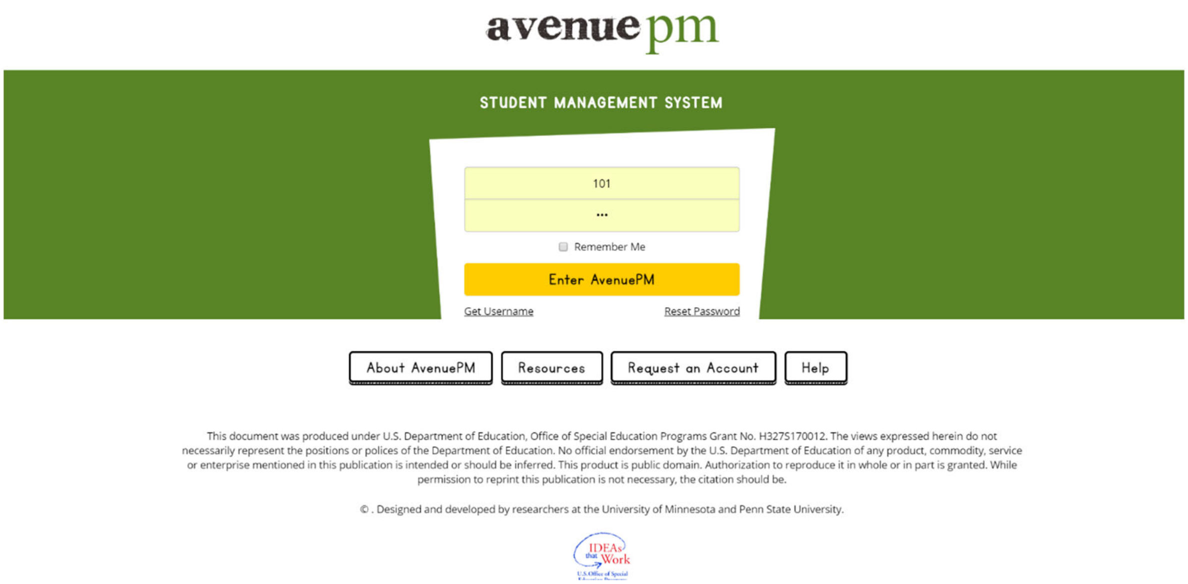

Figure 1. Initial design of the AvenuePM homepage.

Method

Participants

Participants were 9 teachers (7 female, 2 male) from four different states in the United States. All teachers had some knowledge of CBM. Four teachers were from schools that partner with the AvenuePM team, and were familiar with the software; the 5 other teachers were using the software for the first time. All participants received a 50 dollar gift voucher as compensation.

Materials

The materials were similar to those used in the previous study. Two additional tasks related to data interpretation (items 6a, 9a in Table 4) were added. In data interpretation tasks, the moderator asked the participants to identify the data elements, the trend, and compare the progress levels against expected progress levels or goals.

Procedure

The study was a remote study conducted using the Zoom video conferencing software. The moderator and the participants used their own device and internet connection. All other procedures were similar to the previous study. The study was designed for 1 hour and most studies lasted between 45 and 60 minutes.

Results

Participants successfully completed all tasks, except one; one participant did not complete the task of creating a new account as web forms failed to load correctly. A total of 143 of the attempted 144 tasks were completed successfully. The task completion rate was 99.3%. The mean SUS score for AvenuePM was 82 (Table 3), representing a score in the top quartile of SUS scores (Bangor et al., 2008). SEQ ratings on ease of use are included in Table 4. Tasks such as logging in, logging out and finding items were rated as easy to use. All tasks had a mean SEQ rating of at least 5.5, except the following: creating an account; sharing a student; using data charts; and the data chart option.

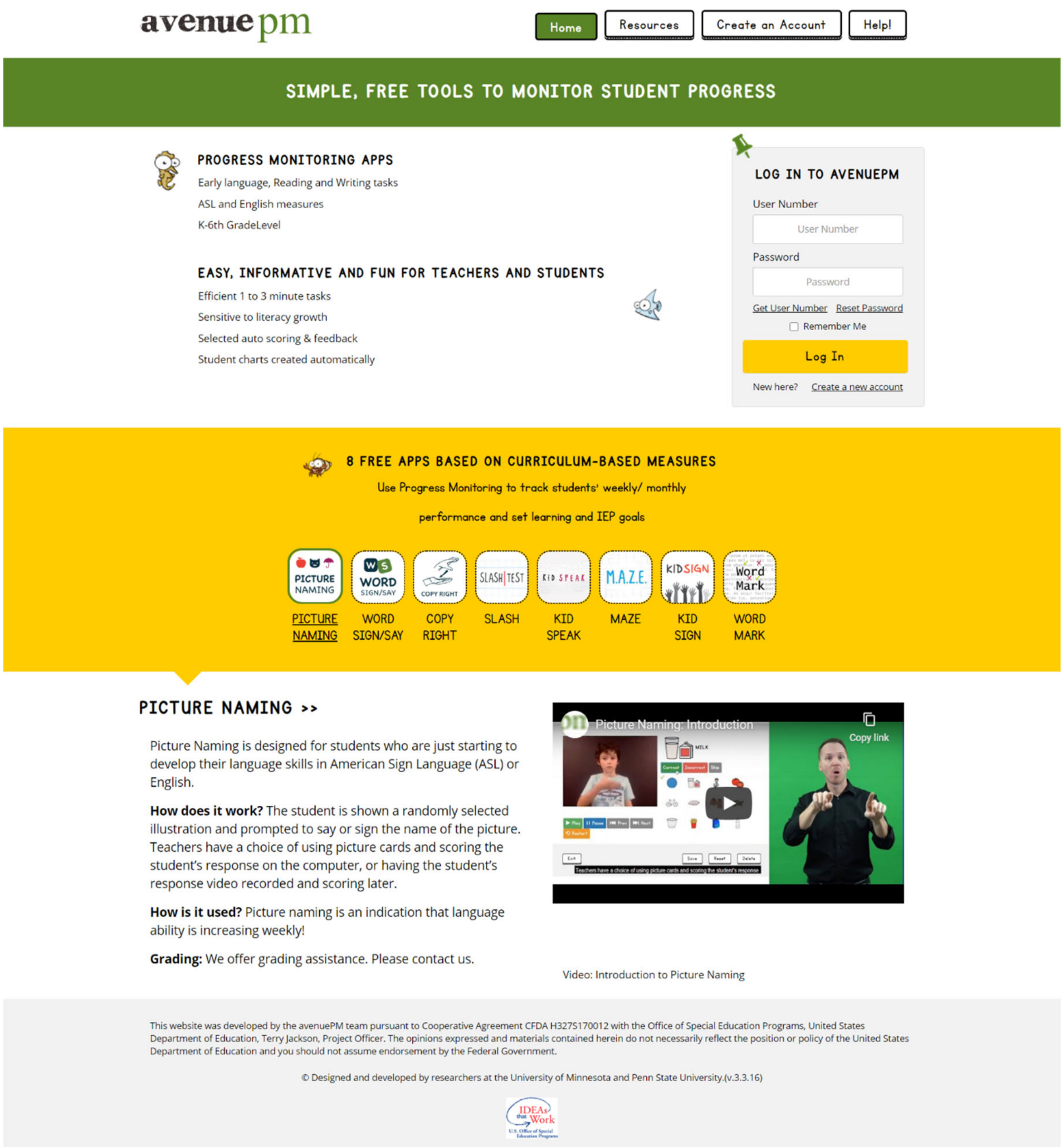

Figure 2. Redesigned home page of AvenuePM.

Discussion

Results from the second study suggest that the design changes were effective in improving the SUS usability ratings. The SUS mean score of 82.2 corresponds to a grade A, or top 10 percentile SUS scores, according to Lewis and Sauro (2018). Though SUS scores may improve with further modifications, it may require larger sample sizes to confirm improvements.

Also note that though overall usability scores seem good, tasks related to creating an account, sharing a student, and date interpretation were not rated as easy to use; there is scope for making improvements. While SUS scores assess overall usability, SEQ ratings and feedback on induvial tasks can be combined to complement SUS scores and make specific changes (Sauro & Lewis, 2012).

Most of the participant feedback was about making labels or instructions clear using common language and ensuring that participants can find them. Participants noted that the task of creating an account was confusing because of the label, 'Request an Account;' most participants (undergraduates and teachers) preferred the standard label of 'Create an Account' or 'Create a Free Account.' Some participants noted that the purpose of AvenuePM software was not clear based on content on the homepage. For the task of sharing a student, participants noted that the labels were ambiguous as the terms 'share a student' and 'change teacher' were used interchangeably in different places; participants were not clear whether sharing a student meant sharing student details with another teacher, or changing the teacher for a student, or both. Participants preferred consistent design elements like labels, images, or titles across pages.

In tasks related to assessments and data interpretation, participants appreciated the practice sections, help videos and other instructions provided in AvenuePM. However, participants again asked for simpler instructions and consistency as they were important tasks. For example, if the link or button labeled 'PictureNaming' was used to navigate to the PictureNaming assessment page, participants appreciated it when the subsequent page title was also consistently named PictureNaming and contained simple instructions about the assessment; participants preferred having the same label and icon at the top of the next page so that it was immediately clear that the new page was the intended destination. Teachers appreciated the student assessment tasks. *PictureNaming* task was rated very easy to use on the SEQ ratings (M =6.1, SD = 1.1). Other assessment tasks, *Slash* and *Word Sign/ Say*, were also rated above the recommended SEQ rating, but participants commented that more instructions were needed. All participants successfully completed assessments tasks in the allotted 5 minutes without any additional instructions. However, since these are assessment tasks or tests, participants wanted clear instructions for the assessment tasks and scoring to prevent any possible ambiguity for students. Similarly, though participants interpreted the data charts successfully, some participants noted that labels and interfaces could be simpler and more intuitive. The conceptual data chart shown was also interpreted correctly by all participants, but existing data charts were preferred. Figure 3 shows the redesigned home page after the second study.

Conclusion

Results suggest that usability and ease of use score improved in the second study. The pilot study suggested that the overall usability of AvenuePM was adequate. Though participants of the pilot study were undergraduate students, and not teachers, feedback from undergraduates was useful in making design changes for teachers. The SUS usability scores improved from 74 to 82, corresponding to 70 percentile (grade B) and 90 percentile (grade A) SUS scores (Lewis and Sauro, 2018). The individual feedback on tasks along with the corresponding SEQ scores provided specific data on making design changes at the task level. Though participants completed most tasks successfully, feedback from teachers suggests that further work is needed to ensure that labels and instructions are simple, clear, and relevant; tasks related to assessments and data interpretations may need further research on understanding other contextual factors. Additional usability studies will help to make the software better and, hopefully, to ensure that teachers can use the software effectively for the main purpose of progress monitoring – helping students to learn.

Table 1. System Usability Score (N=27). Fall 2018 Study.

Metric	Average	SD	95% Confidence Interval Lower Limit	95% Confidence Interval Upper Limit
System Usability Score (SUS)	74.6	13.8	69.2	80.1

Table 2. Single Ease Question scores (7-point Likert scale, N=27). Fall 2018 Study.

Task	Average	SD	95% Confidence Interval Lower Limit	95% Confidence Interval Upper Limit
1 Creating a teacher account	3.2	1.6	2.6	3.9
2 Logging in as a teacher	6.8	0.5	6.6	7.0
3 Creating a Class	6.4	1.0	6.0	6.8
4 Adding a Student to a Class	6.4	0.8	6.1	6.8
5 Changing / editing Student Details	5.3	1.7	4.6	5.9
6 Finding Student data, charts or scores	6.0	1.5	5.4	6.6
7 Finding notifications/ to-do list	6.7	1.0	6.3	7.1
8 Sharing a student with another teacher	5.1	1.7	4.4	5.8
9 Logging out as a teacher	6.7	1.0	6.3	7.2
10 Logging in as a student	6.9	0.5	6.7	7.0
11 Finding Picture Naming & Slash as student	6.5	0.9	6.2	6.9
12 Picture Naming - completing a task	3.1	2.0	2.3	3.9
13 Slash - completing a task	3.7	1.7	3.0	4.4
14 As student, finding your progress data	4.8	2.1	3.9	5.6
15 Word Sign/ Say - completing a task	4.5	1.8	3.8	5.2

Table 3. System Usability Score (N=27). Spring-Summer 2019 Study.

Metric	Average	SD	95% Confidence Interval Lower Limit	95% Confidence Interval Upper Limit
System Usability Score (SUS)	84.1	12.6	73.5	94.6

Table 4. Single Ease Question Scores (7-point Likert scale, N=27).
Spring-Summer 2019 Study.

Task	N	Average	SD	95% Confidence Interval Lower Limit	95% Confidence Interval Upper Limit
1 Creating a teacher account	9	4.8	1.9	3.4	6.2
2 Logging in as a teacher	9	7.0	0.0	7.0	7.0
3 Creating a Class	9	6.8	0.4	6.4	7.1
4 Adding a Student to a Class	9	6.4	0.5	6.0	6.9
5 Changing / editing Student Details	9	6.8	0.4	6.4	7.1
6 Finding Student data, charts or scores	9	6.0	1.5	4.9	7.2
6a Using the Data Chart	9	5.0	1.7	3.7	6.3
7 Finding notifications/ to-do list	9	6.8	0.4	6.4	7.1
8 Sharing a student with another teacher	9	5.0	1.9	3.5	6.5
9 Logging out as a teacher	9	7.0	0.0	7.0	7.0
9a Data Chart Option	9	5.2	1.5	4.1	6.4
10 Logging in as a student	9	7.0	0.0	7.0	7.0
11 Finding Picture Naming & Slash as student	9	7.0	0.0	7.0	7.0
12 Picture Naming - completing a task	9	6.1	1.1	5.3	6.9
13 Slash - completing a task	9	5.7	1.6	4.5	6.9
14 As student, finding your progress data	9	6.2	1.1	5.4	7.1
15 Word Sign/ Say - completing a task	8	5.9	1.4	4.7	7.0

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Analysis of The Turkish Online Journal of Distance Education Through Text-Mining

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Abstract

This paper presents a review of distance education literature published in the Turkish Online Journal of Distance Education (TOJDE) to describe the status thereof and to identify gaps and priority areas in distance education research based on a validated classification of research areas. The articles (N=784) published between 2000 and 2015 were reviewed for this study. Accordingly, computer-assisted content analysis revealed that "the rise of ICT and e-learning (2000-2003)", "the increasing use of educational technologies in distance education (2004-2007)", "technology supported online/virtual learning environments (2008-2011)", and finally "the rise of the student centered, technology supported education and data-driven approaches (2012-2015)" were major themes in articles published in TOJDE.

Keywords: Turkey, distance education, research trends, systematic review, bibliographic analysis

Introduction

Taking advantage of previous experience and then using it as guide provides a robust walkthrough for those who want to move forward and improve the field. In this regard, analyzing, understanding and then synthesizing research trends in Distance Education (DE) forge the current state of the art and help it to develop further. Similarly, Lee, Driscoll and Nelson (2004) emphasize that "understanding trends and issues in terms of topics and methods is pivotal in the advancements of research on distance education" (p. 225). The structure of a research discipline forms the foundation for identifying gaps and priority areas (Mishra, 1997, p. 281). According to Bozkurt and Akgun-Ozbek, (2015), identifying the research areas is important because they act like a compass for online distance education researchers. They further highlight that distance education is a dynamic, interdisciplinary field that reacts to the changes swiftly; therefore, it is vital to keep the knowledge up to date through research on global, local or glocal dimensions. In this regard, analyzing, understanding and then synthesizing research trends in Distance Education (DE) forge the current state of the art and help it to develop further. In this regard, this paper addresses following research questions with a special emphasis on Turkish distance education research:

- What are the most common research areas covered in TOJDE and where are there gaps in distance education research?

Literature Review

Latchem (2009) conducted a content analysis of articles published in TOJDE between 2000 and 2008. He reported that articles originated from the Asia followed by articles from the Middle East, Africa, South America, USA, Eastern and Western Europe, and Australia. He highlighted that TOJDE is an important source to better understand the non-Western perspectives in distance education field. Özarslan, Balaban-Sali and Demiray (2012) analyzed the articles in TOJDE published between 2000 and 2010. They reported that Turkey, USA, India, Nigeria, Malaysia, Pakistan, Australia, Canada, UK, Bangladesh, Greece, and Iran, respectively, are the leading contributors. Bozkurt, Zawacki-Richter and Aydin (2019) conducted social network analysis to identify keyword network patterns and revealed that techonolology centric views widely accepted in the articles published in TOJDE. Aydin, Zawacki-Richter and Bozkurt (2020) conducted a follow up study and reported that as an international open access journal, TOJDE is representative of its own region, mostly developing countries, and is also representative of many other countries, which makes it an important publication venue.

In addition to above studies, there are some other papers that examine distance education from the perspective of scholarly journal networks. For instance, Zawacki-Richter, Anderson, and Tuncay (2010) examined impact of 12 distance education journals (6 open and 6 published in closed format). They found that articles in open access journals, such as TOJDE, tend to be cited more quickly than in closed format journals. Zawacki-Richter and Anderson (2011) analyzed the relationships and influences in peer reviewed distance education journals using social network analysis. In their research, they found that TOJDE is one of the journals in the core of the citation network. Lastly, Perkins and Lowenthal (2015) investigated open access journals in educational technology and reported that TOJDE is one of the most influential open access journals.

There were some other efforts, which were intended to map out trends in distance education research and scholarship by examining journals. For instance, Zawacki-Richter and Naidu (2016) analyzed titles and abstracts of the 515 articles, published in the SSCI journal Distance Education between 1980 and 2014, and they identified seven emerging themes: Professionalization and institutional consolidation (1980–1984), instructional design and educational technology (1985–1989), quality assurance in distance education (1990–1994), student support and early stages of online learning (1995–1999), the emergence of the virtual university (2000–2004), collaborative learning and online interaction patterns (2005–2009), and interactive learning, MOOCs and OERs (2010–2014). Zawacki-Richter, Alturki and Aldraiweesh (2017) examined 580 articles published in International Review of Research in Open and Distance/Distributed Learning (IRRODL) between 2000 and 2015 and they revealed following emerging themes: the establishment of online learning and distance education institutions (2000–2005), widening access to education and online learning support (2006–2010), and the emergence of Massive Open Online Courses (MOOCs) and Open Educational Resources (OER) (2011–2015).

In addition to these studies, some other articles examined distance education journals from a broader perspective and sampled more than one journal in their research. Berge and Mrozowski (2001) examined 890 articles published over a ten-year period from 1990 to 1999. They reported that key issues in distance education were the roles of key participants, technology selection and adoption, design issues, strategies to increase interactivity and active learning, learner characteristics, learner support, operational issues, policy and management issues, equity and accessibility, and cost/benefit trade-offs. Lee et al. (2004) also examined 383 articles published in four distance education journals between 1997 and 2002. They indicated that that interaction, learners, perception, collaboration, video conferencing, program evaluation, and faculty support were main issues covered in distance education journals. Zawacki-Richter, Bäcker and Vogt, (2009) analyzed 695 articles published in five distance education journals between 2000 and 2008. They found that issues about instructional design, interaction and communication patterns in computer-mediated communication, learner characteristics, and educational technology dominated the distance education field. Bozkurt et al., (2015) conducted a complementary study and examined 861 articles published in seven distance education journals published between 2009 and 2013. They confirmed that educational technology, interaction and communication in learning communities, learner characteristics, and instructional design are the most studied research areas.

Methodology

Research design

This study is a literature review that intends to reach a synthesis by examining articles published in TOJDE. For this purpose, review study benefits from computer-assisted content analysis.

Computer-assisted content analysis

Computer-based content analysis enables us to examine the conceptual structure of text-based information, so it can be used to identify the most important and most commonly occurring themes within large bodies of text (Krippendorf, 2013). This approach is considered to be an appropriate method for mapping out a research domain (Fisk, Cherney, Hornsey, & Smith, 2012). By employing this approach, Leximancer, the software tool creates concept maps that display the core concepts within the text body (conceptual analysis) and show how these concepts are related to each other (relational analysis) by recording the frequency with which words co-occur in the text. Similar concepts that appear in close proximity are clustered together in the concept map (Smith & Humphreys, 2006). In this research, titles and abstracts of the articles published in TOJDE analyzed to identify research themes.

Sample: Articles published in TOJDE

For this study, all the articles published in TOJDE between 2000 and 2015 were reviewed (N=784). Book reviews and editorial notes were excluded from the sample.

Results and Discussion

The Rise of ICT and e-learning (2000-2003)

The major themes emerging between 2000 and 2003 are *distance (100%), learning (23%), study (18%), information (13%), developing (12%), teachers (8%),* and *process (5%)* (see Figure 4). Developments in ICT and online technologies paved the way of e-learning. Distance education mostly benefited from e-learning model and it is used for facilitating learning processes. Students' perceptions and teachers' views on e-learning, and comparison of traditional courses and online courses were other topics covered in this period.

By the 2000s e-learning was becoming widely accepted and adopted by higher education institutions (Guri-Rosenblit, 2009) and thought to be as an innovative component of the distance education (Bates, 2001). E-learning was further considered as a natural evolution of distance learning (Garrison and Anderson, 2003). As a reflection to these thoughts, many studies published in TOJDE between 2000 and 2003 dealt with issues concerning ICT and e-learning from the perspective of distance education. This situation can be seen in Figure 4 (see concept path *communication – information – technologies – distance).* As examples of the articles published in TOJDE, Reddy and Srivastava (2003) explained ICT and the future of DE; Rajesh (2003) researched on problems associated with ICT adaptability in developing countries; Edmundson (2003) evaluated ICT in terms of cultural disparity; Flood (2002) suggested that e-learning is a driver for continuing professional development; and Fourmier reported the results of their survey on e-learning in Europe. In this context, students' perceptions and teachers' views were also important themes in this term (See concept path *teachers-research-offered-paper-students-perceptions* in Figure 4). For instance, Nakos and Jourdan (2002) explored students' perceptions of online courses, while Dzakiria and Idrus (2003) examined teacher-learner interactions in distance education.

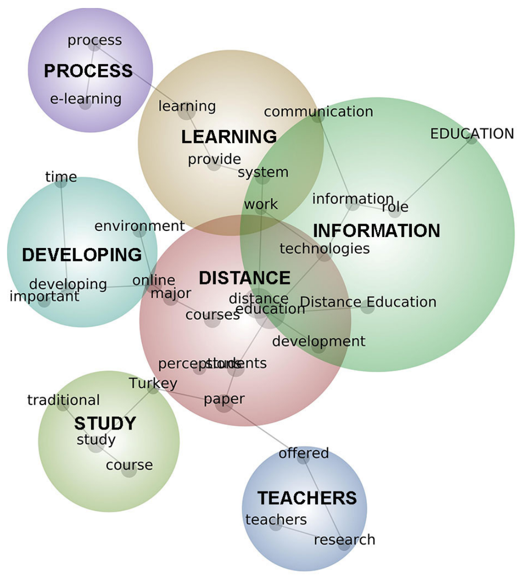

Figure 4: Concept map for the period between 2000 and 2003

The theme, *rise of the ICT and e-learning*, is similar to the themes identified in the journals Distance Education and IRRODL. Zawacki-Richter and Naidu (2016), who examined the journal of Distance Education, labeled the years between 2000 and 2004 as *the emergence of the virtual university* and Zawacki-Richter et al. (2017), who examined IRRODL, labeled the years between 2000 and 2005 as *online learning and distance education institutions.* Based on these findings, it can be concluded that online learning had already moved into the mainstream of distance education by the beginning of the new Millenium.

Increasing use of educational technologies in distance education (2004-2007)

The major theme between 2004 and 2007 was *learning (100%)*, followed by *education (83%), technology (34%), program (16%), training (10%),* and *group (6%)*. When compared, we can see a strong focus on learning which intersects with all other themes except training (see Figure 5). As identified in the previous period, as a result of the developments in ICT and the great interest in e-learning, educational technologies in distance education attracted much attention. As a field of practice, distance education naturally intended to increase learning opportunities by benefiting from educational technology.

From the beginning of distance education, educational technology and distance education has an intertwined relationship (Casey, 2008). Even though educational technology is not a new area, it has evolved and took many forms (Reeves, 2006). By 2004, Web 2.0 emerged and the nature of online learning spaces changed in line with these developments. Therefore, as an extension of the previous time period, *rise of the ICT and e-learning*, articles published between 2004 and 2007 revisited educational technology to explore new developments from the view of distance education. As can be seen in figure 5, *learning, e-learning, technology, information, technology,* and *knowledge* concepts are directly linked to each other and demonstrated the direction of research interest in this time period. Some of the noteworthy articles published in TOJDE between 2004 and 2007 are as follows: Ozana (2007) examined attitudes of graduate students on educational technology and distance education. Additionally, it was also seen that among the many educational technologies, there was a focus on Learning Management Systems (LMSs) in the articles published in TOJDE between 2004 and 2007. In their article, Sturgess and Nouwens (2004) evaluated online LMSs from an Australian context, Ahmad, Edwards and Tomkinson (2006) examined use of LMSs in distance learning from a United Kingdom perspective.

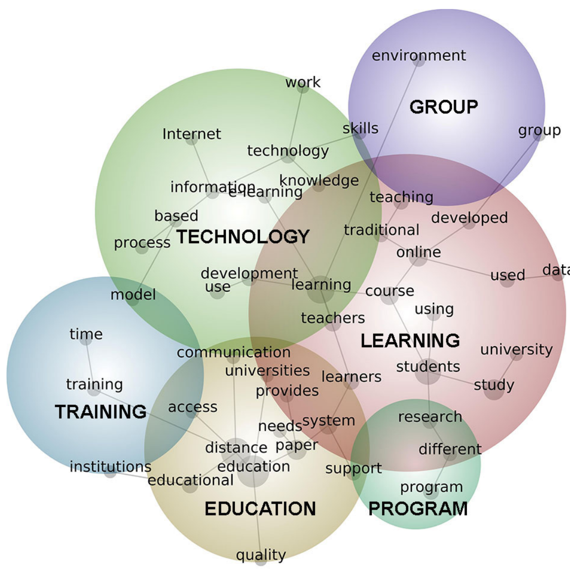

Figure 5: Concept map for the time period between 2004 and 2007

While *an increasing use of educational technologies in distance education* was identified as the main theme for the 2004-2007 period in TOJDE articles, for the Distance Education journal it was *collaborative learning and online interaction patterns* in 2005–2009 (Zawacki-Richter and Naidu, 2016) and *widening access to education and online learning support* in IRRODL for 2006–2010.

Technology supported online/virtual learning environments (2008-2011)

The third theme emerged as an extension of the previous periods. Accordingly, *students (100%), education (88%), learning (74%), academic paper (37%), information (18%), communication (10%)* and *data (4%)* were the themes identified for the articles published between 2008 and 2011 (see Figure 6). As can be seen in the concept map, higher education institutions used online learning environments to support the learning processes and lessen the limitations of distance education, which is mainly about time and space constraints, by using online spaces in learning processes. As can be seen in figure 6, learning, *distance-learning-*

online-course-environment concepts are directly linked to each other and demonstrated the direction of research interest in this time period. We also see that *data* emerged as one of the major themes, which then became very critical in the following period. The interest online/virtual environments stem from one of the popular online/virtual environment, SecondLife at this time period and 2011 issues mostly published articles about online/virtual environments and worlds. For instance, in their study, Inman, Wright and Hartman (2011) evaluated use of Second Life from the perspective of K12 and higher education; Liski (2011) examined Second Life for training design, and Hargis evaluated Second Life for distance education.

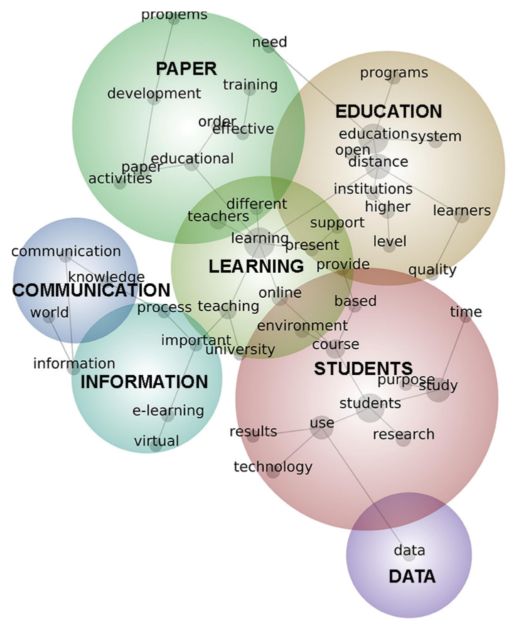

Figure 6: Concept map for the time period between 2008-2011

While online learning environments were not a new phenomenon, they became a viable learning space with many new concepts, such as semantic web, social networking, and cloud computing. Unlike other developments in technology, online learning in networked spaces devised its own pedagogy, which was then called the third generation of distance-education pedagogy (Anderson and Dron, 2011) and more specially known as connectivism (Siemens, 2004). With the opportunities that online learning environments afford, separation in time and space is no longer an issue; in contrast, the new motto with online learning is *anytime, anywhere learning* (Ally, 2004). Based on these developments in the field, not surprisingly, one of the major issues covered in the studies published in in TOJDE between 2008 and 2011 was technology supported online/virtual learning environments. In figure 6, the following path, *open education, learning, online, course,* and *environment* demonstrates how these concepts are tied to each other and how other peripheral concepts clustered around them.

Rise of the student centered, technology supported education and data-driven approaches (2012-2015)

Even though some themes and concepts such as information, technology, education, learning, are reoccurring in this time period, the final time period was entitled *Rise of the student centered, technology supported education and data-driven approaches.* The major themes were *students (100%), education (49%), technology (18%), development (11%), data (11%)* and *time*

(1%) (Figure 7). According to the analysis of articles published in TOJDE, the first time period (2000-2003) was *rise of the ICT and e-learning*, the second time period (2004-2007) was *increasing use of educational technologies in distance education*, and the third time period (2008-2011) was *technology supported online/virtual learning environments.* As a natural consequence of the previous periods, a shift from technology centered research to *student centered, technology supported education and data-driven approaches* emerged in the fourth time period (2012-2015).

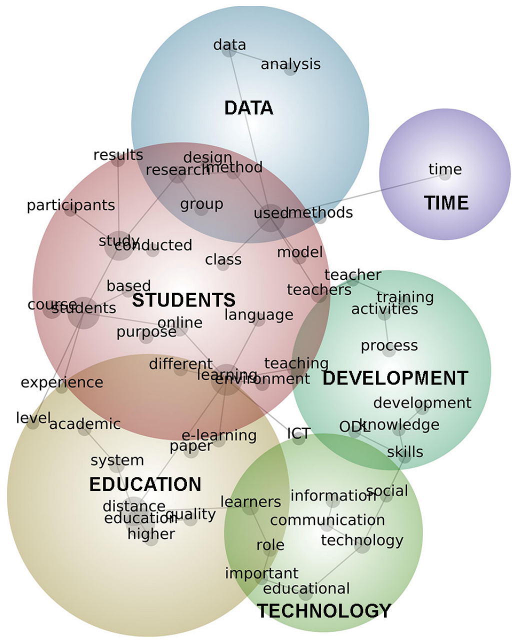

Figure 7: Concept map for the time period between 2012-2015

As can be seen in the path *method-used-data-analysis* (Figure 7) increasing the use of data-driven approaches has resulted in research that has adopted mainly quantitative approaches. This confirms Latchem's study (2009, in which this tendency was identified, and it seems that this tendency continues increasingly. However, as can be tracked in path *experience-students-online-learning-environment-elearning-ICT*, the main focus was *student centered, technology supported education.* When examining the articles published in TOJDE, it can be seen that topics such as students' academic achievements (Unal-Colak and Ozan, 2012; Hanbay, 2013; Deniz, Kesan and Izgiol, 2013; Celikoz and Gursoy, 2014), satisfaction (Green and Denton, 2012; Calli, Balcikanli, Calli, Cebeci and Seymen, 2013; Goulimaris, 2015; Anagnostopoulou, Mavroidis, Giossos and Koutsouba, 2015) and learning styles (Omidvar and Tan, 2012; Wu, 2014) were salient.

If we compare the period referred to as, *the rise of the student centered, technology supported education and data-driven approach,* which emerged in articles published in TOJDE between 2012 and 2015, with other periods that emerged in Distance Education journal and IRRODL, we can see how TOJDE followed a different path. It was *interactive learning, MOOCs and OERs* (2010–2014) in Distance Education journal and *the emergence of MOOCs and OER for* 2011–2015 in IRRODL (Zawacki-Richter et al., 2017).

Overall evaluation and comparison of the themes and concepts

When examined, it was seen that the main characteristics in all concept maps was the information and communication technologies. This indicates that TOJDE has a special focus on educational technologies in distance education processes.

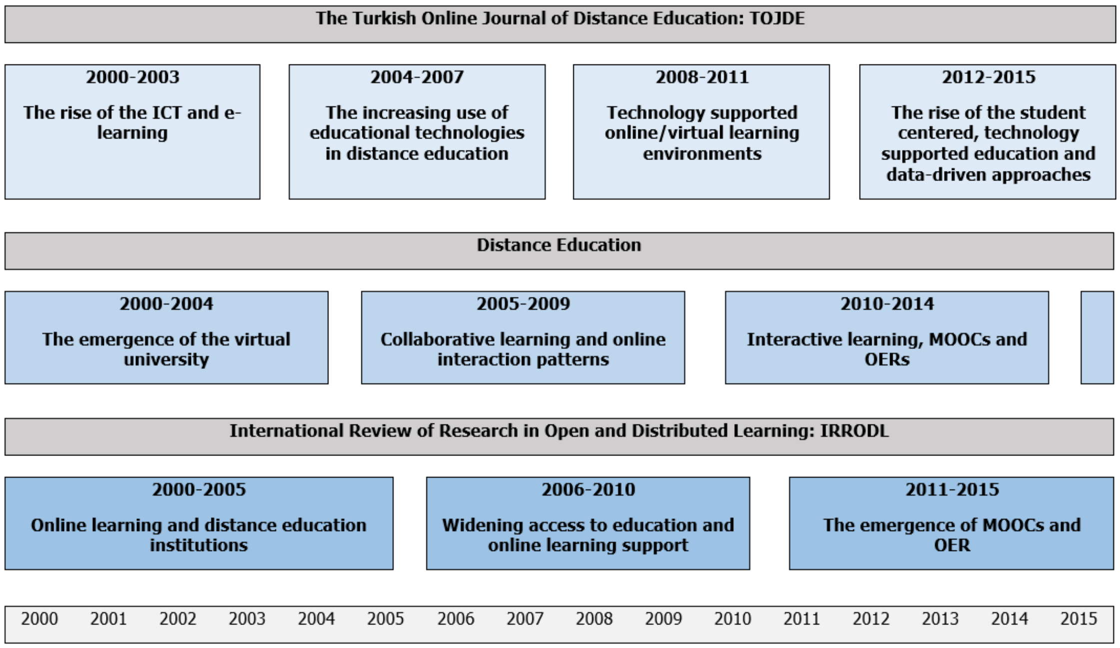

Figure 8: Comparison of the main themes in TOJDE, IRRODL and Distance Education Journals

If we compare the main characteristics of the periods that emerged in TOJDE, Distance Education, and IRRODL (Figure 8), we can see that all three journals reacted to the developments that had taken place by the 2000s in the same manner; however, as time progresses, we can also see that their focuses shifted to different aspects of the distance education field. While TOJDE laid special emphasis on topics such as ICT, educational technology, online learning environments and use of data; Distance Education and IRRODL shifted their focus to topics such as online learning institutions, interaction, learner support, online collaboration and accessibility. One thing that is very striking, this focus became very distinct and apparent after the first decade of the new millennium. While articles published in TOJDE covered topics related to the use of the data, articles published in Distance Education and IRRODL covered topics on new approaches and learning models, such as open educational resources and massive open online courses. These three journals represent different regions, and the articles originate from different countries. Considering that progress across the globe is not at the same pace and the needs of the regions vary according to socio-economic need, and probably many other reasons, this is natural and expected. In a broader perspective, it is also promising to see that researchers who contribute to these journals do not follow the same trends, thus adopting a realistic perspective and contribute to the field by providing knowledge in a wide spectrum of research interests.

Conclusions

With the purpose of identifying trends and patterns in distance education from the perspective of TOJDE, this study examined articles published between 2000 and 2015. The computer-assisted content analysis showed that the *rise of the ICT and e-learning* (2000-2003), the *increasing use of educational technologies in distance education* (2004-2007), *technology supported online/virtual learning environments* (2008-2011), and the *rise of the student centered, technology supported education and data-driven approaches* (2012-2015) were the main themes.

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Optimizing the Culturally Immersive Peace Corps Experience for Long-Term Commitment to Public Service in the Education Sector

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Abstract

This study investigates the academic and professional relationships between Peace Corps Volunteers and host-country partners that continue post-service. Peace Corps sends citizens of the United States abroad to work with host country partners in different sectors, including education. This study will address the impact of partnerships that originated from relationships maintained by Volunteers from the education sector and their host-community after the obligatory two-year service ended.

Introduction

The purpose of this study is to examine the impact of culturally immersive experiences and cultural understanding on international academic and professional partnerships. This research will include participants from the Returned Peace Corps Volunteer (RPCV) community. The study will address motivations for choosing to maintain a working relationship with international partners after in-country service has ended. The depth, breadth, mutual benefits, and sustainability of a transformative partnership will also be examined.

The unique culturally-situated learning experiences that Peace Corps provides Volunteers in-country sets the foundation for successful integration to host communities. The in-country community-based training program includes situated-language instruction, training in language teaching methodology, classroom observation and teaching practice, and key area studies (history, economics and cultural norms). Skills acquired during pre-service training are further enhanced by daily interactions with the host community. PCVs and the host community develop a mutual cooperation and learn about each other's academic expertise and interests. PCVs are trained to identify needs of the host institution through formal learning experiences.

Once the two-year service ends many PCVs maintain relationships with host partners through distance mentoring and training, providing access to technological tools and shared educational resources. Appropriateness of strategies employed at this stage are implicitly established through mutual cultural understanding and capacity awareness. The inclusive nature of activities can lead to a more formalized relationship, as is the case of this study's partnership. My motivation to pursue this research is to explore the outcomes of international volunteer service for host countries and Returned Peace Corps Volunteers. The philosophy of developing mutual cultural understanding, to establish a learning community that provides access to technologies essential to learning.

Peace Corps

Peace Corps, an independent agency of the United States (U.S.) federal government, sends qualified citizens to communities abroad for a minimum of two years to work with host partners in resource- restricted nations. PCVs live in communities where they serve, learn the local language of their community, and are trained to identify priorities, strategies, and activities to build local capacity in specific sectors, such as agriculture and education (Lough, et al, 2014). Members from the host community develop professional and social relationships with PCVs through daily interactions. Interpersonal relationships between PCVs and host country partners and acceptance of PCVs within the communities lead to improved cross-cultural understanding. PCVs who integrate into successfully gain trust and respect within the host community (Hall, 2007). Among host country partners, frequent contact with PCVs leads to a greater understanding of Americans.

RPCVs often make concentrated efforts to maintain relationships with their host communities to create sustainable change that lasts after in-country service. The culturally immersive experience and cultural understanding that results from Peace Corps experience is a conducive element for creating transformative international academic and professional partnerships. The outcomes of the partnership are transformative as opposed to transactional. Transformative partnerships are multi-dimensional, mutually beneficial, and more likely to be sustained over time.

USA-IFNTUOG Partnership

I served as PCV in a Ukraine from 2010-2012. I was assigned to work with a Ukrainian counterpart, who served as a linguistic interpreter and liaison to the host community for two years. The counterpart also acted an agent of professional integration and cross-cultural mentor at the Ivano-Frankivsk National Technical University of Oil and Gas (IFNTUOG) in Ivano-Frankivsk, Ukraine.

After the end of in-country service 2012, my Ukrainian counterpart and I maintained a collaborative academic relationship. From 2014 to 2018 the relationship was informal in nature. IFNTUOG students were introduced to online learning as part of the initial stages of collaboration. My colleagues from the University of South Alabama (USA) and I trained my counterpart in online course design using educational technologies provided by our institution. This experience revealed a mutual interest in instructional design, online course development, and student engagement.

In 2018, the informal collaborative relationship was elevated to that of a formal partnership, with the signing of a Memorandum of Understanding between the both partner universities. This official action recognized the importance of the relationship, ensured institutional commitment, and gave my former Ukrainian counterpart a higher status as an international partner.

Since the formal partnership was established, our work has expanded. Our Ukrainian partner hosted the first webinar in the series on the topic of developing verbal English skills outside the classroom using TEDx techniques. This was a presentation at the Conference on Teaching and Learning, hosted by my university. The conference was virtual, so it was also attended by her Ukrainian colleagues. She was then asked to train other instructors in her department to use web conferencing technology (i.e. Zoom). This was of major importance when Ukrainian campuses closed due to COVID-19. The technical skills she for our department's remote professional development workshops and one-on-one training had a positive impact in her educational environment.

We engage her students in partnership activities to develop global competencies. Student-initiated classroom participation and self-regulated learning is not presently characteristic of Ukrainian higher education. The partnership gives Ukrainian students access educational technologies that reflect the cultural learning practices of that country. The partnership integrates online learning experiences with traditional face-to-face education to promote a more learner-centered curriculum at the partner institution (Loo, et al, 2019).

My motivation to pursue this research to explore the outcomes of international volunteer service for host countries partners and Returned Peace Corps Volunteers. The current research that exists on international service does not provide evidence of impact, rather the majority of current research in this area is based on case and cross-sectional studies (Devereux, 2008; Lough, et al, 2014).

The following research questions will be explored in this study.

- What are some of the changes in values and beliefs that individuals experience during Peace Corps service?
- How did cross-cultural experiences with individuals from the host country affect these changes?
- Did the experience result in a commitment to the education sector or related service-oriented career paths?
- What types of relationships do RPCVs maintain with host country individuals and organizations?

Method

Procedure

I chose to use mixed-method approach for this study. The research is conducted in two phases. Phase 1 (P1), described in this paper, used an online questionnaire to collect quantitative data. The quantitative data collected in the questionnaire identified individuals who meet the inclusion criteria required to participate in Phase 2 (P2). I used descriptive statistical analysis to examine the 32 participants on the quantitative variables. Because of the qualitative focus of this study and the small number of cases, I did not use statistical significance testing.

Starting in P2, qualitative data will be gathered through in-depth interviews conducted over Zoom. A letter of Informed Consent will be given to each participant prior to each interview. During this phase, the perspectives of each participant will be revealed through qualitative methods using Strauss and Corbin's (2015) approach to data analysis. The constant comparative method will be used to develop concepts from the data through continual data collection, coding, and analysis.

P1 Participants

Thirty-two individuals participated in P1 this study. All were Returned Peace Corps Volunteers who satisfactorily completed two years of Volunteer service in a foreign country or completed their Volunteer service with an early Close of Service. Twenty participants were female, eleven were male, one self-described as non-binary, and three did not indicate their gender. Twenty-nine participants indicated that they served only once, in one host country. Two participants served twice, in a different host country each time. One participant served twice, each time in the same country. The earliest starting year of service among the participants was 1973. The most recent Close of Service year reported was 2020. The participants' primary assignment sectors included agriculture, community economic development, education, organizational development, health, and youth in development.

Findings

All 32 participants responded to which geographic region of the world they served. The responses indicated six different regions. The majority served in Eastern Europe and Central Asia (44%). The second region with the where participants served was Africa (22%). Other participants indicated serving in Eastern Asia (16%), Central America (13%), Caribbean (3%), and South America (3%).

Ukraine had the highest concentration of participants (34%). Three participants (9%) served in Tanzania. Guatemala and Armenia each hosted two of participants. The other countries each hosted one participant. Two participants indicated that they served twice, one of them served in Mauritania after serving in Chad and the other served in Comoros after serving in Kyrgyzstan. One participant responded that they served twice and indicated that they served in Ukraine both times. See Table 1 for countries represented in this study. Table 2 depicts the host countries of those participants that served in Peace Corps more than once.

Table 1
Host Countries of Participants

Country	Number of Participants	Percent
Ukraine	11	34%
Tanzania	3	9%
Guatemala	2	6%
Armenia	2	6%
Belize	1	3%
Chad	1	3%
Ethiopia	1	3%
Jamaica	1	3%
Mongolia	1	3%
Nepal	1	3%
Philippines	1	3%
Romania	1	3%
Ghana	1	3%
Burkina Faso	1	3%
Peru	1	3%
Kyrgyzstan	1	3%
Georgia	1	3%
Honduras	1	3%

Table 2
Host Countries of Participants Who Served Than Once

Country	Number of Participants	Percent
Only Served in Once	29	91%
Mauritania	1	3%
Ukraine	1	3%
Comoros	1	3%

Overall, 13 of the 32 respondents worked in the education sector for their primary assignment. This includes secondary school, higher education, math education, teachers of English as a foreign language. The participants indicated their level of agreement with several aspects of their Peace Corps experience. Overall, 30 participants strongly agreed that the experience was rewarding and two simply agreed. The participants were asked to share their secondary community projects. See Table 3 for a self-description of secondary community projects that the participants were involved in during their service.

Table 3
Primary Assignment Sector and Host Country of Participants

Country and Service Sector	
Armenia	Education
Belize	Served in Two Sectors (Health and Youth in Development)
Chad	Served in Two Sectors (Education and Community Development)
Ethiopia	Education
Guatemala	Agriculture
	Health
Jamaica	Education
Mongolia	Education
Nepal	Education
Philippines	Health
Romania	Organizational Development
Tanzania	Education
Ukraine	Education
	Community Economic Development
Ghana	Education
Burkina Faso	Health
Peru	Served in Two Sectors (Education and Community Development)
Kyrgyzstan	Education
Georgia	Education
Honduras	Education

Overall, 13 of the 32 respondents worked in the education sector for their primary assignment. This includes secondary school, higher education, math education, teachers of English as a foreign language. The participants indicated their level of agreement with several

aspects of their Peace Corps experience. Overall, 30 participants strongly agreed that the experience was rewarding and two simply agreed. The participants were asked to share their secondary community projects. See Table 5 for a self-description of secondary community projects that the participants were involved in during their service.

Table 5
Self-Description of Secondary Community Projects

Secondary Community Projects	
Armenia	English clubs at the windows on America library, baseball camps, leadership camps
	English clubs; English poetry recitation club; English camps
Belize	English teaching, youth soccer club, gardening club
Chad	Women's credit union Building wells for farmers (non-potable water) Scholars bowls for middle school maintenance (project started by prior PCV): - Garden - Computer room
Ethiopia	English club, Drama club, Grassroots Soccer, Gender & Development Club, Girls Club, HIV support group, entrepreneurship program for HIV positive women and children, GLOW cam; hygiene and awareness program for the prison population.
Guatemala	English Clubs
	ESL, WID (nutrition, French Intensive gardening)
Jamaica	Environmental science club for teens
Mongolia	English lessons for teachers
Nepal	Taught primary-level science (primary assignment was English)
Philippines	Diversity camps, Leadership camps
Romania	GLOW/TOBY (gender) camps; environmental activities
Tanzania	English book club, English movie night, weekly English language club
	Grassroot Soccer
	HIV-aids awareness
Ukraine	English and Journalism club, summer camps, community clean-ups
	English Camps for Ukrainian teachers of English. I also raised money to purchase a computer for my school.
	English Camps, English Clubs
	English camps, English clubs, HIV/AIDS awareness/prevention camps, human trafficking awareness/prevention camps, teacher training camps, drama camps
	English camps, English movie clubs, GLOW seminars for girls
	English club for youth; English club for adults; helping friend with her after-school students practicing their English lessons.
	English Club University English language classes Plast (youth scouting organization) activities
	English summer camp and English club
	English/youth leadership development/environmental/HIV AIDS camps, English clubs, after school tutoring
Ghana	English Club

Burkina Faso	English classes, cooking classes, cognitive stimulation class for senior citizens, girls soccer club, movie club, exercise clubs.
Kyrgyzstan	English clubs, environmental camps, competitions & field days
Georgia	Nutrition awareness, feeding the male nourished, supporting women's income generating projects of clay, seeds, clothing, and corn husks designs.

Next Steps

The data collected for this exploratory study will be used to develop questions for the in-depth interviews that I will conduct in Phase 2. The interview questions will also be based on data collected on existing literature on Returned Peace Corps Volunteers and the cultural, social, academic post-service outcomes. After the interviews are conducted, each case will be examined in totality. The different cases will be compared for patterns that emerge and differences that exist.

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Social Justice Education in the US Rural South: Research and Practice

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Abstract

This paper presents an emerging model of social justice education that has been implemented in a rural K-12 school system in the Southeastern US. The model was developed over a five-year period through a research practice partnership between a state university (e.g., college of education) and the local community. Using a DBR approach, the research team worked closely with teachers and students to take a process of historical inquiry and embed it into the K-12 school system. The result of this effort is an emerging model of learning that attends to different components of social justice education, including the doing of history, the juxtaposing of various narratives, and the development of critical consciousness. These components are then illustrated through a case study that focuses on the interactions between the components and how those interactions supported students' meaning-making. Implications for the design and study of learning in the context of social justice are discussed.

Introduction

This project involved creating bridges between a state university and K-12 students in rural and economically-disadvantaged Putnam County, Georgia. One goal was to open a discussion of Putnam's past among those who grew up there decades ago and the students who make up its future. Our hope was that building a model of K-12 education to support and engage in these dialogues would develop students' critical awareness of who they are and where they come from, and ultimately empower them to realize their potential in the world as fully as possible. Over the course of a five-year research-practice partnership, we, the authors of this paper, have worked together to construct a model of K-12 education in which both teachers and students listen to, uncover, and preserve the stories of the community members while using those stories as a tool for developing critical perspectives about the history of Putnam county.

With that in mind, this paper begins with an introduction to the research-practice partnership and the community in which the partnership was established. After a brief summary of the partnership, we present an emerging model of learning that draws on our experiences over the past five years. The model, which was built through a design-based research approach, is then illustrated through a single case in which two students engaged in the "doing" of history, the juxtaposition of narratives, and the practice of critical consciousness. The individual components of the model as well as the importance of their intersectionality are then discussed.

Research-Practice Partnership (RPP) and Design-based Research (DBR)

The RPP began with a broad goal of building the in-school experience of K-12 students around their local community, where the community served as a place for teachers and students to both meet standards and engage in a democratic society. To guide our work, we drew from design-based implementation research (DBIR) (Penuel, Fishman, Cheng, & Sabelli, 2011), which embraces an iterative process of developing, testing, improving, and retesting a research-driven educational intervention through deep collaboration with local contexts (see also Cobb et al., 2003). DBIR emphasizes the value of *co-design,* meaning researchers and local stakeholders (e.g., administrators, teachers, students) work collaboratively to shape and accomplish the driving goal of the project. Examining a well-designed intervention over time *and* in a local context leads to the formation of research-based learning principles and practices that advance theory while having relevance in an applied context (Penuel et al., 2011).

The RPP consisted of several entities, including members of the Wilson Center for Humanities & Arts and the College of Education at the University of Georgia, and the public-school system in Putnam County, Georgia. Putnam County Charter School System is a PreK-12 system that serves approximately 3,500 students (44% white, 41% black, and 11% Hispanic). The percentage of families living below the poverty line is between 15 and 30%, while 79% are classified as economically disadvantaged.

The rich and complex cultural history of Putnam County played a significant role in our work as a partnership. Both Joel Chandler Harris (1845-1908) and Alice Walker (b. 1944) were born and raised there, and the county figures prominently in their literary works. While Harris's 19th-century *Uncle Remus* tales focus on the time before Putnam's enslaved residents were freed, Walker's poetry and prose of the 1970s and 80s, such as *The Third Life of Grange Copeland* and *The Color Purple,* embodies the repercussions of the long period of racial and economic inequality and injustice that followed. Walker's work has been celebrated for creating a literature about those who lived ordinary and hard lives in the segregated South, but, drawn out of her own experiences, it also provides a critical lens for examining the specific history of the place she grew up both before and during the Civil Rights era.

Putnam is in many ways like most rural communities across the Deep South, including that many of its K-12 students are descended from families that have been there for multiple generations. For example, many Putnam residents in their 70s and 80s grew up with Alice

Walker and her siblings and most residents over 60 have clear memories of segregation and the struggle for civil rights. These older generations, who lived through what Walker later wrote about, have their own stories to tell of the hardships, setbacks, victories, and changes that have transformed the place of their childhoods into the one their grandchildren and great-grandchildren are now growing up. The purpose of the project was to create opportunities for K-12 students to engage with those community members and their stories, to open a discussion of Putnam's hard past between those who grew up there decades ago and the students who make up its future. Our overall goal was to work with teachers and students to capture those stories and use them as both a context for, and document of, the history of Putnam county while also achieving the performance standards to which they are held accountable. The question guiding this research was: *What design perspectives/principles were most salient in this project, and what did they look like in practice?*

An emerging model

Through a reflexive design practice, we situated our work within our partnerships with teachers and students in order to center and value the different ways of knowing and knowledge that each partner brought. This reflexive practice included exploring how to navigate the tensions that arose around long-standing racial and economic injustices in the community, and how to support teachers and students in exploring those tensions while being sensitive to the historical context and people in a community as well as attending to our own identities as white scholars. There were no clear-cut answers to these questions. Instead, our work as an RPP focused on continuously developing our own understanding of the design through our interactions with each other, the teachers, the students, and members of the Putnam community. This has resulted in an emerging model of social justice education that consists of three components (see Fig. 1): the "doing" of history, critical consciousness, and the juxtaposition of narrative. We call the model "emerging" for the simple reason that it has been developed and continues to develop through our *relationship* with each other and the other participants (see Lawton et al., 2020; Walters, Kopcha, & Lawton, 2020). That relationship is not static; it grows and shifts each year as new challenges develop and accomplishments are realized.

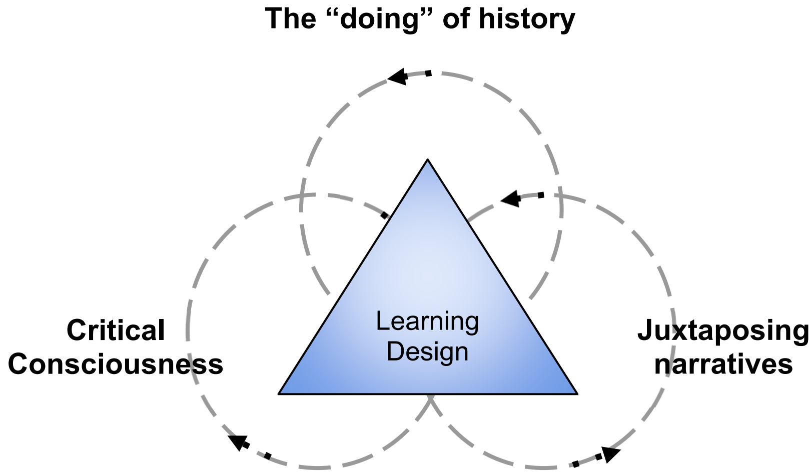

Figure 1: An Emerging Model for Social Justice Education.

The doing of history

The doing of history is a phrase used in social studies education that refers to engaging students in the work of real-world historians in the classroom (Levstik & Barton, 2011). From this perspective, history is viewed as something that is constructed by people from the pieces of the past that remain today (Wineburg, 2001). This work is always incomplete and subjective -- as new evidence comes to light, new perspectives on history can be constructed (Rüsen, 2005). Thus, the primary activity in the doing of history is making arguments based on our analysis of the evidence at hand. By creating their own evidence-based arguments, students learn that history is not static, i.e., the "true" presentation of facts in a textbook, but a process of human inquiry into the past driven by current-day interests and questions (Buehl & Alexander, 2006; Rüsen, 2005).

In the context of social justice education, many scholars have introduced critical perspectives to the doing of history. This takes the methods of historical inquiry and layers an additional focus on issues of social justice and equity (Parkhouse, 2018). Activities such as creating narratives that center untold stories and marginalized people (Salinas & Alarcón, 2016), exploring alternate perspectives on dominant and/or traditional narratives (Freedman, 2015; Salinas & Alarcón, 2016), and reflecting on their own perspectives and assumptions (Lim, 2010; Parkhouse, 2018) can support students in critical historical inquiry.

Critical consciousness

Critical consciousness is a philosophical perspective that interrogates long-standing traditions and practices in society. Engaging in critical consciousness means observing and identifying the social and political structures that shape the world, and developing an awareness of how those structures affect different groups of people differently. The notion of critical consciousness is rooted in the work of Brazilian educator Paulo Freire (1973; 1974) who worked with illiterate, impoverished adults in Brazil to understand the way oppression becomes operationalized in society and use this knowledge to create change. For Freire and others who have adopted this perspective (e.g., Cammarota & Fine, 2008; Paris, 2012; Souto-Manning, 2010), there is a common emphasis on action (i.e., critical action, social change, participation), self- and socio-political efficacy, and critical reflection. Related practices in K-12 include Ladson-Billings' (1995) Culturally Responsive Pedagogy (CRP) and Paris' (2012) Culturally-Sustaining Pedagogy. These reposition students as 'knowers' in the classroom, attempting to disrupt their assumptions about the source and nature of our knowledge. All students' unique perspectives, experiences, and cultures play a role in the way that students see themselves as agents of knowledge and have space to engage in critical dialogue (Taylor, 2019).

Juxtaposing narratives

The act of juxtaposing two ideas or concepts, such as narratives, is rooted in pedagogical strategies that promote alternative perspective taking (Jonassen, 2011) and cognitive flexibility (Spiro et al., 2011). The general idea is that juxtaposing narratives about the same person, time, and/or place creates an opportunity for students to observe what is similar and, more importantly, where differences in those narratives arise. Those differences are often rooted in long-standing political and social issues that shape the structure and nature of each narrative. Thus, juxtaposing narratives is a powerful way of supporting both the doing of critical historical inquiry and the development of critical consciousness. This work allows for students to engage with multiple perspectives, reveal normative assumptions, and provides spaces of action for critical dialogue and identity formation.

Methods

Broadly, the project has grown over the past five years to include 25 teachers and their students as part of the RPP. In this paper, we present a single descriptive case study (Yin, 2017) of two high school students engaged in a semester-long critical historical inquiry project. The analysis focuses on the meaning-making processes that were evident in their work products, particularly as related to the doing of history, critical consciousness, and juxtaposing narratives. The two students serve as embedded units that represent the phenomena of the meaning-making process (Baxter & Jack, 2008; Yin, 2017).

Participants

Participants included two students enrolled in an inclusion-level 10th grade U.S. History course. Raymond (all student names are pseudonyms) is an African American male whose family is from Putnam. Ashley is a white female student, also from Putnam. Their teacher, a white male, was among the first members of the project; at the time of this study, he had been teaching history for about 12 years.

Design and analysis

This case focused on the students' meaning-making process during historical inquiry and was selected because it illustrates the way different components of the model supported the project goals. Student-produced artifacts, including worksheets, archival research, and written and audio reflections, were analyzed using a social semiotic approach to multimodality. The social semiotic approach centers on a sign-maker's (in this case the student's) meaning-making process as presented through the choice, use, and integration of various modes (e.g., color, text, tone, gestures) (Jewitt et. al, 2016; Kress, 2010). According to this theory, meaning is communicated through the interaction between the modes rather than any singular mode (Kress, 2010).

Consistent with a social semiotic multimodal approach, our analysis included a focus on how multimodal artifacts related with the social, cultural, and historical context. This was ethnographic in nature, in that we collected and analyzed documents related to these contexts in addition to student work products (Coffey, 2018). We engaged in data collection and analysis throughout the project, continually revisiting our data to inform future collection and analysis choices in a non-linear process (Coffey, 2018; Madison, 2020). This process included a close and detailed reading of all the data to construct a holistic understanding of the case (Coffey, 2018). We then situated the students' historical inquiry work and reflections within the social, cultural, and historical context of Putnam County.

Meaning-making during critical historical inquiry

Over the course of a semester, the two students in our case study engaged in a high school U.S. history course. The curricular unit addressed here, *Understanding our community's roots: A beginning lesson plan setting the stage for connecting local and national history,* was built to meet part of the Georgia standards for Reconstruction and the era known as "Jim Crow." Students explored the political, economic, and social histories of the period by engaging in lessons and projects that focused on historical inquiry in the local community. Through examples, modeling, and practice, students in the course learned to locate and analyze primary sources, collect their own primary sources (e.g., census records, genealogical data, oral histories with local elders, etc.) and conduct historical research in their community. The course was structured to connect students to their community through place-based lessons, research, and reflection.

The doing of history

Throughout the semester, students engaged in collecting, assessing, and interpreting historical source material to construct their own understandings of their community's past. Students gradually took on the role of historian as they completed activities that scaffolded their inquiry process. The inquiry began as the students and teachers wanted to know more about the families who attended a local Baptist church found in photos of the community taken in 1941. Because the church still stands today, the class began working with 1940 U.S. census documents to collect information about the families who lived there at the time and may have visited the church regularly. To support the activity, they also made multiple visits to the church and the cemetery located on the church grounds. Using census records and the information available on tombstones, as well as ongoing conversations with the elder deacon, who has been a member of the church since his childhood in the 1940s, they then constructed family trees and composed short narratives about their inquiries. The work of interpreting primary sources is critical to historical inquiry, as is using evidence from these sources to construct historical narratives (Seixas, 2015; Wineburg, 2001).

Juxtaposing narratives

In both our cases, students began by engaging with existing historical narratives before moving towards constructing their own. This process of juxtaposition was informed not only by their research, where narratives were explicitly taught and constructed, but also by allowing space for their lived experiences to enter into analysis. As teenagers growing up in a rural and economically-disadvantaged Deep South community, both students were shaped in part by various metanarratives about race, class, and rural life.

These existing narratives were challenged by the students' research into the community -- specifically, they began inquiring about the only land-owning African American family in the area at the time of the 1940 census. The family's land-owning status created an opportunity to juxtapose various existing narratives. The dominant narrative was that African Americans at the time typically occupied low social and economic statuses, particularly in a rural community. The story of this land-owning family, then, offered an opportunity to understand a different narrative, one in which an African American family held a higher status than expected.

Ashley highlighted the family's economic status in her narrative. She included the amount of money the family's home was worth and noted how it was "their *own* home," [emphasis added]. She then situated these facts in a historical context. Her attention to the fact that, "They are an African American family," suggests that she is aware of how the family's narrative runs counter to the existing narrative. The inclusion of the family's racial identity reveals both her awareness of the dominant narrative of the intersection of race and economic status and her understanding of the historical significance of this family as a counternarrative.

Raymond also engaged with these contrasting perspectives of his community, but in a different way than Ashley. He addressed negative metanarratives of rural communities more broadly, stating, "For years people have said rude things about Putnam County...things like 'its lame' and there is 'nothing to do' there." He found these existing negative perspectives contrasted his own gut-feeling that Putnam "was something special." As he uncovered and constructed a historical understanding of his county, he realized that its history was the "something special" he had been feeling. He stated, "if people took time to learn [Putnam's] history they'll see that it's special as well." The juxtaposing of narratives helped Raymond see how rural communities are often perceived as stagnant places with "nothing to do," yet new evidence can help reveal such communities as dynamic, diverse, and important.

Critical consciousness

The meaning-making supported during these lessons went beyond a disciplinary focus or understanding. The students made personal connections to the historical narratives they learned and constructed, exploring the ways that power structures influence our understanding of both past and present. At one point, Ashley expressed concern over families having to experience things "they did not deserve" as a result of segregation, as well as acknowledged people's resilience in getting through difficult times. These empathetic connections enabled her to see the human connection between past and present peoples, as well as to make sense of current-day emotions and actions rooted in past oppression: "There will always be this really dark part of history that lives in the back of some people's minds. There will always be a sense of hatred that lives in some people's hearts." Ashley's reflection suggests that she felt that what happened in the past was unfair. She also recognized how the story of Putnam is actually reflected through *multiple* stories, and that there are "unspoken" and unheard stories that represent the "heart of Putnam." She concludes her reflection looking towards action, stating these stories must continue to be told.

Raymond's reflection similarly wrestled with ideas of power, stories, and action. He recognized the power of historical knowledge, particularly in the stories of those traditionally marginalized. He was upset by his newly-acquired knowledge of the painful history of enslavement, segregation, and reconstruction in the county, especially how this history and its legacy impacted both people in the past and the present. Moreover, he felt angry because the stories represented a missing piece in his understanding of himself "Learning this story so late into my life angers me," he wrote, adding, "It hurts to learn this now." Like Ashley, he also expressed a desire to take action and stated that he would use the information he learned and "[do] something" with it, although, "learning it sooner would have been very useful."

Discussion

Each component of our model represents an important component of learning, with an established body of literature in its own right. In the case above, we have tried to illustrate how each of those components was embodied in the learning activities that the teachers designed, as evidenced through the work that students produced. For example, the doing of history was supported through hands-on field work by the students, who visited a church whose history reaches back to the family they were research (ca. 1940) and beyond. There, they explored the names of those buried at the church and used various archives (e.g., census data) to learn more about the community. This supported them in juxtaposing existing narratives about the community with other less dominant narratives and engaging in reflective practices that supported a critical position on themselves and their ancestors (i.e., critical consciousness). This study lends support to the importance of activities associated with critical historical inquiry, historical narrative, and critical pedagogy in the K-12 classroom (Ladson-Billings, 1995; Paris, 2012).

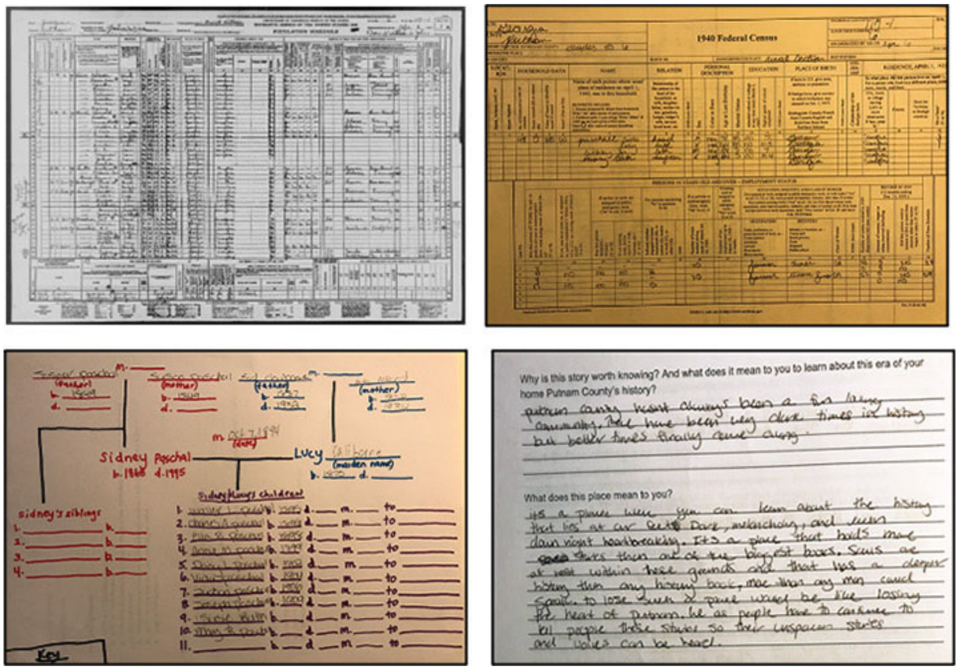

Figure 2: (Clockwise from top left) Page from 1940 U.S. Census for Putnam County, student-created census worksheet, family tree, and reflection produced as part of an on-site visit to a local church.

While we have presented these three components of our model as separate and distinct entities in our design work, we have an emerging sense that it is the *intersection* of these three components that is as, if not more, important than each component individually. Simply put, the sum of our model ends up being greater than its parts. While each component introduces a different way of thinking and knowing to the project, it is their integration that supports our participants in developing what we are calling a critical-dialectical-historical perspective. This perspective is not just a reflection of the overall design of the project, but also a mechanism through which *all* participants -- the researchers, teachers, students, community members -- engage in the process challenging notions of "truth" that exist around the historical and social narratives and artifacts that reflect that truth.

A critical-dialectical-historical perspective demands that one questions what we know, collectively *and* individually, and how we have come to know it -- whether we are looking back to the past, making sense of the present, or looking forward to the future. It means taking the evidence we have, that is part of the historical record, and ascertaining the social, political, and economic systems that have contributed to that record. Because ultimately, those systems have produced a framework that determines whose stories are permitted to be left behind, and therefore what narratives are available as meaning-making resources in the present (Wineburg, 2001).

In the case we have presented, the C-D-H perspective emerged as one in which students opened conversations about issues not normally addressed in a K-12 classroom. Not only did students and teachers discuss issues of injustice and inequity, they did so in ways that directly connected to students' out-of-school lives and the broader community. The long-standing patterns of injustice/inequity from the past were no longer abstract. The students described their findings with phrases like “a sense of hatred,” “it hurts,” and “dark part of history” -- these suggest how they connected with the themes of injustice from their own community by going beyond dates and facts. Their construction of historical narrative came with a sense of empathy and presence within their community, creating an opportunity for them to be more critical of the structures that contributed to those patterns. Comparing what had *once happened* to their own lived understanding of *the present* compelled them to engage more deeply with their sense of justice (e.g., “The opportunity to ...give this family and the Harmony community the recognition that is long overdue”) and speak up about the injustices they saw (e.g., “This kind of history is a serious topic and a fragile thing to tell”). It was the tension between the past and present narratives (i.e., dialectic) that created an opportunity for deeper engagement with developing a critical perspective on the history of the community.

Historical perspective taking and identifying continuity and change are two of the major components of the historical inquiry process (Seixas, 2015). In our project, students engaged in both through their juxtaposition of narratives while engaged in the “doing” of history. The doing of history opened up space for student-centered, place-based inquiry. As implemented in our RPP, this inquiry involved community engagement and a focus on historically-marginalized peoples’ stories. Juxtaposing narratives occurred when students compared stories about the past as told from multiple perspectives, as well as when they compared their previous understandings to those gained through inquiry. With teacher support, students developed an understanding of how narratives provide insight into social and political structures and the ways these structures impact individuals and communities across time.

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Chicagoland PK-12 Teachers' Experiences Transitioning to e-Learning amid COVID-19

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Abstract

Amid the COVID-19 outbreak in the United States, PK-12 teachers quickly transitioned from their face-to-face classrooms to an e-learning environment due to the shutdown of schools. To better understand teachers' experiences with this transition, a 31-question survey was developed and sent to in-service PK-12 teachers enrolled in a small, private liberal arts Lutheran university in the Chicagoland area. Survey responses (n=109) demonstrated needs relative to classroom management, e-learning pedagogy, technology access, and clearer policies for e-learning moving forward. Next steps for continued research into this topic and the ways to support those who are teaching children in today's online classrooms are discussed.

Keywords: PK-12 teachers, e-learning, educational technology, COVID-19

Introduction

During the coronavirus (COVID-19) outbreak in the United States, PK-12 teachers had to quickly transition from their face-to-face classrooms to an e-learning environment due to the shutdown of schools and shelter-in-place orders across states in the spring of 2020. Many teachers were new to the e-learning landscape and found that they suddenly needed to support students and parents who were acclimating to learning at home. Additionally, educational policymakers were scurrying to put policies in place that would support teachers and their students while considering various limitations of e-learning.

As teachers were suddenly switching to e-learning during the shutdowns due to COVID, the researchers sought to better understand the strengths and challenges with this transition to assist other teachers and administrators in adapting to emergency e-learning situations in the future. This article provides an introduction to the research study, a look at the profile of survey respondents, and the patterns and themes identified from the data collected. The conclusion provides information about what this means for educators as well as ideas for the next steps in this research.

Theoretical Framework

There are several theoretical perspectives that provide insight into the function and design of online learning experiences. The "community of inquiry" model developed by Garrison, Anderson, and Archer (2000) is particularly helpful for this purpose. In their model, it is claimed that three "presences" combine to shape a student's online educational experience: cognitive presence, social presence, and teaching presence. Cognitive presence is the extent to which participants can learn through sustained communication with other participants. Social presence is the ability of participants to connect socially and emotionally in the environment. Teaching presence is the ability of the teacher to effectively design and deliver instruction.

The “community of inquiry” model provides a helpful lens for analyzing the responses teachers provided about the constraints, resources, technology tools, successes, and failures, experienced during the move to e-Learning because of the COVID-19 pandemic.

Method

A 31-question survey was developed by the researchers about teachers’ backgrounds and settings in e-learning, including their instructional practices, the technology used, and recommendations moving forward based on their experiences transitioning to e-learning during school shutdowns due to COVID-19.

The survey also included questions informed by the community of inquiry (COI) model, which suggests that a successful online learning environment must incorporate teaching presence, social presence, and cognitive presence (Garrison, Anderson, & Archer, 2000). The COI model links to Kolb’s (1984) experiential learning cycle, which focuses on a student’s real-life learning context, particularly in the form of primary social relationships as contexts for experiential learning, as well as the input of the teacher (teacher presence) and content (cognitive presence).

The survey was sent to in-service PK-12 teachers enrolled in graduate-level teacher education programs at a small, private Lutheran university just outside of Chicago. The university has offered teacher education since the late 1800s, and teachers continue to make up a significant portion of its student body. The majority of teachers in these programs teach in private and public school districts in the Chicagoland area; a smaller portion of teachers are from other parts of Illinois and out-of-state. The researchers are members of the faculty at this institution, so the sample was one of convenience but also made sense considering the need for quick and easy access to a teacher population during the emergency COVID-19 situation.

With IRB approval granted, the survey was developed in Qualtrics and distributed via a link in an announcement in the teachers’ courses in the university’s learning management system one month after Illinois Governor Pritzker’s shelter-in-place order on March 21, 2020. Participants gave their informed consent, were assured anonymity, and were assured that their participation would not affect their grades. The survey consisted of multiple-choice, fill-in-the-blank, and Likert scale questions related to teachers’ school setting, resources, understanding and implementation of policies, instructional strategies, and overall experience using educational technology in the transition to e-learning during the COVID-19 pandemic.

Survey responses (n=109) were collected from April 24 to June 26, 2020. The researchers conducted a descriptive analysis of the quantitative data and thematic coding of the qualitative data using Qualtrics analysis software.

Survey Respondent Profile

Responses were received from teachers from a variety of settings. Of the 109 respondents, 38 taught in K-4 settings, 41 taught in grades 5-8 settings, and 24 taught in high school settings. The greatest number of respondents had 4 to 6 years of teaching experience. But there were many teachers with even more teaching experience. So data was collected from a large number of very experienced veteran teachers.

On the other hand, the vast majority of teachers had little or no experience teaching students fully online. In fact, only four respondents said they had taught their students fully online as a part of their school's regular curriculum.

Survey Results

The results are grouped into four categories: (1) preparation and professional development received, (2) changes in practice, (3) technology used, and (4) recommendations from respondents.

Preparation and Professional Development Received

Teachers prepared for e-learning in three major ways: professional development, preparing, organizing, and sharing content, and setting up communication and record keeping. The list below provides examples teachers gave for each of these categories.

Professional development:

- planning day at school before shutdown
- some training/professional development for technology at school and district level: PLC, coaches
- divided work and collaborated with teacher teams
- research online resources, Teachers Pay Teachers, etc. for making lessons and assignments digital

Preparing, organizing, posting content:

- consider what activities and technology students were already familiar with
- make checklists, daily schedules, routines
- wrote out instructions for classroom assignments
- recorded instructional videos and built slideshows
- prepared to teach with print as well as digital resources; convert print to digital
- posted digital content to LMS and district websites
- not much to do if already using an e-learning platform or had a blended or flipped classroom

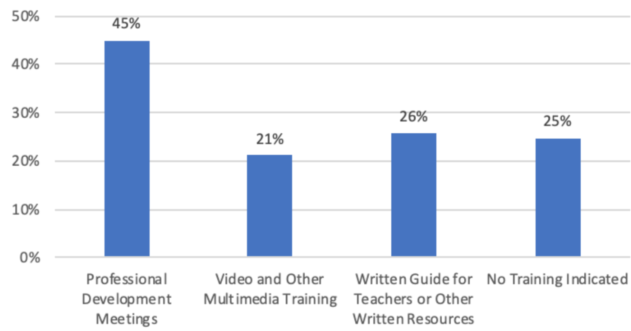
Setting up communications and record keeping:

- set up video conferencing software
- create email/phone lists
- set up virtual office hours
- send expectations to parents and students
- set up log for tracking work and participation

Almost all respondents participated in some type of professional development during the initial shutdown of schools, whether offered by their school, through teaching teams, or self-directed learning. To prepare for the school response to the Covid-19 pandemic, 75% of respondents indicated that they had received at least some form of e-Learning training before moving to a fully online environment (see Figure 1). Of those who received some combination of training, 45% participated in formal professional development meetings, 21% received video or other multimedia training resources, and 26% received written materials. About two thirds of the respondents said they had access to someone at their school who was knowledgeable of the technology integration, strategies, and pedagogical approaches to fully online teaching most of the time or always.

Figure 1

Prior e-Learning Training



Teachers then began to prepare, organize, and share content, such as by making daily checklists, creating instructional videos, and posting content to their e-learning platform or district website. However, some respondents noted that if their school was already 1:1 (e.g. each student uses a device on loan from the school) or if they were already using apps for learning, they didn't have to prepare much.

Lastly, they set up communications and ways to keep records of students' experiences with e-learning, such as video conferencing software, virtual office hours, and logs for tracking attendance and participation.

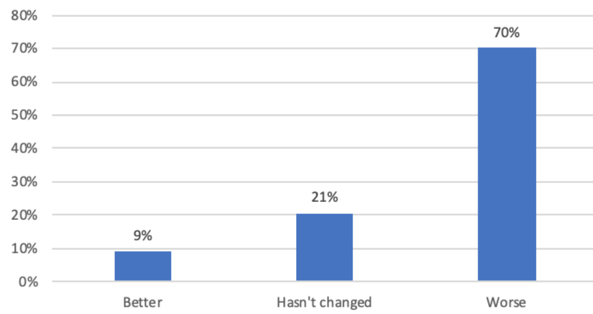
Changes in Practice

The requirements teachers received from their districts for online learning varied, but 38% reported needing to do daily briefings for students. 25% took no attendance, and 50% were told not to give grades. With the move to online, 78% of respondents said they communicated with their students multiple times each week, with 50% saying they did so every day. Communication frequency with parents saw an increase for 67% of respondents, while only 6% reported a decrease in the frequency (compared to before the shutdown).

With the move to fully online learning, it was expected that a teacher's sense of being socially connected to students (or "social presence") would get worse. Not surprisingly, 76% of teachers who responded to this specific question, felt their sense of social connection worsened during the shutdown. A teacher's ability to effectively design and deliver instruction (or "teaching presence") also saw a negative change, with 70% of teachers who responded to this specific question, indicating that things got worse (see Figure 2). Finally, the ability to promote student learning through reflection and discussion (or "cognitive presence") saw a negative change, with 74% of teachers who responded to this specific question, indicating that things got worse.

Figure 2

Change in Teaching Presence



When asked, "What has been going well and not well in your role as teacher during COVID?", the strength appeared to be in the technologies that allowed for synchronous communication and social presence. On the flip side, the weaknesses mirror other responses, specifically dealing with the platform flexibility, the preset curriculum, difficulty with grading and attendance policies, workload issues, and the general lack of resources. The lists below show responses to the question, "What has been going well and not well in your role as a teacher during COVID-19?"

Going well:

- Zoom and other virtual conferencing software
- Seeing students and connecting with students
- Many students have become self-directed
- Collaborating with teachers
- Teachers sharing tasks: e.g. one teacher creates a video and the other takes another task
- Lots of resources
- Having 1:1 computers at home
- Supportive teaching teams and online teacher groups

Not going well:

- Students struggled with motivation and engagement
- Incomplete work or no work submitted
- Students are not ready for digital education: struggle with completing assignments
- Students are overwhelmed and frustrated; do not understand process of e-learning
- Students and parents lack of resources and tech support while at home
- Internet disruptions
- Attendance
- Honesty and integrity, students are cheating
- Staying connected: more meetings, email, calls than usual
- Reduced work speed with higher workload
- Struggles with instructional design online
- Preset curriculum is hard to follow
- Online feedback, grades, and management is a difficult, long process

- Lack of expectations & guidance from school/ISBE
- Completing IEPs
- Parents did not see e-Learning as school

Teachers were more confident in transitioning to e-learning during COVID when they were already 1:1 and using e-learning technologies when they were allowed to be flexible in how and when they could teach, and when schools were fair and clear in their expectations. They also appreciated when their administration already had a plan for emergency e-learning situations and were consistently communicative, and when parents were responsive in noting their child's participation and completion of work. Teachers' confidence was greater when they worked together to set goals and plan curriculum, when monitoring technology was available, and when they actually had more time to complete the additional work that e-learning required of them.

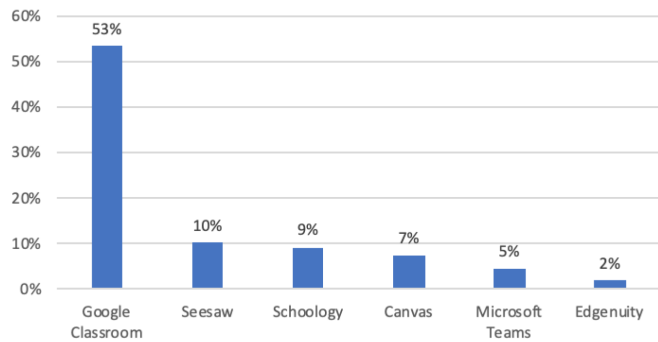
Technology Tools Used

Our qualitative data revealed that teachers used a wide variety of digital tools as they transitioned to fully online learning when their schools closed. Tools they mentioned ranged from e-learning platforms to video conferencing tools, to assessment apps, to educational apps across various subjects. About three quarters of teachers who responded mentioned using at least two tools besides their school's e-learning platform to teach students. The most popular was content creation tools and video conferencing tools. See several examples of the technology tools for e-learning during COVID-19 mentioned by respondents below. Of the wide variety of e-Learning platform tools used, Google Classroom was the most common with 53% of respondent's mentioning it (see Figure 3).

- **e-Learning Platform/Learning Management System (LMS):** Google Classroom, Class Dojo, Canvas, PowerSchool, Haiku, Seesaw, Flipgrid, Padlet
- **Video conferencing tools:** Google Meets, Zoom, Microsoft Teams
- **Content creation tools**: Google Slides, iPad screen recorder, Seesaw, Google Docs, Adobe Creative Suite, YouTube, Microsoft 365, TikTok, Screencastify
- **Assessment:** ALEKS, Quizziz, Kahoot, Assignments and quizzes in LMS
- **Education/subject-level apps:** Edgenuity, RAZ-Kids, IXL, XtraMath, Freckle, Seesaw, Artsonia, Remind App, Mystery Science, Khan Math, Newsela, GoodReader, EdPuzzle, Google CS First: game design course

Figure 3

e-Learning Platform Tools Used



The e-Learning platforms used appeared to have a noticeable impact on a teacher's ability to promote social, teaching, and cognitive presence. 50% of teachers who responded to the social presence question, indicated that the e-Learning platform they were using helped promote social presence very well or somewhat well (see Figure 4) Similarly, 49% of teachers who responded to the question about e-Learning platforms and Teaching Presence, indicated that the e-Learning platform they were using helped promote teaching presence (see Figure 5). However, when it came to promoting student learning through reflection and discussion (or "cognitive presence"), most respondents to this question indicated that their e-Learning platform did not do a good job helping with that (see Figure 6).

Figure 4

e-Learning Platforms Promoting Social Presence

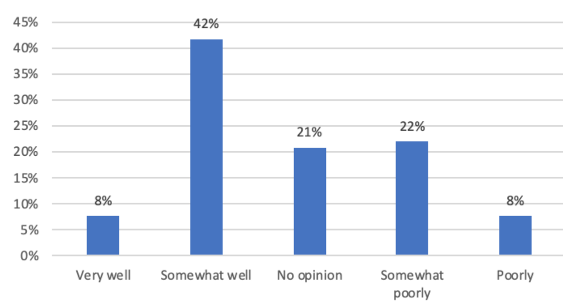


Figure 5

e-Learning Platforms Promoting Teaching Presence

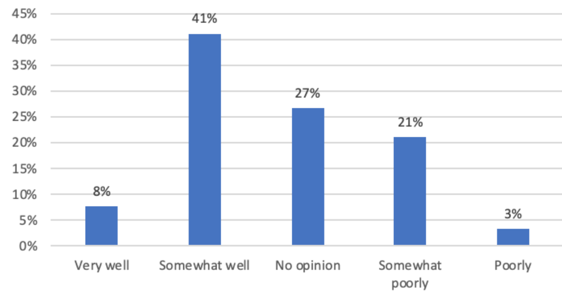
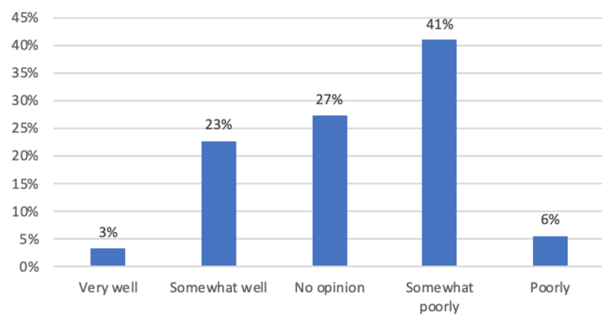


Figure 6

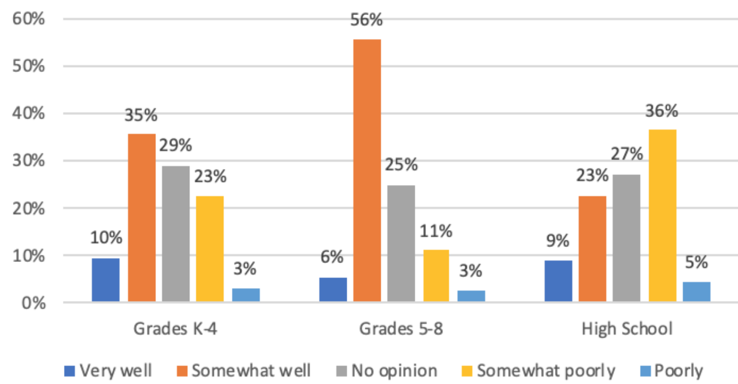
e-Learning Platforms Promoting Cognitive Presence



The data collected also showed variations depending on factors like grade level taught (see Figure 7). For example eLearning platforms were seen to help encourage teaching presence by a large number of Grade 5-8 teachers (62%) and Grade K-4 teachers (45%). But, eLearning platforms were not viewed as favorably by High School teachers.

Figure 7

e-Learning Platforms Promoting Teaching Presence by Grade Level



Recommendations from Respondents

Teachers provided tips and recommendations for both parents and teachers who were new to e-learning. Four categories of replies were identified: managing the "new normal," communication, instruction, and technology.

The first theme was around managing the new normal. Teachers suggested that parents and teachers be patient, practical, consistent, simple, and offer incentives for their students.

The second theme was that of communication. Teachers suggested that reaching out should be reciprocal among parents, teachers, and students. They identified different ways to use virtual meeting time beyond instruction, including check-ins, Q&A sessions, games, show and tell, and guided reading and discussion groups. They also suggested that communications should focus not only on academics but also on empathy and physical, social and emotional wellness.

The third theme of tips for teachers and parents centered around instruction. Tips included slowly moving activities from easy to difficult, being creative and experimenting with activities, collaborating with other teachers for ideas across subjects, getting regular feedback from students, regularly assess students with low-stakes assignments like quizzes, and consider using grades and scores even if it's not required by the state to increase motivation.

The final theme was that of technology. Teachers advocated for using a combination of tools such as e-learning platforms, conferencing software, apps, and email. It would be best if these were tools that students, teachers, and parents were already familiar with. They also felt that preparing and organizing digital content such as videos and screencasts of lessons was key, although time-consuming sometimes. Lastly, they suggested using technology that was fun and motivating, such as games, simulations, modeling videos, and activities with scores.

Teachers were also asked for any suggestions for their school or district administration. Their main comments were on the need for planning, policy around grading, technology resources such as 1:1 and e-learning platforms, dedicated technology support for students and parents, and ongoing professional development. They also appreciated flexibility, communication between administration and staff, and more support for converting print resources and guidance around e-resources that were opened up to the public during COVID. A more detailed list of these suggestions for administration during COVID-19 is provided below.

- Put a plan in place and provide specific instructions for teachers, staff, students, parents
- Grading policy: graded assignments leads to higher motivation and participation
- Participation standards/accountability need to be established
- e-Learning platform should be in place
- Equal access and training for student 1:1 technology
- Dedicated technology support for students; teachers shouldn't be tech support
- Ongoing professional development and teacher community/forums; subject specific
- Flexibility – students/parents/teachers need a break
- Consistent communication
- More synchronous Q&A sessions between administration and staff
- More support for managing and converting print resources
- Take advantage of e-resources made free/available by companies and organizations during COVID

Discussion

The results suggest several issues and opportunities for making decisions about potential next steps and future research to support in-service K-12 teachers facing the transition to e-learning amid COVID-19. These include the need for further pedagogical support for K-12 teachers in integrating e-learning tools and activities, especially on when and how to use synchronous versus asynchronous strategies for different subjects and grade levels. Teachers also demonstrate a need for clearer guidance on how to develop and implement consistent and reasonable assessment and attendance policies in emergency e-learning situations that also support student engagement and motivation. The role of technology access, training, and implementation in the PK-12 e-learning environment is apparent as well. There were clear differences for teachers in schools that already had a 1:1 technology program before the pandemic.

The results also suggest that there are clear needs for implementing and balancing Garrison et al.'s (2000) three constructs of social, cognitive, and teaching presence within the e-learning environment. Achieving this balance requires instructional design that incorporates not only the presence of the instructor, but also uses technology that can enhance student engagement and cognitive presence in synchronous and synchronous activities and communications. While teachers stated that e-learning platforms mentioned in this study were useful for social presence and teaching presence, they were not as useful for cognitive presence. The presences need to be intentionally created as these three elements are foundational to the development of deep and meaningful educational experiences in e-learning environments (Dunlap, Verma, & Johnson 2016).

Conclusion

In addition to additional professional development for teachers and administration about pedagogy as well as policy, researchers should conduct a closer analysis for themes around the teaching, social, and cognitive presence in e-learning at the PK-12 level. The developers of e-learning software and hardware can benefit from understanding the importance of this framework in the development of their products as well. Evaluating the technologies most frequently mentioned in this study are a starting point. Follow up surveys with teachers and administration would aid in this regard to better understand their next steps pending the decisions made concerning e-learning in the new school year.

While many are beginning to embrace the new normal of the pandemic, others continue to believe that we will return to what we were prior to the pandemic. This may or may not be true; but we cannot wait to find out. We need to find more ways to replicate the avenues for cognitive presence, teaching presence, and social presence not only in our academic online classes, but also reflectively in our lives. Using technology effectively, adapting the pedagogical approach to teaching online, and opening our minds up to change are a good place to start.

Acknowledgments

The researchers would like to thank the teachers who participated in this study, and the faculty of the Concordia University Chicago Educational Technology and Teaching, Learning, and Diversity departments for helping to distribute the survey. Most importantly, a special thanks goes to all teachers for being the heroes you are.

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Engaging Students with Instructional Videos – Perspectives from Faculty and Instructional Designers

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Keywords: Online courses, instructional design, instructional videos

Abstract

Instructional video is a dynamic and important content-delivery tool in online courses. However, instructional designers, when providing support to faculty in the design of online instruction, may not accurately understand faculty's expectations and perspectives. This study attempted to analyze the perspectives of the designer and those of the faculty to enhance mutual understanding between the two groups. From these two perspectives, we attempted to derive the best practices concerning the production and employment of instructional videos in online courses. Two surveys were administered to collect data for the study, one to the faculty and another to the instructional designers at a major eastern state university in the United States. Based on the survey results concerning the use of instructional videos in online education, faculty and instructional designers share similar views regarding best practices of using videos in online courses. However, differences exist in terms of the video styles, and the optimal video length.

Introduction

Video is a dynamic type of instructional material, as compared with many traditional materials. Research has shed light on the important role of videos for effective teaching. Berk (2009) discussed key advantages of instructional videos such as inspiring, engaging learners, and fostering deeper learning. Sablić et al. (2020) analyzed 39 peer-reviewed articles on video-based learning and supported positive effects of online instructional videos.

The widespread use of instructional videos in online courses brings immense benefits and challenges to both instructional designers and instructors in terms of effective incorporation of videos in online teaching. Research has indicated that using instructional videos alone in teaching does not necessarily improve learning. Zhang et al. (2006) stated that "simply incorporating video into e-learning environments may not always be sufficient to improve learning" (p. 11). Their study suggested that "interactivity can be a valuable means to improve learning effectiveness in an e-learning environment" (p. 11). Similar to Zhang et al.'s findings, simply including video lectures does not necessarily produce better learning outcomes (Evans & Cordova, 2015). If not well designed, lecture videos may not be superior to still slides and text.

The above research entails numerous questions concerning the effective use of videos for online instruction. This study answered the following research questions: 1) What best practices are used by faculty in instructional video production to engage students? 2) What best practices are used by instructional designers in instructional video production to engage students? 3) To what extent do faculty use these practices in their online courses? 4) To what extent do instructional designers/developers use these practices in their instructional design work supporting faculty teaching online?

With those questions in mind, we designed and administered a survey to a group of instructional designers and faculty in different departments of a large state university. By exploring and analyzing the views of instructional designers and those of the faculty regarding the uses of instructional videos in online courses, we attempted to find answers to the above-mentioned research questions. Our findings support the statement that instructional videos in online courses, only when effectively designed, developed and employed, can enhance student engagement and effectively support students' achievement of desired learning outcomes.

Theoretical Frameworks

Cognitive Load Theory

Learners process instructional information initially in working memory (Sweller, et al., 2011) which is then stored semi-permanently in the long-term memory (Atkinson & Shiffrin, 1968; Tulving, 1972). However, there is a limit to the amount of new information a learner's working memory can process at one time. When information presented to a learner is overloaded, the learner's cognitive capability will be overwhelmed. Consequently, the learner's working memory cannot process the information effectively. The working memory load is determined by two types of cognitive loads - the "intrinsic cognitive load" which is imposed by the structure of the information and the "extraneous cognitive load" which is imposed by the manner in which the information is presented (Sweller, et al., 2011). The extraneous cognitive load can cause additional stress on the learner's processing capability. High extraneous cognitive burden would be generated on the mental process if improper use of instructional design is employed in course design (Cierniak et al., 2009). When creating instructional videos, faculty and video producers can incorporate certain strategies to avoid information overload so that learners can process information efficiently.

Motivation Strategies

Keller (2009) described a model for designing the motivational aspects of learning environments to stimulate and sustain students' motivation. The model includes four categories - attention, relevance, confidence, and satisfaction (ARCS model). Incorporating the elements in each category can motivate students to learn the content. When creating instructional videos, faculty and video producers can incorporate motivation strategies to encourage student engagement in viewing videos.

Student Engagement

Student engagement has been defined as investment or commitment (Marks, 2000), participation (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007), or effortful involvement in learning (Pekrun & Linnenbrink-Garcia, 2012; Reschly & Christenson, 2012). Video engagement is a metric regarding how a viewer watched a video, dropped the video in the middle or watched until the end. This type of engagement time is used by both free video providers and enterprise providers. However, this engagement metric suffers limitations regarding whether a watcher is actively watching the video or merely playing it in the background while multitasking

(Guo et al., 2004). As indicated by the study of Guo and others on MOOC videos, shorter videos are much more engaging, videos under 3 minutes have the highest engagement level, and the median engagement time is at most 6 minutes, regardless of total video length. They provided seven recommendations on video lengths, style, etc. for instructors and video producers. The recommendations, in summary, include logical chunking of the video, appearance of instructor's face at opportune moments, visual fluency, speaker spontaneity and dynamism, suitability for teaching platform, and supporting resources for tutorial videos.

Methods

This study examined best practices in the use of instructional videos in online courses from both the instructor's and the instructional designers' perspectives. Faculty members and instructional designers in a state university on the east coast were surveyed in 2020. Data were collected and analyzed to investigate best practices, and the differences and similarities among views of faculty and instructional designers. Descriptive analysis was utilized to identify best practices of instructional videos used by faculty members and instructional designers in online courses.

Research Sites and Participants

The participants of this study were faculty and instructional designers at a US university on the east coast. The university has strong instructional design and technical support to faculty in online course design and delivery. Two surveys were designed for the study, one for input from the faculty (37 participants) and another for input from the instructional designers (20 participants). Among the faculty respondents, 62.2% were female; 35.1%, male; and the rest, undisclosed. The faculty employment status included full-time (64.9%) and part-time (35.1%). All respondents had at least one-year online teaching experience with 22.2% of them having six or more years of online teaching experience. Among these faculty participants, 91.4% had used instructional videos in their courses. The faculty respondents had taught courses at all levels (undergraduate, graduate, and certificate) in varied disciplines (e.g., agricultural sciences, arts and humanities, business, engineering, health science, and medicine).

Among the instructional designers who responded, 56.3% were female, 12.5% male, 6.2% genderqueer, and 25% undisclosed. Their roles in online course design and development at the institution included designing online courses (50%), providing pedagogical support (68.8%), providing technical support (75%), developing online courses (25%), assembling courses in LMS (62.5%) and producing instructional/promotional videos (6.3%). The majority (81.3%) of the designers who responded had at least six years of experience.

Instrumentation

Based on the researchers' experiences teaching online courses and supporting faculty members in course development with videos, two instruments were created to gain input from faculty members and instructional designers on best practices of using instructional videos in online courses. One instrument was designed for faculty and one for instructional designers due to the difference in their experiences in using instructional videos in online courses.

Both instruments included questions to gain their perspectives on using instructional videos in online courses, such as the length, type, style, time, number of video clips, strategies that motivate students to view videos, and the degree to which instructional videos contribute to student-content interaction. Five questions regarding participants' demographics were also included.

Data Collection and Analysis

The study was approved by the university's IRB committee. The surveys were sent to 352 faculty members and 20 instructional designers in the university. Thirty-seven and 16 responses were collected respectively from each group with response rates of 10% for faculty and 80% for instructional designers. Data were downloaded and analyzed with Excel for descriptive statistics, responses to open-ended questions were coded to reveal themes on strategies in using instructional videos to promote student-content interaction.

Results

This study endeavored to answer the following central research questions: what best practices are used to what extent by faculty and instructional designers in their production and employment of instructional videos in online teaching? This section reports results from our surveys to answer the above research questions.

Optimal Video Length. Both faculty and instructional designers responded that shorter videos less than 10 minutes work the best. As illustrated in Fig. 1, only 13.50% of faculty indicated that the optimal length of videos is more than 15 minutes, while none of the designers agreed to this as the optimal video length. The most popular "optimal video length" seems to be 6 - 10 minutes (as perceived by 45.9% faculty and 68.8% instructional designers).

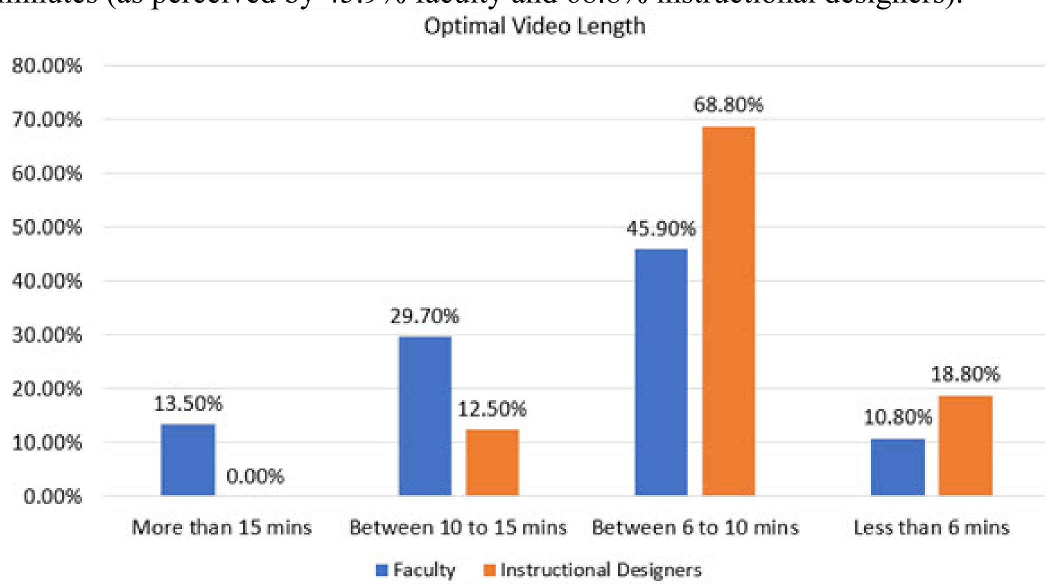

Fig. 1 Optimal Video Length

Types of Videos. Faculty reported that they have used varied types of videos to engage their students in their online courses. As illustrated in Fig. 2, the most widely used videos are voice-over of PPT slides (77.80%), and videos from YouTube or publishers (77.80%). The second widely used video is screencasts (38.90%), and the third group is guest speakers (27.80%), lecture captures (25%), and talking head (22.20%). Faculty also reported other types of videos such as clips from television news, write on blank ppt slides with stylus (mimic chalkboard), and videos created by students showcasing their work. Concerning the same question, most instructional designers recommended videos of PPT slides with voice-over (80%) and screencasts (80%). They also recommended videos from YouTube or publishers (73.30%), guest speakers (73.30%), lecture captures (73.30%), and talking head (60%). Instructional designers also recommended lightboard video captures. Instructional designers indicated that the type of video used varies by the learning goals.

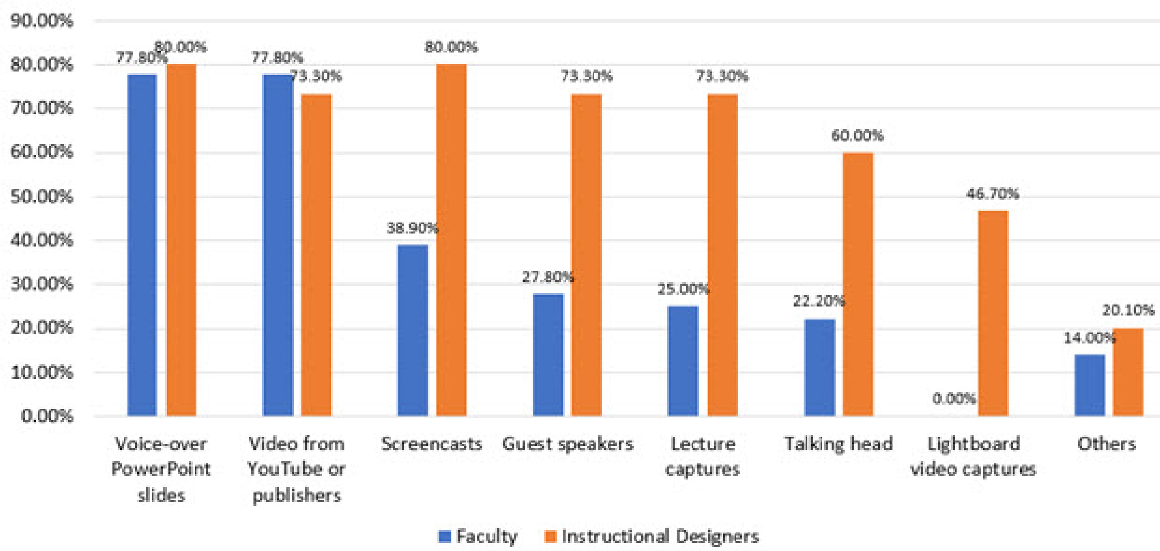

Fig. 2 Types of Videos

Video Styles. As illustrated in Fig. 3, faculty reported they used varied styles of videos in their online courses such as formal lectures (69.40%), informal dialogues (38.90%), guest interviews (22.20%), and some group conversations (11.10%). Faculty also reported that they have created entertaining lectures to engage their students. When asked what type of video styles they would recommend to faculty in their online courses, most of the designers recommended informal dialogues (50%), and formal lectures (14.30%). Instructional designers also recommended using a mix of video styles according to the learning goals and the nature of the content.

When asked about the rationales of their choices of video styles for *formal lectures*, faculty participants offered the following:

- Students will likely listen to a teacher with a strong online presence.
- The formal lecture presents content needed to fulfill course objectives. Other formats would be harder to do in a succinct way w/o watching multiple sources.
- Coronavirus didn't leave time to plan creative videos like guest interviews or conversations!
- One comment was, "I use this format to get the information across in a quick and easy manner. It is somewhat similar to how I would do it in the classroom for this specific course."
- Another comment was, "I am trying to mimic what they would get in the classroom."

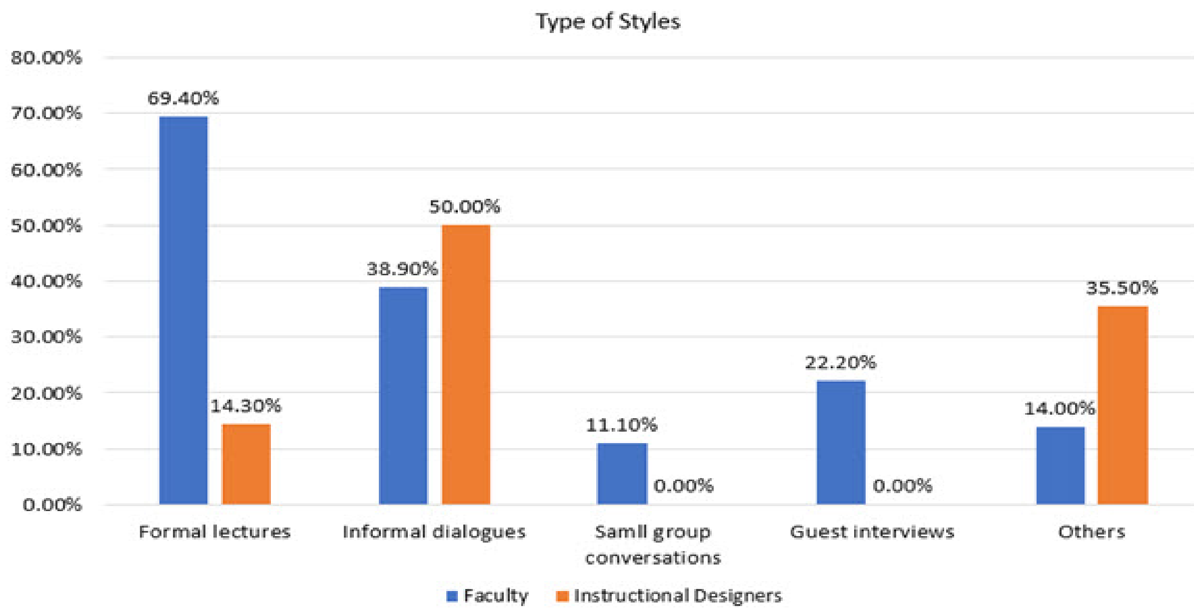

Fig. 3 Types of Video Styles

When asked about the rationales of their choices of video styles for *informal dialogues*, faculty participants expressed the following rationales:

- Students are likely to listen to a teacher with a strong online presence.
- It's best to be personable when faculty are talking "one on one" with each student.
- These videos are easy to create and often help answer questions students would have asked during office hours. Verbal response will be more efficient in conversational dialogues.
- Informal dialogue creates more of a classroom, in-person scenario.

Use of Captions and Transcripts. Captions or transcripts in videos are helpful not only to screen-reader users, but also to students for whom English is not their native language. Although faculty believed that captions or transcriptions should be included in videos, only 36% of the faculty had sometimes, often, or always included captions or transcriptions to their videos, while the rest (64%) of them had not.

Number of Videos in a Module. Faculty also reported that the appropriate number of videos included in one learning module should be 1 to 2 (31.40%), 3 (17.10%) and more than 3 clips (8.60%), as presented in Fig. 5. However, the majority of faculty reported that all depends on varied factors such as the length of videos, the nature of the content, and the learning objectives.

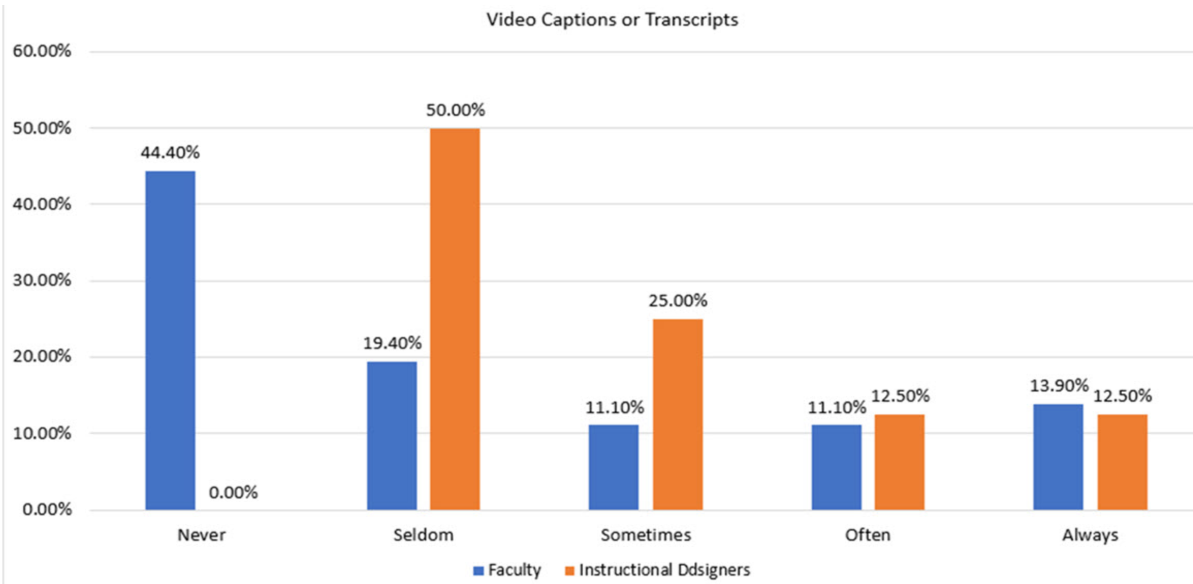

Fig. 4 Use of Captions and Transcripts

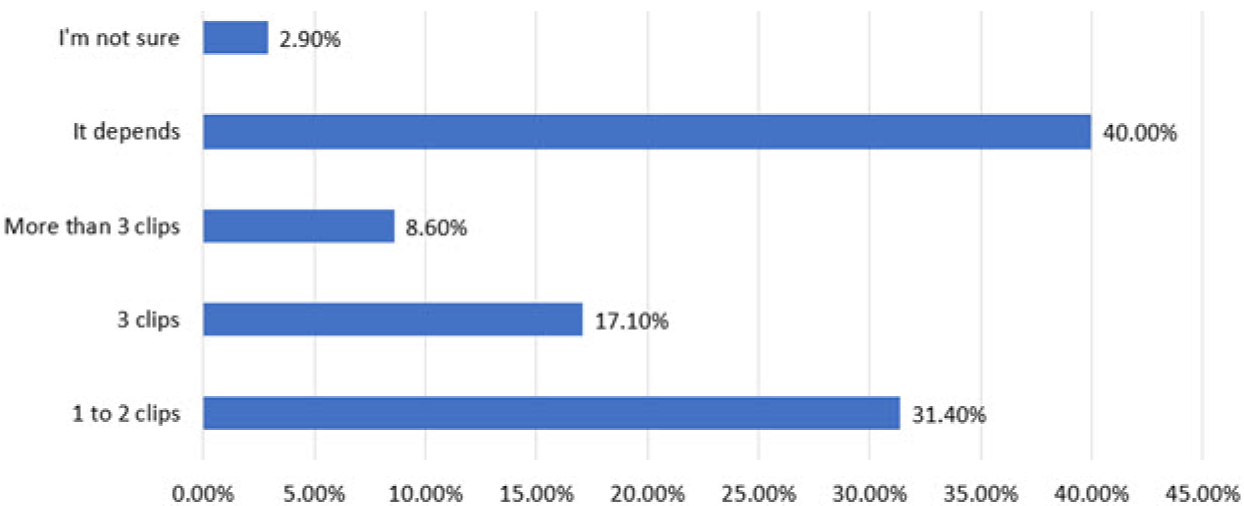

Fig. 5 Number of Videos in a Module

Strategies to Enhance Student-Content Interaction. As presented in Fig. 6, faculty and instructional designers both reported that short instructional videos enhance student to content interaction to a great extent (46.80% and 67.70% respectively) or to some extent (51.40% and 31.30% respectively).

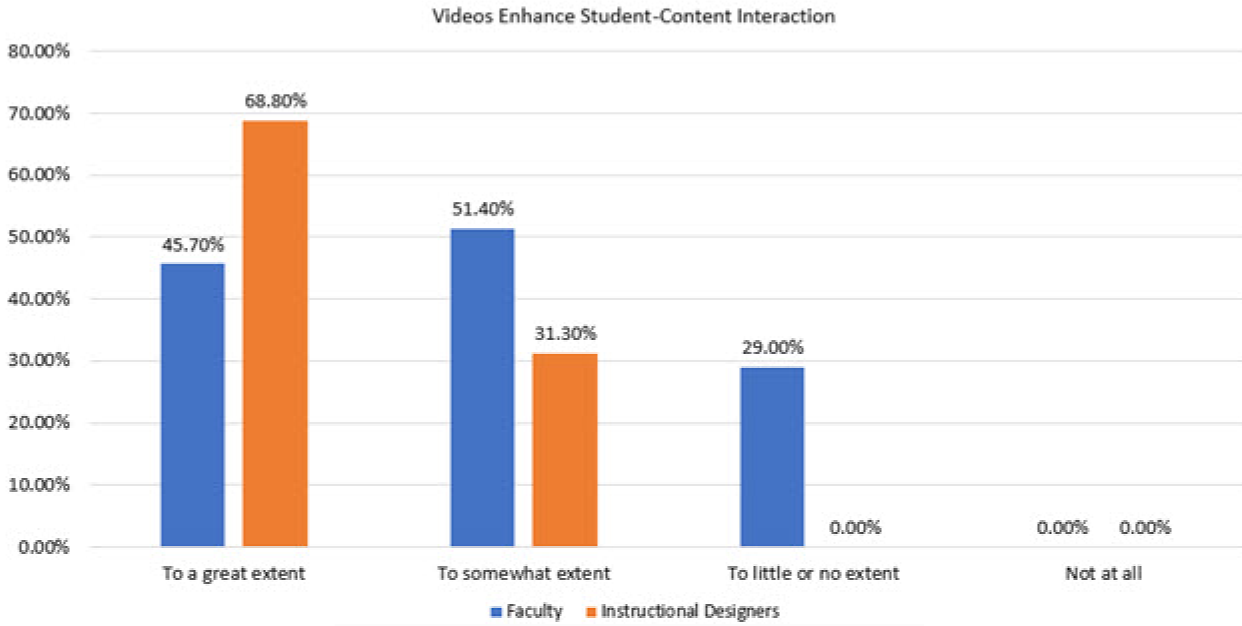

Fig. 6 Enhancing Student-Content Interaction

Strategies to enhance student-content interaction. Faculty also reported that they have employed varied strategies in their videos to enhance student to content interaction. These strategies include:

- Using humor, visually appealing, enthusiastic in tone, incorporating questions, drawing connections to class assignments, providing examples that they can follow along in their computers.
- Connecting videos with learning activities such as small group discussions, application activities, reflection papers, and Q&As.
- Making video lessons mandatory before coming to Zoom sessions.
- Connecting videos to high-stake assessment activities such as midterms and finals.

Instructional designers shared following strategies to enhance student to content interaction in videos.

- Making them interactive or adding a question set targeting the video info to follow up with assessments.
- Embed video quizzes.
- Make sure the video is necessary, make sure the video's purpose/relevance is clear, and provide an opportunity for action afterwards.
- To better engage students, keep each video focused around one main idea or topic.
- Flip the class and only discuss the most recent recorded lecture when interacting live.
- Students may not proceed until they have watched the videos, a short knowledge check / quiz based on the video (better if graded).

Faculty reported a number of challenges when creating their own instructional videos. The challenges include time, equipment, tech skills, quiet space, and resources such as pictures and cool effects.

Instructional designers also reported their challenges when supporting faculty in creating instructional videos. The challenges that designers reported echo those reported by faculty, such as time commitment, technical skills, learning curve, motivation to start early, resources, and equipment quality.

Discussion and Recommendations

Produce short high-quality instructional videos. The question is how short videos work best to motivate students to watch the video completely. Research (Guo, et al 2014) indicates videos of six minutes work best. According to their study, the median engagement time for videos less than six minutes long was close to 100%. In other words, students tended to watch the entire video without dropping out. The views of the faculty and instructional designers in our study tended to support this view that shorter videos less than 10 minutes work the best.

Use the right type of videos. Videos can be created in multiple ways, such as voice-over slides, screen-cast, Khan-style drawing tutorials or lightboard videos, talking-head with minimum slides, or a mixture of talking heads, relevant visuals, embedded skits, application story, ponding questions, pop quiz questions, etc. to make instructional videos interactive. Research (Guo, et al 2014) indicated mixing the instructor's talking head with other visuals and materials at opportune times is more engaging than a single video format. The views of the faculty and instructional designers in our study also supported this view that varied types of videos be used according to the learning goals and the nature of the course content.

Employ a style that fits your goal. Usually, there are two styles to adopt for producing instructional videos: conversational and formal lecture. Research (Meyer, 2008) indicates that the use of conversational style rather than formal lecture showed a positive effect on students' learning. The conversational style works better than the formal lecture style as the conversational style provides a personal touch on what the instructor presents and makes the student feel connected to the instructor and the topic. However, not all instructors are comfortable with the conversational style on campus, and not all videos should be produced in a conversational style. Decisions should be made according to the goals and the instructor's teaching style.

Tie assessments to your videos. Students may take many courses and are involved in extracurricular activities simultaneously. If the videos are not tied to their learning assessments, it's likely that some students will not watch those videos. Therefore, it is necessary to create online discussions, group work, reflection activities on the short videos and provide clear instructions on how students' learnings from the videos will be assessed.

Create an active learning activity based on the videos. In addition to tying videos to assessments, creating an active learning activity based on the video is another option. For example, you can create a "Watch-Think-Write" activity to activate student learning (Serrato, 2016). Before students watch a video segment, provide several prompts, ask students to watch the videos with those questions in mind. Then ask the whole class or small groups to discuss the video. The last phase is to ask the students to reflect on what they have watched and answer the questions, and then pose new questions to their groups or the entire class.

Include an appropriate number of videos per module and sequence videos properly in a module. Research (Beatty et al, 2019) indicates that student video viewing was lower following the initial part of a muti-video sequence for a topic. They suggested frontloading important content of a topic at the beginning of a video sequence or subdividing units into smaller units to include fewer videos in a sequence.

Instructional video is a dynamic and important content-delivery tool in online courses. This study surveyed faculty and instructional designers at a major state university to understand experiences, expectations, and perspectives from both groups. The study intended to improve mutual understanding between the two groups and to derive best practices concerning the production and deployment of videos in online instructions.

One limitation of the current study is the lack of perspectives of students, who are the ultimate users of instructional videos and should thus be the ultimate judge of the effectiveness of instructional videos. Future studies may need to further investigate students' perspectives to afford a more comprehensive and more useful understanding of the whys and hows of effective production and deployment of instructional videos.

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Volume 2

Selected Papers On the Practice of Educational Communications and Technology

An Analytical Framework for Inclusive Online/Blended Learning Experiences in Higher Education

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Introduction

Trends such as globalization, automation, and a shift towards skilled-services necessitate college degrees for good wages (Carnevale et al., 2018). The U.S. will not be able to meet the workforce demands of today's knowledge economy without equitable access to higher education (U.S. Department of Education, 2016). Yet, despite steady growth in diversity in the U.S., college participation and degree completion rates of most ethnic minorities and other underrepresented groups are lower as compared to Whites (McFarland et al. 2018; U.S. Department of Education, 2016). The degree attainment gap for low-income (Association of American Colleges and Universities (AACU, 2015) and first generation students (AACU, 2015; Cataldi et al., 2018) puts increasing pressure on institutes of higher education to address retention issues faced by a diverse student body to provide students with 21st century skills that employers demand (Adams Becker et al., 2017).

Technical skills and cultural awareness are just two of the 21st century competencies identified by van Laar et al.'s (2017) systematic literature review as necessary skills for working in today's global economy driven by an ethnically diverse workforce. With the number of students participating in distance education continually growing (Seaman et al., 2018), technical and cultural competencies of students and faculty become a greater concern. Attrition issues still plague online learning (Chiyaka et al., 2016), making it even more imperative for universities to rethink the ways digital platforms can support diverse learners through collaborative student-centered learning in innovative ways (Alexander et al., 2019).

How then do universities ensure that their faculty possess a critical awareness of increasing student diversity, and are able to design and deliver inclusive 21st century education that will ultimately meet the needs of the modern workplace? We propose a framework that brings emerging trends and best practice research together through Functional-Modular (Layer Design) View (FMV) (Gibbons & Rogers, 2009). FMV allows the articulation and incorporation of multiple layers to build a holistic analytical framework needed for the design and delivery of equitable 21st Century learning experiences. Our framework utilizes Universal Design for Learning (UDL) (CAST, 2018b), culturally relevant pedagogy (CRP) (Ladson-Billings, 1995), and intersectionality (Collins, 2015) in a three layer framework that encompasses context, design and pedagogy.

Literature Review

With a focus on creating inclusive learning environments, Universal Design for Learning (UDL) provides a framework to support the needs of diverse learners from different backgrounds and ability levels. Originating from architectural principles developed to ensure access to all built structures (North Carolina State University, The Center for Universal Design, 1997), the Center for Applied Special Technology (CAST) applied theories and practices in education, developmental psychology, cognitive science, and cognitive neuroscience to create the UDL Framework (CAST, 2018a). The framework is based upon the fundamental notion that all learners respond in different ways to instruction and takes a benefits-based standpoint when considering learner differences. Adopted by the Individuals with disabilities Act (IDEA 2004), UDL gained popularity in special education classrooms, but has since realized relatively steady and widespread adoption (Al-Azawei et al., 2016). By embracing student differences, UDL presents several strengths in supporting online learners who may be nontraditional students drawn to the flexibility of distance learning (Rogers-Shaw et al., 2018).

Guidelines for applying UDL are organized by three principles: 1) multiple means of engagement, 2) multiple means of representation, and 3) multiple means of action and expression (CAST, 2018b). Each principle consists of three guidelines to support the design of instruction across three major categories of learning actions to 1) increase access to the learning goal, 2) develop effort and persistence, language and symbols, and expression and communication, and 3) empower learners through self-regulation, comprehension and executive function. Each guideline contains several checkpoints that provide more specific suggestions for applying the framework.

The first principle, multiple means of engagement addresses the “why” of learning by providing options for recruiting interest (7), sustaining effort and persistence (8), and self-regulation (9). There are 10 checkpoints within this category that broadly define the need to build engagement and provide learner choice for the purpose of providing an effective learning environment. This includes creating effective challenges for learner motivation, providing flexible support, and incorporating opportunities for peer grouping and role change while supporting learners to set personal goals and manage emotional responses during the learning process.

The second principle, multiple means of representation addresses the “what” of learning by providing options for perception (1), language and symbols (2), and self-regulation (3). There are 12 checkpoints within this category that broadly define the need for the provision of learning environments that activate existing learner knowledge and link out to pre-requisite content information. This includes the use of embedded model scaffolds, feedback, and memory supports to explicitly highlight relationships between content elements in order to make text more comprehensible and facilitate perceptual clarity with visual supplemental support to decipher semantic elements.

Finally, multiple means of action and expression addresses the “how” of learning and provides options for physical action (4), expression and communication (5), and executive functions (6). There are 9 checkpoints within this category that broadly define the need to allow for learner adaptability and independence by reducing learner barriers through the provision of alternative media choices for artifact representation and participation accompanied with instructor demonstration of embedded supports and organizational aids for strategic planning.

Research supports the overall effectiveness of UDL in positively affecting learner perceptions and/or academic performance (Al-Azawei et al., 2016) including students with disabilities (Cook & Rao, 2018), English language learners (Rao & Torres, 2017) and international students (Bracken & Novak, 2019). Research on its effectiveness in online settings, however, is still emerging (Al-Azawei et al., 2016). Recent studies conducted in online higher education settings included the areas of teacher education (He, 2014; Lohmann et al., 2018), an undergraduate computer science course (Al-Azawei et al., 2017), graduate student orientation (Lock et al., 2019), and faculty professional development (Craig et al., 2019; Singleton, 2019). Findings suggest that UDL engagement strategies have the potential to make students feel more connected, valued and supported (Lohmann et al., 2018) and improve learners' satisfaction and acceptance of e-learning (Al-Azawei et al., 2017) as well as their confidence and self-efficacy (He, 2014). Additionally, learning about UDL practices influenced participants' likeliness to adopt UDL in their own teaching (Craig et al., 2019; He, 2014; Singleton, 2019).

Like UDL, culturally relevant pedagogy (CRP) has been shown to promote inclusiveness and academic success (Garvin-Hudson & Jackson, 2018; Sanguins, 2015) by scaffolding learning and incorporating multiple forms of assessment (Ladson-Billings, 1995). Embracing social justice, CRP additionally "helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate" (Ladson-Billings, 1995, p. 469). By expecting academic success and promoting cultural competence, CRP fosters positive cultural identity, thereby increasing engagement (Chinn, 2015) and positive self-efficacy (Jocson, 2016; Sanguins, 2015). Creating interactive environments for culturally diverse students to recognize their learning needs and collaborate with peers enables students to bridge knowledge gaps (Heitner & Jennings, 2016; Lim et al., 2019) and cultural differences between faculty and students, which has demonstrated the potential of improving retention rates in higher education (Heitner & Jennings, 2016).

Although UDL encourages the use of a variety of activities and sources of information in order to be culturally relevant and responsive (CAST, 2018a), it fails to critique education norms and address the ways power and privilege oppress students in the margins (Waitoller & King Thorius, 2016). Expanding UDL to incorporate culturally relevant pedagogy can help educators consider the impacts dominant race, culture and language have on learning that are necessary for truly equitable learning experiences (Keiran & Anderson, 2019). Waitoller and King Thorius (2016), proposed to enhance UDL with a cross-pollination of ideas from culturally sustaining pedagogies like CRP in order to dismantle racism and ableism by enlisting students in interrogating dominant culture and empowering students to redefine the notion of expert learner.

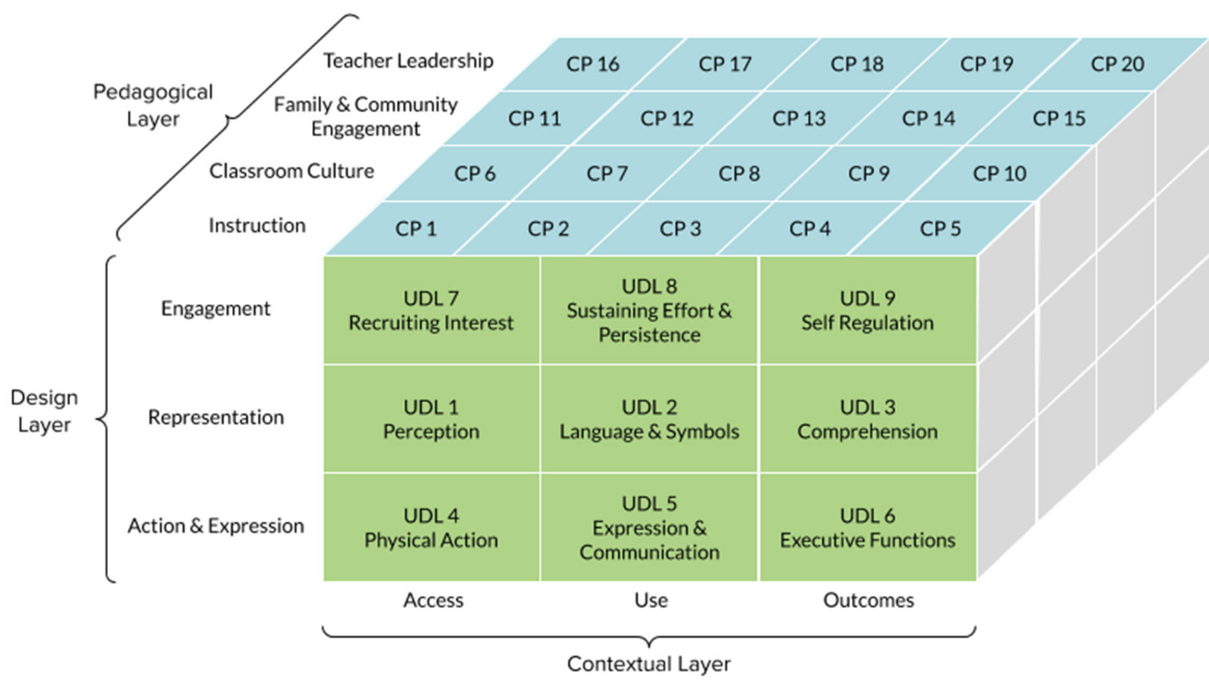
Similarly, intersectionality theory interrogates the social construction of power and the creation of multiple, complex inequalities (Collins, 2015). The theory serves as a tool to highlight the multiplicative effects of marginalization experienced by individuals with more than one stigmatized socially constructed identity dimension as well as the systemic inequalities that perpetuate those unequal intersections of power (Crenshaw, 1990; Collins, 1990/2009). Intersectionality provides additional considerations for understanding the diverse needs of learners for inclusiveness and equity in online/blended learning (Harris & Patton, 2019). Examining online learning environments through the lens of intersectionality brings attention to the new digital divide (issues of access, use and outcomes) (Warschauer, 2010) as well as reducing stigmas associated with multiple overlapping identity factors (Alvarado & Hurtado, 2015).

To address culturally responsive teaching practices and intersectionality, we propose the use of Critical Practices for Anti-Bias Education (Scharf, 2016). Developed by Teaching Tolerance, a non-profit group dedicated to reducing prejudice and promoting equitable school experiences, the guide contains twenty critical practices informed by Teaching Tolerance Social Justice Standards. The four sections: Instruction, Classroom Culture, Family and Community Engagement and Teacher Leadership, help to organize recommended practices and specific strategies that support diverse learners through culturally responsive teaching practices that engage families and communities and encourage students to take action against bias and injustice. Critical Practices for Anti-Bias Education has been recommended as a tool for reducing prejudices against disability and leveraging differentiation to develop an equity pedagogy (Bialka, 2017).

Analytical Framework for Inclusive Online/Blended Learning Experiences

Recognizing the need for a flexible tool to guide instructional design and coaching for culturally responsive equitable learning environments that support the needs of diverse learners, we developed an Analytical Framework for Inclusive Online/Blended Learning Experiences (AFIOBLE). The AFIOBLE combines UDL Guidelines with Critical Practices for Anti-Bias Education into three interconnected layers: contextual, design and pedagogical (see Figure 1). The contextual layer additionally supports a critical awareness of the varying intersections of identity essential in understanding the needs of diverse learners in online/blended learning through a lens of intersectionality. The AFIOBLE synthesizes UDL checkpoints and Teaching Tolerance critical practices (see Table 1) and utilizes guiding questions (see Table 2) to assist the user in operationalizing UDL and culturally responsive practices.

Figure 1
AFIOBLE Contextual, Design & Pedagogical Layers



Note. UDL = Universal Design for Learning; CP = Critical Practice for Anti-Bias Education

Table 1
Synthesis of UDL and Critical Practices for Anti-Bias Education

UDL Checkpoints	Critical Practices for Anti-Bias Education
Contextual Layer	
1.1 Offer ways of customizing the display of information	7. Thoughtful classroom setup & structure
	9. Social & emotional safety
4.2 Optimize access to tools & assistive technologies	13. Increased connections among families
	14. Use of local resources
5.2 Use multiple tools for construction & composition	17. Speaking up & responding to prejudice, bias & stereotypes
6.4 Enhance capacity for monitoring progress	18. Building alliances
7.3 Minimize threats and distractions	19. Leading beyond the classroom
Design & Pedagogical Layers	
Recruiting Interest	
7.1 Optimize individual choice & autonomy	2. Differentiated instruction
7.2 Optimize relevance, value & authenticity	3. Real world connections
7.3 Minimize threats & distractions	14. Use of local resources
	15. Engage with community issues & problems
	17. Speak up & respond to prejudice, bias & stereotypes
Perception	
1.1 Offer ways of customizing the display of information	7. Thoughtful classroom setup & structure
1.2 Offer alternatives for auditory information	
1.3 Offer alternatives for visual information	
Physical Action	
4.1 Vary the methods for response & navigation	2. Differentiated instruction
4.2 Optimize access to tools & assistive tech	7. Thoughtful classroom setup & structure
Sustaining Effort & Persistence	
8.1 Heighten salience of goals & objectives	1. Critical engagement with material
8.2 Vary demands & resources to optimize challenge	3. Cooperative & collaborative learning
	5. Values based assessment, evaluation & grading
8.3 Foster collaboration & community	6. Honoring student experience
8.4 Increase mastery-oriented feedback	7. Thoughtful classroom setup & structure
	8. Shared inquiry & dialogue
	10. Values based behavior management
Language & Symbols	
2.1 Clarify vocabulary & symbols	11. Culturally sensitive communication
2.2 Clarify syntax & structure	12. Inclusion of family & community wisdom
2.3 Support decoding of text, mathematical notation, & symbols	
2.4 Promote understanding across languages	
2.5 Illustrate through multiple media	

Table 1 (continued)
Synthesis of UDL and Critical Practices for Anti-Bias Education

UDL Checkpoints	Critical Practices for Anti-Bias Education
Design & Pedagogical Layers	
Expression & Communication	
5.1 Use of multiple media for communication	8. Shared inquiry & dialogue
5.2 Use multiple tools for construction & composition	11. Culturally sensitive communication
5.3 Building fluencies with graduated levels of support for practice & performance	
Self Regulation	
9.1 Promote expectations & beliefs that optimize motivation	5. Values based assessment, evaluation & grading 10. Values based behavior management
9.2 Facilitate personal coping skills & strategies	13. Increased connection among families
9.3 Develop self-assessment & reflection	20. Ongoing reflection & learning
Comprehension	
3.1 Activate or supply background knowledge	1. Critical engagement with material
3.2 Highlight patterns, critical features, big ideas & relationships	2. Differentiated instruction 4. Real world connections
3.3 Guide information processing & visualization	
3.4 Maximize transfer & generalization	
Executive Functions	
6.1 Guide appropriate goal setting	2. Differentiated instruction
6.2 Support planning & strategy	4. Real world connections
6.3 Facilitate managing information & resources	17. Speaking up & responding to prejudice, bias & stereotypes
6.4 Enhance capacity for monitoring progress	20. Ongoing reflecting and learning

The AFIOBLE tool is a real-time Google Doc that contains the framework and guiding questions. It is intended to support critical reflection on course design and practice on an individual, peer to peer, or instructional coaching setting. Google Docs is a cloud-based word processing application that allows for simultaneous sharing and editing with multiple users. The tool also includes commenting and chat features, document version history, and document permissions and sharing. Employing existing free/low cost resources furthers replication, customization, collaboration and broader use. As such, the tool is available at http://bit.ly/afioble, and is licensed by Creative Commons 4.0 Share-Alike (CC BY-SA 4.0). Additionally, the choice of Google Docs for tool creation facilitates embedded technology skills acquisition through the use of the web-based tool during the usage process (Singleton et al., 2019).

We also recommend that the AFIOBLE tool be used alongside the ADDIE instructional design (ID) framework. Branch and Merrill (2012) define the core elements that inform many ID models as ADDIE, an acronym for Analyze, Design, Develop, Implement, and Evaluate. Analyze describes the needs assessment stage, where measurable objectives are created and learning types and activities are specified. Thus, we recommend using the context layer during this stage. Findings from the analysis stage inform the design and development stages where instructional strategies are planned and instructional materials are subsequently created. The design layer complements these phases. The implementation stage involves the delivery of the intervention in the context for which it was designed and aligns with the pedagogical layer. Finally, the evaluation component includes both formative and summative assessments and subsequent revisions. ADDIE embraces an iterative process to be adaptive (Branch & Merrill, 2012). The AFIOBLE incorporates this tradition and other important characteristics of ID such as its student-centered, goal-oriented, empirical, self-correcting, and collaborative nature that is focused on meaningful performance and measurable outcomes (Branch & Merrill, 2012).

Table 2
Sample AFIOBLE Guiding Questions

Layer	Guiding Questions
Contextual	Consider internet connectivity and speeds in relation to accessing course content and activities. Are there low tech options to engage in the course?
Design	How does the design of your course allow for use across the continuum of technological ability and access?
Pedagogical	How does your teaching style facilitate varied student interaction with the course site and materials based on individual student need?

Conclusion

This analytical framework was developed in response to the complexity and interrelatedness of the skills needed to teach in the 21st Century classroom. We believe it can contribute to research that supports understanding of how instructional design and teaching interacts within a system and culture. This understanding is critical to bridge the divide between different cultures and foster better appreciation and acceptance of cultural diversity (Walter, 2018) as well as avoid clashes with the system (Warr et al., 2019). This framework also serves to support growing research on cultural perspectives in learning environments, and teaching strategies that address diversity in education using student-centric approaches (Alalshaikh, 2015). Ladson-Billings (2014) stated, "remixing is vital to innovation in art, science, and pedagogy, and it is crucial that we are willing to remix what we created and/or inherited" (p. 76). This remixed framework provides an ecological and holistic way to view the knowledge, skills and pedagogies necessary for inclusive 21st Century teaching and learning.

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Designing effective learning experiences for diverse and scattered ethnic minority groups across Yunnan Province, China

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Abstract

Five key interrelated areas are being mapped, analyzed, and synthesized to better understand the challenges and issues for quality multicultural educational materials and learning experiences for ethnic minority groups within a large province in southwest China. Rapid urbanization and intensive social exchanges have changed the cultural outlook of ethnic minority groups and society. The related educational issue is how to preserve the cultures and languages of ethnic minorities and their sociocultural identity in the process of government-encouraged social and cultural integration with Han culture, Mandarin, and modernity.

Sociocultural Ethnic Minority Groups in Yunnan Province, PRC

Yunnan Province in the People's Republic of China (PRC) is slightly smaller in size than the U.S. state of California. Its diverse geography and widespread rurality are home to approximately 48.3 million people (2018 estimate). While the majority are of Han ethnicity, 34% (16.4 million) of the population are members of ethnic minority groups. The 25 largest ethnic groups within the province have populations of 5,000 or more, including the Yi, Hani, Bai, Dai, Zhuang, Miao, Hui, and Lahu. A number of these ethnic groups also move freely back and forth between the borders of the PRC and neighboring countries leading to fluctuations in minority populations and quite active cross-border relations. Yunnan is widely known as an area within China where ethnic minorities are concentrated; it ranks first in the country in variety and number of ethnic minorities.

Gao and Wang (2015) believe that the 26 distinct ethnic groups found in Yunnan are the epitome of China's multi-ethnic groups and are uniquely different in religion, food, clothing, architecture, festival etiquette, literature and art, etc. They serve as representatives of the different characteristics found among the entire 56 recognized ethnic groups throughout the nation. Wu (2020) conducted field investigations on the development of compulsory education in nine ethnically-concentrated provinces, including Yunnan. According to his team's investigation, the development of compulsory education in ethnic areas still faces difficulties and problems, such as the diversification of education supply functions, special school administration units, high school operating costs, and a poor supply of teachers. Wu (2020) noted that within education in border ethnic areas such as Yunnan, it is considered vitally necessary to continuously enhance ethnic students' recognition of the outstanding culture of the Chinese (overwhelmingly Han-dominant) nation. The purpose of this educational effort is to prevent ethnic separatists located on China's border areas from propagating false statements and undermining national unity. This concern has led to the implementation of additional social functions to compulsory education. These additional social functions provided by the compulsory education program in ethnic areas brings a substantial increase in tasks for frontline teachers. The required diversified educational services pose significant challenges to teachers' knowledge levels, language abilities, and working styles. Teachers' teaching energy is diffused by all these requirements and teaching quality inevitably decreases as such policies are implemented (Wu, 2020). Because ethnic areas are scattered in mountainous areas, pastoral areas, and forested areas which are sparsely populated, the forms of compulsory education are also unique, with boarding schools and small-scale schools (teaching sites) most common. These small-scale schools in the Chinese context refers to schools with less than 100 students (Lei & Zhang , 2011; Yang & Zhang, 2014).

We are mapping a variety of information sources across the following five areas to increase our own understandings of the complex interactive issues in play regarding education of ethnic minorities in Yunnan Province:

1) Chinese national government policies and the formal curriculum of schools
2) Instructional designs that promote learning by ethnic minorities in China
3) Rurality and the tradeoffs facing rural development in Yunnan
4) Urbanization and globalization as both threats and opportunities for China's ethnic minorities
5) Analogous situations and approaches that have been or could be fruitful when confronting these types of challenges

National Government Policies and the Formal Curriculum of Schools

In 1951, the "Report of the Ministry of Education on the First National Education Conference on Ethnic Minorities" mentioned that for ethnic groups, school subjects in primary and middle schools must be taught in their own languages. The meeting unanimously agreed that schools of all ethnic groups at all levels may provide Chinese (i.e., Mandarin) lessons according to the needs and voluntary wishes of the minorities. Between 1957 and 1965 the government largely ignored ethnic differences and the role of ethnic languages declined. The Cultural Revolution and its aftermath, 1996-1976, further damaged bilingual education. The teaching of ethnic languages was abolished, and ethnic primary and secondary schools in ethnic autonomous areas were mostly closed or converted to ordinary schools (Huang et al., 2015).

Between 1992-2001 the PRC issued a series of policies to promote the (re)development of minority education. The National Civil Affairs Commission and the State Education Commission of China in 1992 stipulated that "in areas where ethnic languages are used for teaching, bilingual teaching shall be carried out in accordance with local conditions." The policy encouraged the compilation and publication of ethnic textbooks while also promoting "universal Mandarin" as the required lingua franca. By 2010, bilingual education became compulsory for pre-school age minority children, and bilingual teaching objectives were further expanded.

Xu and Cai (2018) analyzed the current development status and problems of curriculum resources in minority areas in China from the perspective of multicultural education. First of all, the development of multicultural curriculum resources in many ethnic areas is only a spontaneous act initiated by the supervisor, without systematic and standardized guidance from the Ministry of Education or regional educational officials. Secondly, in many ethnic regions, the multicultural curriculum takes Han culture as its core value and standpoint and then merely introduces the cultural content of ethnic minorities as a supplemental attachment. This kind of multicultural curriculum has not taken significant hold in the multicultural environment of ethnic minority areas not least because it does not adequately account for students' daily experiences. In addition, the implementation of multicultural courses in many regions follows common utilitarian purposes. Multicultural courses in most ethnic regions are integrated with disciplines such as music, sports, and fine arts. These subjects are not included as examination subjects. Due to the influence of exam-oriented education, these courses are often squeezed by exam subjects and receive little distributed time in the curriculum. Some education authorities require schools to offer multicultural courses; others leave it to local discretion. Some schools offer courses only to satisfy upcoming inspections and investigations by superiors.

Finally, the development of ethnic minority curriculum resources and the implementation of multicultural courses requires evaluation as a driving force. The teaching evaluation system needs to be developed in a diversified way that accounts for the existence of ethnic minority curriculum content. But in the actual operational process, strongly affected by test-oriented education, the scores achieved are still the dominant factor used to measure the quality of a school's teaching. This has largely precluded the establishment and implementation of a diversified teaching evaluation system that is sensitive to multicultural issues. Both teachers and students are constrained by the scores. Teacher initiative and student interest in the implementation of minority curriculum issues is diminished and incommensurate with the needs to preserve ethnic minority awareness and cultural and linguistic understanding.

Instructional Designs that Promote Learning by Ethnic Minorities

Li and Ma (2010) proposed that only by implementing a multicultural education concept into the curriculum content can education be culturally inclusive and adaptable to diverse needs across the nation. Students from ethnic minorities come from different ethnic groups and possess deep and diverse cultural backgrounds. Therefore, appropriate curriculum content should have its own characteristics consonant with these backgrounds. However, the current curriculum content still rarely covers minority cultures. The content of courses continues to use mainstream culture as the standard which not only leads to a superficial understanding of minority cultures, but also causes minority students a lot of discomfort in the classroom as many topics discussed are ill-matched to local cultural mores, customs, and practices.

There are many practical difficulties in multicultural curriculum design. For example, should a multicultural curriculum include all cultures? It seems reasonable on the surface, but in reality it doesn't work because the capacity of the curriculum is limited and the learning burden of both students and teachers is limited. Moreover, some cultural customs or mores may only be suitable for students within that ethnic group; there is no need to enculturate students from different cultural groups to these unique features. Yet Feinberg (1995) correctly points out that students who have not received their own cultural education may feel alienated and rootless. At the same time, students who lack mainstream cultural education will lose many economic, political, and social advantages and opportunities. Therefore, not only is it difficult for curriculum designers to make cultural choices, but it is also a challenge for affected ethnic minorities. Monistic culturalism is still the dominant guiding ideology within the current Chinese national curriculum, so how will the curriculum within Chinese schools in areas of high minority concentrations solve this dilemma?

In the context of maintaining the diversity of world cultures, the inheritance and development of ethnic minority traditional cultures has become more and more prominent. In August 2015, the State Council of China issued the "Decision on Accelerating the Development of Ethnic Education," which clearly states that it is necessary to ensure the continuance and promote the excellent traditional culture of ethnic minorities. Among topics mentioned is the construction of ethnic culture school-based courses as an important measure to promote the inheritance of ethnic culture and advance the progress of ethnic education. During this period, the guarantee of relevant national policies and regulations also provided motivation for the study of curriculum reform in ethnic areas.

Zhu and Li (2020) used "Citespace" software to conduct a content quantitative analysis of relevant documents in the field of school-based construction of Chinese ethnic culture from 2003 to 2018. Their research shows that the rapid development of ethnic culture school-based curriculum research took place between 2012 and 2018. Zhu and Li demonstrate that there are some common problems in the development of an ethnic culture school-based curriculum: First, the goals of curriculum development were too general to play a true guiding and regulatory role. Second, there is a lack of external support. Meng and Wu (2016) concurred, pointing out that there is a lack of financial support and policy guarantee in the development of an ethnic culture school-based curriculum. Finally, the regulatory system is imperfect. Most ethnic schools have not established a special school-based curriculum development committee, nor have they introduced a supporting inspection (i.e., evaluation) system (Zhu & Li, 2020).

Jin (2020) proposed that minority cultures shape individuals with different personalities and abilities than those typically found in the dominant Chinese culture. In terms of the target culture of the curriculum, the pre-school curriculum in ethnic regions should cultivate multicultural awareness and promote the comprehensive and harmonious development of children; in the content of the curriculum content and culture, it should be multi-valued and culturally appropriate. In terms of curriculum evaluation culture, educators should pay attention to diversity and differentiation to meet the inherent needs of children in ethnic regions.

Zhu and Cao (2012) investigated the bilingual teaching situation in ethnic minority areas in Yunnan Province and pointed out a series of problems in the composition and support of teaching staff. For example, the distribution of bilingual teachers is uneven, the overall structure is unreasonable, and the teaching staff is unstable. In addition, bilingual teachers have heavy teaching tasks, the overall quality is not high, and the enthusiasm for bilingual teaching among supervisors is low. Although the training of bilingual teachers is institutionalized and routine, there are too few trainings on practical teaching strategies. The bilingual teaching teacher training policy for ethnic groups with a small population is very weak as compared to bilingual teaching teacher training in, for example, Mandarin and English.

Teachers in ethnic areas tend to focus on their own culture and teach from the perspective of that culture – which is most cases is Han (Wang, 2020). They lack understanding of and sensitivity towards the cultural background of ethnic minority students. Wang believes that the reason is that China's teacher education and teacher training usually form teacher professional skills and those teacher training models reflect the mainstream Han culture. Such a model ignores the acquisition of local and ethnic cultural knowledge, as well as promoting a lack of understanding of the differences in students' cultural backgrounds across the nation and within particular regions. Therefore, in the current teacher training and especially training in ethnic areas, it is necessary to enhance teachers' own cross-cultural sensitivity and strengthen the training of teachers' cross-cultural knowledge and skills.

Rurality and the Tradeoffs Facing Rural Development in Yunnan

Yang (2012) used ethnographic field work to investigate the case of a Lahu village school and summarized the difficulties in the development of local education. Among them, the early marriage and childbearing of the Lahu people has a negative impact on formal school education. In addition, the economic drive brought about by the rise of the tea trade in the villages has led to high, yet largely hidden school dropout rates. Existing textbooks were also deemed unsuitable for the realities of mountain villages with their alien and difficult content.

Lin and Zhang (2002) conducted a field survey of 25 ethnic minority villages in Yunnan and found that the economic development of Yunnan's ethnic minority villages was uneven, at best. In 2009, the National Ethnic Affairs Commission of China launched the "Pilot Work for the Protection and Development of Ethnic Minority Characteristic Villages." The main objective of the commission was the creation of a pilot program in progressive activities work. On the basis of summarizing the protection and development experience of the pilot project, the guiding principles and measures were further developed and improved. In 2012, the "Outline for the Development of Ethnic Minority Villages 2011-2015" was officially promulgated and implemented throughout China, which became the basis for the ongoing development of ethnic villages in China.

Urbanization and Globalization as both Threats and Opportunities for China's Ethnic Minorities

Historically, Yunnan was an important launch pad and hub for the opening of Southwest China to the outside world. However, due to its relatively backward economic development, limited access, and low use of resources in ethnic regions compared with the more accessible domestic coastal cities, Yunnan's level of openness to the outside world is lower and foreign investment is less than in all but three other (large ethnic minority) Chinese provinces (Li et al., 2016). After implementation of the national government's "Belt and Road" strategy, Yunnan and its many ethnic minorities will have closer communication and greater openness with both the PRC as a whole, as well as with its many Southeast Asian neighbors. Li et al. (2016) are worried that there will be problems as cross-border ethnic groups attempt to manage both the centripetal and dispersive forces in terms of "cultural identity" and "national identity." It could cause civil unrest as minorities become restive regarding internal development versus what they see among their cultural counterparts in adjacent countries. This may resurrect prior government programs that resulted in diminished multicultural educational efforts in Yunnan. Some areas in northern China with large minority populations already seem to be experiencing such a response.

Globalization has intensified the heterogeneous exchanges between cultures. In this cultural development, Yunnan's cross-border ethnic groups are faced with significant new challenges. The traditionality and relative independence of the original cultural system of cross-border ethnic regions has been broken (Zhou and Chen, 2020). They now exist synchronically with foreign values and local values. For cross-border students, it is particularly important to promote multicultural understanding and value consensus.

Analogous Situations and Approaches that have been or could be Fruitful when Confronting these Types of Challenges

Some scholars have proposed that we can innovate multicultural education through informatization and networking while providing a more precise and humane educational support structure (Xiong and Yang, 2019; Wang, 2020). They believe that the combination of artificial intelligence and education can provide promising new ideas for multicultural education and education equity. Using artificial intelligence technology allows for the real-time collection of classroom teaching data, allows educators to monitor students' learning process at any time, analyzes the interaction between teachers and students in real-time, improves teaching efficiency, and promotes the evaluation and personalization of teaching performance and goals (Xiong and Yang, 2019). In addition, technologies such as knowledge graphs, big data platforms, and pattern recognition can also be used to analyze and accommodate the social and cultural background of students outside the curriculum (Wang, 2020). Yang and Yang (2014) believe that the research on the informatization of minority education focuses mainly on the construction of information network infrastructure, information technology education, education informatization management and evaluation, and development status and countermeasures.

Although there has been some progress in the construction of ethnic education informatization, there are also some problems. For example, the construction of education informatization in ethnic areas is relatively lagging, especially in the construction of information infrastructure and the loss and shortage of informatization talents and not surprisingly, areas of high rurality and low labor opportunities are unattractive to knowledge workers (Zhao and Liu, 2020).

Designing Effective Learning Experiences for Diverse and Scattered Ethnic Minority Groups

The design of curriculum structure, the compilation of teaching materials, the development of cognitive tools, the creativity of related education networks, and the development of various learning and teaching resources should all be devoted to promoting the organic connection among school, family, and society. The design concept is to actively create an open, immersive, and active interactive learning process to help students overcome knowledge inertia, enhance knowledge flexibility, and promote knowledge transfer.

Bilingual education is an effective way to realize multi-ethnic language protection and cultural diversity inheritance (Wei & Tian, 2019). The challenge is how to better provide the educated with a language environment and choice of bilingual learning so that they can master the tools, knowledge, and skills necessary for a globalized society, instead of isolating and inflexibly inheriting a certain language that is not one's native tongue. This requires us to focus not only on the school and the family, but to go beyond the school and the family to achieve lasting and measurable change.

As the main place for the acquisition and use of ethnic languages, the protection of ethnic minority villages is essential to help strengthen language vitality. This is also the clearest path to maintaining and improving the ecological environment of minority languages. Qian (2005) called the Wa villages in Yunnan the "cultural fingerprints" and "spiritual homes" that maintain the Wa language context (pp. 159 - 171). Protecting the Wa villages will help strengthen the vitality of the Wa language and activate the ethnic language ecology (Zhao, 2013; Fan, 2005).

In order to realize and promote the healthy development of ethnic culture school-based courses in ethnic areas, the most urgent task is to further coordinate the relationship between school education functions and the development and setting of ethnic culture school-based courses. It is necessary not only to reform and innovate ethnic education regulations and systems at the national (macro) level, but also to actively develop multicultural courses through the ethnic schools themselves. Yao (2019) combed and analyzed the literature regarding the protection and development of ethnic minority villages in the past ten years. He found that there were not too many protected villages. Whether a village can be developed is affected by the characteristics of the village and the support of the local government.

At present, in specific practice, we can see that the construction of ethnic culture school-based courses is mainly based on the education management department, supplemented by the school, resulting in the decision-making and planning related to the curriculum being determined by the management department (Zhu & Li, 2020; Wang, 2020). To a certain extent, this situation has weakened the school's leading role in the construction of such courses and the main status of students. There are some contradictions between the focus of school education and the development of ethnic culture school-based curriculum which need to be addressed if there is to be any significant progress.

Wang (2020) believes that the key to the development of teacher education in ethnic areas is the preparation of teachers' cross-cultural knowledge. Facing students from different nationalities and different cultural backgrounds, teachers need to have a certain amount of cross-cultural knowledge in order to correctly guide students of various ethnic minorities with their diverse cultures.

Conclusion

The preservation of ethnic minority cultures and their distinctive languages can only be achieved by far-ranging partnerships both within and outside of the People's Republic of China. Success over time will undoubtedly involve learning from and learning with partners working on similar issues throughout the world, but especially among nations whose situations are similar in certain respects to those of China in regards to distribution of minority groups, geographic barriers, rurality and mountain cultures, and economic development within minority-intensive areas. While there are a reasonable number of ethnic Han scholars actively investigating these issues within China there remains a need for the development of additional scholarly interest and research and development investments addressing the many issues raised by language-minority cultures within larger, more pervasive language-majority contexts. It is never a question of lose-win but rather a question of balancing many factors in sufficient manner to produce future generations that appreciate the worth of fully bilingual speakers of multiple ancient languages of China with each of those languages successfully evolving its own grammar and vocabularies in a manner that increases the likelihood of language sustenance and continuance far into the future.

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Six Key Principles in Designing Artificial Intelligence (AI) Curriculum for Middle Schools

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Abstract

Recently, AI education in K-12 schools has begun in full swing; however, educators and experts found designing AI-related curricula challenging. We seriously lack of the relevant studies to inform practitioners to design and implement AI-related curricula. Curriculum design approaches could inform researchers and curriculum designers how to planning a quality and sustainable curriculum. Teacher perspectives are very essential to make sense of the emerging AI technology for curriculum designing. According. This paper used four curriculum design approaches – content, produce, process and praxis as the framework and thematic analysis to analyze data collected from 12 K-12 schools including individual interviews, teaching documents, meeting minutes, school-based curriculum documents of 24 teachers. Hence, we posited 6 key principles - definition, relationale, impact (content), flexibility, learning, communication (process) - in designing AI curriculum.

Keywords: Artificial Intelligence Education, Curriculum Design, K-12 schools, design principles

Introduction

The explosive growth of Artificial Intelligence (AI) is fundamentally transforming the way we live, learn and work. The emerging ubiquity of innovative AI applications has significant implications to our society and our future generations. AI has grown way beyond a branch of professional and academic research. It is necessary to move AI education from professionals to the mainstream (Chiu and Chai, 2020). Topics in AI, which have conventionally been covered in post-secondary education, are making their way into K-12 classrooms as a global strategic initiative (Pedró et al., 2019). This initiative aims to educate the future generation. AI education in K-12 not only helps children understand what the emerging technologies are and how they work, but also inspires future AI users, ethical designers, software developers and researchers (Pedró et al., 2019). However, curriculum design for K-12 schools is more complex compared to post-secondary education. It involves considerations of how the new initiative translates into practice and considerable variation in delivery can be expected from school to school. Hence, designing AI or AI-related curricula is challenging (Chiu & Chai, 2020; Touretzky et al., 2019).

To address the global initiative, we lack of relevant studies that informing how to design a quality AI curriculum for K-12. Curriculum designing theory could inform researchers how to design the curriculum (Chiu & Chai, 2020). As such, this study used four basic curriculum theory approaches - curriculum as content, product, process and praxis – as a framework to suggest six principles in designing AI curriculum for K-12 schools.

Literature Review

Four curriculum design approaches

Curriculum refers to the totality of student experiences in the educational process that are planned and guided by the teachers, and learned by the students in any environments (e.g. group, individual, classrooms, after schools, online) (Kelly, 2009; Marsh and Willis, 2003). Current literature points out four major design approaches to understand curriculum. They are curriculum as content, product, process and praxis (Kelly, 2009; Grundy, 1987; Glatthorn et al., 2018), and theorize curricula design. They are useful for researchers to study curriculum innovation and for practitioners to create or revise curriculum.

The curriculum as content approach sees education as transmission of knowledge. This approach is thus a body of subject content, i.e. a syllabus, and the identification of effective teaching methods (Blenkin et al., 1992; Glatthorn et al., 2018; Kelly, 2009). Teachers will follow suggestions stated in the curriculum - an order of contents, a knowledge structure, and teaching methods to teach. They tend to limit their lesson planning to a consideration of the body of knowledge that they want to deliver. The justification for the curriculum lies in its content, but not its effects. This view of curriculum is very popular amongst primary school teachers (Kelly, 2009).

The curriculum as product see teaching as instrumental to enhancing student competencies. It takes the performance and competence of students as the core components (Bonnett et al., 1999; Swanson & Pashby, 2016) and the assessment of student learning outcomes as main goal (Glatthorn et al., 2018; Kelly, 2009). The curriculum development is viewed as a technical exercise. This curriculum approach aims to prepare students adequately for specific tasks; therefore, its development requires detailed attention to what the students need to learn and know. This approach is often found in many technical, skill-based, training programmes where specific tasks or jobs have been identified. It often prepares lists of competencies, inform students what they must learn and how they will do it; therefore, the students have little or no voice to their learning. By having pre-defined outcomes, this approach tends to direct attention to teaching. These two approaches create set of documents for implementation. However, contemporary education advocates student-centered approaches - curriculum as process and praxis by shifting the focus of curriculum from teaching to learning (Kelly, 2009).

The curriculum as process sees teaching as development and emphasizes how teachers, students and content interact and evolve, rather than pre-defined content and outcomes. The learning goals have will change as the triadic relationships evolve (Kelly, 2009). The curriculum is not a standard package of materials for all the teachers to cover and deliver in their classrooms, but a guideline about teaching practice (Glatthorn et al., 2018). It could tell us what teachers and students do to prepare and evaluate the lessons, i.e. what actually happens in the classroom (Chiu & Chai, 2020). For example, choices of content depend on what fit student needs and interests; learning outcomes are developed from the collaboration of teachers and students, but not applied to all the students. In this curriculum, students are not treated as objects but as subjects who have voices (Chiu & Hew, 2017; Chiu & Lim; 2020).

The process approach emphasizes meeting student needs, and does not make clear statements about the interests it serves. Bringing this issue to the center of the process, the curriculum as praxis sees teaching as committed action, and focuses on making sense of the knowledge in the learning process by connecting it to real world applications (Glatthorn et al., 2018; Grundy, 1987). Guided by teachers, students will learn with peers to solve real-world problems by working out an action plan for acquiring the content knowledge and achieving the outcomes. The learning process and outcomes are continually evaluated.

Adopting a particular curriculum design approach has a major influence on teaching and learning strategies (Priestley & Biesta, 2013). For example, the content approach encourages teacher-centered approaches to teaching; the heavy emphasis on product encourages drilling and practice; the process approach leads to the design of student-centered learning activities; the practice approach tends to adopt problem-based learning. However, these four approaches to curriculum designing are not mutually exclusive (Glatthorn et al., 2018; Kelly, 2009). For example, followers of the process approach would not argue that content and assessment are unnecessary and negligible, but the selection of content is a secondary consideration. The first two approaches adopt behavioral stance and structured teaching, and set objectives and attainment targets that must be taught to students. The last two approaches are "the curriculum is not simply a set of plans to be implemented, but rather is constituted through an active process in which planning, acting and evaluating are all reciprocally related and integrated into the process" Grundy (1987). They draw on student-centered learning theory, and educational and developmental psychology. They identify and nurture the strengths of students, with every student taking an active role in her or his learning, and with both students and teachers developing the curriculum.

AI education for K-12 research

Most studies on AI education for K-12 focused on what techniques and skills should be included and what AI tools should be adopted in teacher teaching (Burgsteiner et al., 2016; Papert and Solomon, 1971; Sensetime, 2018; Williams et al., 2019). For example, the first formal study of teaching children AI was to explore AI concept through LOGO programming and Turtle robot (Papert and Solomon, 1971), which was a pilot teaching, rather than a curriculum. SenseTime (2018) worked with East China Normal University, to write the first textbook series for high schools - Fundamentals of Artificial Intelligence. The content in these series is aligned with AI courses in higher education, hence they focused on techniques and skills. The series are appropriate for student with higher academic abilities or stronger engineering knowledge. This curriculum adopted content and product approaches. Moreover, Williams and colleagues (2019) from Massachusetts Institute of Technology examined different AI learning activities with robots on children learning. Their ideas focused on more process and praxis approaches. In sum, these studies did not useful guidance us to design AI formal curricula for K-12, but provided crucial but fragmented findings in the research of AI K-12 curriculum design. Therefore, there is neither existing established curriculum nor well-defined content knowledge for secondary schools. To address the global initiative, it is essential to conduct research on the curriculum design so that this educational innovation can be sustained. Curriculum design approaches could inform researchers and curriculum designers how to planning a quality and sustainable curriculum (Chiu & Chai, 2020; Kelly, 2009; Marsh & Willis, 2003).

This Study

Research Question and Participants

Teacher perspectives are very essential to make sense of the emerging AI technology for curriculum designing (Chiu, 2017; Chiu & Churchill, 2016; Cope et al., 2020;). Accordingly, this paper used the four major curriculum design approaches – content, product, process and praxis – as a framework to investigate the views of AI teachers' curriculum and teaching experience on key principles for designing AI curriculum for K-12 education. The research question is "How do the four approaches relate to the curriculum design?".

The participants were 24 teachers from 12 Hong Kong middle schools (2 from each school), and designed and taught their own school-based teaching units of AI. The average age of the teachers is 30.5 years old; 20 teachers are male, and 4 are female. The schools were located in different districts and varied in socioeconomic backgrounds and academic standards.

Method

A qualitative method was adopted to achieve this study goal. Sixty-minute individual semi-structured interviews with the teachers were conducted to understand what, why and how they taught the units. Documented data including their teaching materials (plans, slides and worksheets), meetings minutes, emails, teacher reflections and student work, were collected. To analyze the data, this paper used thematic analysis to identify the essential components of AI curriculum because the analysis usefully summarizes key features of a large body of data, and highlights similarities and differences across the data set; therefore, offers a useful method for working within participatory research paradigm and informing curriculum development (Braun and Victoria, 2006).

Results and Discussions

The final thematic map devised in the results consisted of two themes: (i) content and product and (ii) process and praxis, hence this paper posited 6 key principles - definition, relationale, impact (content and product), flexibility, learning, communication (process and praxis) - in designing AI curriculum, See Figure 1. The followings explains the 6 subthemes (key principles).

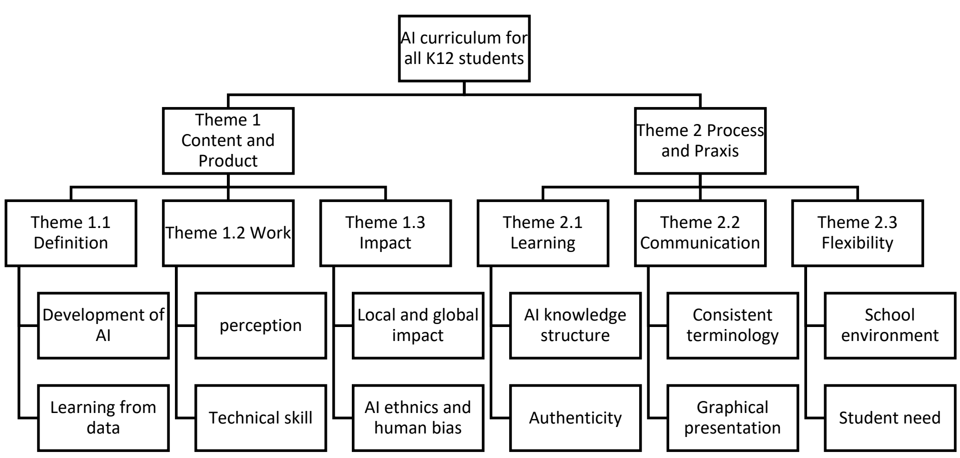

Figure 1 The final thematic map

Theme 1: Curriculum as Content and Product

All the AI teachers highlighted that there was no existing and appropriate content for their teaching. Majority of them shared that the content and learning outcomes should be Knowledge in AI (what AI is), Process in AI (e.g. how AI works) and Impact of AI (social good and ethical use). See the following expert.

> *"I did not have any appropriate content for my students to learn. The existing textbooks we bought were not too technical and professional."* (Teacher 1)
> *"Students should know who the background and history of the AI technologies."* (Teacher 4; Knowledge in AI)
> *"Students should learn about how the computer develops the ability, which includes modeling, statistics and learning algorithm. ... They also should learn how AI technologies process data in different aspects."* (Teacher 5, Process in AI)
> *"I believe my students should learn about societal and personal impact of AI locally and globally."* (Teacher 8, Impact of AI)
> *"My students should consider ethical issues from different perspectives of stakeholders including developers, policy makers and users. They should not only explore ethical issues from different perspectives, but also develop principles for the ethical design and deployment of AI-based technologies."* (Teacher 10, Impact of AI)

Theme 1.1: Definition - What is AI?

This paper analyzed all the data such as teaching slides, school-based teaching materials and teacher interviews, and showed that the definition of AI should comprising (1) Development of AI: The impact of AI in our everyday life is more sophisticated, from the business and entertainment to your mobile phone and social media; from providing online help to recognizing our voice and face. More integration of AI technologies in our everyday lives will be seen relatively soon. Students should understand the history and development of AI: fourth industrial evolution and its changes of workforce, evolutions of technologies including big data and deep learning, as well as the future development. (2) Learning from data: AI refers to the ability of a computer to perform tasks that are similar to that of human learning and decision making (Shubhendu and Vijay, 2013). Students should learn about how the computer develop the ability, which includes modeling, statistical inference and learning algorithm. To train better model and/or algorithm, this requires cloud computing to process tremendous amounts of data.

Theme 1.2: Work - How do different AI technologies work?

The analysis further indicated that perception and technical skills should be included when teaching how AI technologies work. (1) Perception: "Human learning and decision marking" is one of the core knowledge in AI, i.e. it requires computers to perceive our world by collecting data. Perception is ability to organize, identify, interpret the sensory data to represent and understand the presented information. Students should understand how AI technologies process data in different aspects including see, hear, speak, think, create and reasoning through experiencing, interacting and coding. (2) Technical skill: AI is about so much more than coding. Students should be able to perform some mathematical operations and train classifiers / models by drawing upon main machine learning libraries, and be acquainted to the notion of Neural Networks. For example, adding AI elements to existing computer applications and/or students' own work.

Theme 1.3: Impact - How do AI technologies affect our society and life?

Finally, the analysis further showed that impact and ethics of AI are very important in K-12 education. Therefore, the two suggested areas in the analysis are (1) Global and local impact: AI technologies solve real world problems for us on a daily basis and it has the capability to turn every interaction into an endless learning process. They have been making negative and positive impact in our world, society, and personal lives. All teacher teaching adopted an approach of "explainable AI – from local explanations to global understanding" (Lundberg et al, 2016), which make connections between the subject and the students' life. Students could have better understanding of the societal and personal impact of AI by combining many high-quality local explanations that allow to represent global understanding. (2) AI ethnics and human bias: AI ethnics and human bias is another core knowledge in the all teacher teaching. Their goal is to train students to be an ethical designer. AI technologies that computer engineers view as ethical may be seen as unethical by the users. For example, "Google fixed its racist algorithm by removing gorillas from its image-labeling tech". Students should consider ethical issues from different perspectives of stakeholders including developers, policy makers and users. They should not only explore ethical issues from different perspectives, but also develop principles for the ethical design and deployment of AI-based technologies.

Theme 2: Curriculum as Process and Praxis

In this theme, the analysis suggested three subthemes - learning, communications, and flexibility.

Theme 2.1: Learning - How do students learn AI knowledge and concept?

All the teaching suggested two important areas that can facilitate student AI learning. They are (1) Knowledge structure: The structure informs how to learn AI knowledge and concept in an effective way because it promotes self-regulated learning. The 5-stage structure is (i) raising students' awareness by building associations between real-world applications of AI and their daily experiences, (ii) providing foundational understanding that connects student current learning to cutting edge applications, (iii) facilitating student understanding of how different AI technologies work through experiencing, interacting and coding accessible AI applications, (iv) engaging students with appropriate design challenges, and (v) preparing students to be ethical and responsible local and global citizens. This knowledge structure can scaffold and bridge the new learning by allowing going back into previous and drawing it forth. (2) Authenticity: How authentic of the learning design is crucial for AI education due to its abstract nature. Students should learn AI with reference to real-world applications which they are likely to encounter in their daily experiences (Chiu & Chai, 2020). Learning by design that is an emerging paradigm in education and it is advocated as the key instructional approach to cultivate students as ethical designers, developers and users of AI technologies (Tsai et al, 2013). Students should design solutions with authentic problems and examine their designed solutions with reference to AI ethical principles. Being grounded in authentic learning, students should develop better historical and contextual understanding of AI.

Theme 2.2: Communication - How do teachers/teaching materials communicate with students?

All the AI teachers reported that AI terminologies are unfamiliar to the teachers/students and may be too technical for general education. They suggested (1) using consistent terminology to facilitate the communications between teachers and students. In AI teaching, there are many different technical and abstract terminologies such as Big data, cloud computing and machine learning. The terminologies are too new, rigid and rigorous for school general education; sometimes, different terminologies are used to describe the same concepts. Therefore, it is very different for most students to comprehend the relevant concepts and knowledge well when using inconsistent terminologies. Curriculum should not be presented as finished abstractions, but should include the student preconceptions and should incorporate how the students view their own world and language (Chiu & Churchill, 2015; Chiu & Mok, 2017; Chiu & Chai, 2020). The inconsistent and abstract terminologies become one of main obstacles in teaching them all technical knowledge. Accordingly, using consistent and familiar languages facilities the communications between teachers and students. For example, using "Input, process and output" to demonstrate the learning mechanism throughout the curriculum, i.e. how AI learn and process data. (2) using graphical representations. A picture is worth a thousand words. Using graphical representation to present and explain abstract terminologies, knowledge and concept could facilitate teacher teaching and student learning in the curriculum (Chiu & Churchill, 2015; Chiu & Mok, 2017; Chiu et al., 2020). For example, a diagram with a timeline we designed represents and explains the definition and develop of AI. This diagram also gives the students an overview of whole curriculum. These two subthemes are evidenced by the following excerpt.

> *"I used diagrams to explain what machine learning is." (Teacher 2)*
> *"I found many terms so abstract in AI, and needed to suggest new ways to explain them to my students." (Teacher 10)*

Theme 2.3: Flexibility - How does the curriculum address the needs of schools and students?

All the teacher teaching reported that it was necessary to revise their teaching materials and improve pedagogy in cycle; therefore, flexibility is very important. The majority suggested that using module and level up approach would offer high level of flexibility to revise the curriculum. In the approach, all the teaching units should have no prerequisite knowledge and show the learning path, see the following excerpt.

> *"There is no way that I will not revise the teaching materials. I have a lot to improve."* (Teacher 3)
> *"The teaching units must be explicitly designed for a specific goal (module). ... The units should provide students with a clear learning path learn by themselves. (level up)"* (Teacher 5)
> *"Module-based curriculum should be adopted. Easier to choose the unit for teaching and revising."* (Teacher 7)

The analysis suggested that the flexibility – module and level up design approach - is very important in designing a new technology subject that requires extra tools and resources for teaching and learning. It is because (1) School environment: Flexibility is very important for school education. This design approach should offer maximum flexibility for school teachers to teach the curriculum, based on their school environments and students' interests and competencies. The schools and teachers are able to balance "breadth" (i.e. broad coverage of awareness, knowledge and ethical issues across the modules) with "depth" (i.e. choosing to deepdive into a module to cover the technical aspects, interactions through hands-on activities and empowerment through innovative system implementations) in a flexible way. The curriculum is associated with AI teaching and learning tools for developing technical skills. Different schools have different resources, the curriculum should be flexible that allows teachers to make decisions in the best interest of individual schools and students. The teachers can select the tools that are suitable for the school classroom environments and are easily assessed by their students. This will maximize the student learning. (2) Students' need: This approach allows high level of flexibility for teachers to design the best programmes for their students to fit their school culture and learning ability. For example, teachers who wants their students learning more about social issues, they can pick more modules in social impact and future work. The level-up content shows a pathway of learning in term of knowledge structure, which can direct and guide student learning. In other words, the teachers can decide what to teach, when to teach them, and how long to spend teaching them.

Conclusion and Limitations

Designing an appropriate AI curriculum seems remarkably challenging — particularly at K12 general education school level. This paper had considered difficulties in catering to the needs and interests of diverse students and schools, and posited the two themes and six key pricniples for designing the curriculum.

Currently, some emerging AI teaching practices in schools are about coding non-AI applications, for example, remote control appliances - adding microchips to a device. Such practice did not cover the main concepts of AI and may not be beneficial in equipping students with basic understanding and to get them ready for an AI infused world. The author hopes to contribute to the creation of appropriate K-12 AI curriculum with the six principles. However, the main limitation is that the six principles are not tested in the field; it is suggested future studies should examine the applications of the six principles.

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Deep Learning: Helping Teachers Assist Students to Take a Deep Approach to Their Learning by Utilizing All Four Major Parts of Their Brain.

Darin Griffith

Introduction

Teachers cherish those special moments when a student tell them how much their lives have changed because of those things they learned and felt in class. But all too often, teachers hear the sound of students who are just trying to get through the class by saying, "Will this be on the test?" Is it possible for teachers to make changes in their teaching to assist students to take a deep approach to their learning rather than a surface approach? The answer needs to be "YES" or what we as teachers do really does not make any difference. And teachers do make a difference! The purpose of this paper is to: firstly, give a brief review of the differences between deep and surface approaches to learning; secondly, show how different parts of the brain can be used to help a student learn deeply; lastly, offer suggestions for how teachers can assist students in using all four major parts of the brain to assist with the deep learning process.

Deep Approach Versus Surface Approach to Learning

The concept of deep learning is called by many names and defined in different ways which has led to some inconsistencies and ambiguity in research (Dinsmore & Alexander, 2012). Tagg (2003) defines deep learning as "learning that takes root in our apparatus of understanding, in the embedded meanings that define us and that we use to define the world" (p. 70). Deep learning emphasizes integration, reflection, and synthesis by the learner and is retained by the learner (Nelson Laird et al., 2008; Roberts, 2011). Surface learning is when students do the minimal amount of work to remember enough information to pass a test or receive an acceptable grade and students reproduce facts to pass tests and please teachers (Dolmans et al., 2016; Ramsden, 2003). Surface learning engages the lowest stages of Bloom's Taxonomy (Bloom, 1956).

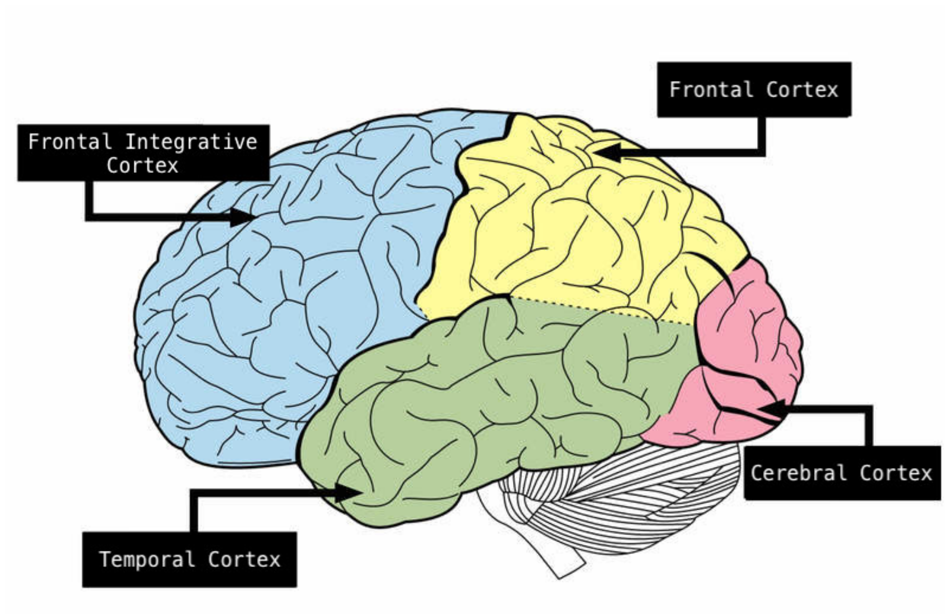
It is important to note the difference between deep learning and approaches to learning. Approaches to learning describe the types of behaviors students use in learning and not the result of learning (Nelson Laird et al., 2008). A deep approach to learning is when a student has intentions to understand what is being taught (Asikainen & Gijbels, 2017). When a student takes a deep approach to learning, they experience higher levels of learning. They move from the knowledge stage of Bloom's Taxonomy up to and including the analyze, synthesis, and evaluation stages and begin to experience deep learning (Razzouk & Razzouk, 2008). In contrast, a surface approach to learning "has nothing to do with wisdom and everything to do with aimless accumulation" (Ramsden, 2003, p. 59). Surface approaches to learning focus on memorization and rote learning and students' academic goals focus on passing tests and avoid failing classes (Nelson Laird et al., 2008).

Students approach learning in a number of ways. For example, some students walk into a class with great excitement and anticipation, while others may enter the same class with hopes of producing minimal effort to pass the class. Martin and Säljö (1976) introduced the terms surface level and deep level processing in their ground-breaking study and later amended the terms to surface and deep approaches to learning (Entwistle, 1991). Their study took a group of university students and assigned them to read an article and asked how they approached learning the information in the article. Students who focused on remembering facts did poorly on retention tests, while students who looked for ideas and principles and made connections with the readings did well. Thus, the approach students took played an important part in what they learned and whether or not they retained that knowledge. The process of learning appears to be directly correlated to the outcome of learning (Marton & Säljö, 1976). One's approach to learning may impact what is learned and how much. "A deep approach to learning emphasizes learning for the purpose of grasping a meaningful understanding and mastery of concepts" (Campbell & Cabrera, 2014, p. 497).

There are many factors to why students choose which approach they will take to learning. Biggs (1978) claims personality is a major factor and Zhang (2003) found that out of the five major personality types, conscientiousness and openness traits contributed to deep learning approaches, while neuroticism predicted surface level approaches while extraversion did not show a relationship to any of the learning approaches. Thus, students approach learning in varying degrees and which approach they take directly affects their level of learning.

Neuroscience and Deep Learning

Figure 1



Insights about how the brain functions can enhance learning and teaching and understanding how the brain learns can help teachers effectively teach and help students more effectively learn (Shearer, 2018). One insight is how neuroscience reveals how people learn and psychologists theorize that deep learning comes through a cycle "of experience, reflection, abstraction, and testing—which then creates a new experience to continue the cycle of learning" (Roberts, 2011, p. 2). Those four cycles use different parts of the brain and thus deep learning does not take place unless all four parts of the brain are used (Zull, 2002). The human brain first processes new information in the back of the brain called the cerebral cortex. Stories, images, actions, and lectures are first processed in this part of the brain. Information is processed with existing knowledge in the temporal cortex, which is the bottom of the brain. Consequently, if students hear a lecture and then take a test, they are using only half their brain. The third area is the frontal integrative cortex which, as it sounds, is in the front of the brain. This part of the brain is where formal operational thinking, judgement, ownership of ideas, and new creation of ideas, takes place. The final area in this cycle is located in the frontal cortex near the top of the brain. This area is where learners test ideas for accuracy and relevance. The process results in new experiences and the cycle begins again (Roberts, 2011; Zull, 2002). "Deep approaches to learning require students to use a diverse array of cognitive complexity in their learning process" (Campbell & Cabrera, 2014, p. 497). Thus, effective teaching and deep learning would use all four parts of the brain.

Because we know how the brain functions in the learning process, teachers can use that knowledge to structure learning activities to enhance student learning. The more we engage the brain during the learning process, the higher the level of learning in Bloom's Taxonomy. Zull (2002) argues that if the entire brain is not engaged, then long term learning will not take place. If no two people are alike, then similarly, no two brains would be alike. Different methods and strategies would be needed for different brains to comprehend learning. Pask (1976) labled two approaches holistic and serialistic styles of learning and Kolb (1971) characterized four learning styles as divergers, accommodators, convergers and assimilators.

The brain is key to memory, and memory plays an important role in learning. There are different types of memory. Episodic memory is the type of memory that helps us remember facts as they are linked to episodes of our lives while semantic memory is an engaging and transforming memory that is long lasting. Episodic memory is linked to surface learning while semantic memory is linked to deep learning (Roberts & Roberts, 2008). Students who use episodic memory are engaged in the lowest level of Bloom's Taxonomy while students who are using semantic memory are using higher levels of learning.

Teachers' Role in Deep Learning

What can teachers do to foster deep learning and help students take a deep approach to their learning? Is it possible to make learning more impactful and change the lives of students, even if the classroom is only a part of their lives? Because context plays an important role in learning, teachers play an important role in shaping which approach students take in their learning for a class (Biggs, 1987; Nelson Laird et al., 2008). Umback and Wawrzynsk (2005) find that faculty have a significant influence on students both in and outside of the classroom. Students work at the level required by their teachers. In other words, generally speaking, students do what their teachers ask them to do (Nelson Laird et al., 2008). Teachers must encourage students to search for meaning with the ideas presented in class by giving classwork and assignments that plant seeds that will result in students engaging in deep learning (Roberts & Roberts, 2008; Tagg, 2003). If teachers are involved with their students' learning, by fostering students active participation, students are more inclined to use deep approaches (Baeten et al., 2010; Biggs, 2003b).

Teacher Strategies

There are numerous methods for teachers to incorporate deep learning strategies in their classroom. As teachers shift from lectures to learner-centered activities, they encourage their students to think and analyze from different perspectives which results in the use of deep learning strategies (Mayhew et al., 2012). Teachers can incorporate role-taking activities and inquiry-based approaches in their classrooms, such as asking and answering questions (Offir et al., 2008; Roberts, 2002). Teachers can structure their lessons with the use of effective questions and discussion. "Effective learning obligates asking questions, and therefore obligates the lecturer to integrate stimuli that evoke the asking of questions" (Offir et al., 2008, p. 1181). In college, students report higher satisfaction with frequent interaction with faculty than with any other type of involvement, thus teachers should be involved with their students in questioning, discussions, and interaction beyond the lecture (Astin, 1999).

Deep learning techniques engage students in the learning process. This does not mean lectures and reading articles and textbooks cannot be used effectively as the use of research articles can still be used as a tool in teaching and achieve deep learning (Bordt, 2005). Teachers can give quizzes to encourage students to read the textbook to promote learning. However, if the purpose is to have the students read the text book, deep learning may not occur as introductory textbooks have been criticized as lacking in intellectual rigor and depth (Howard, 2004). Most comprehensive textbooks represent the kind of reading associated with surface level learning and quizzes on assigned readings often only encourage students to memorize key words and promotes surface level learning and multiple choice and true/false tests encourage superficial memorization and out-of-context facts (Howard, 2004; Roberts & Roberts, 2008; Tagg, 2003). If reading assignmetns, quizzes and testing are not about memorizing facts but helping enhance understanding concepts, these activities can enhance and encourage learning (Jacoby et al., 2010; Jensen et al., 2014).

Roberts and Roberts (2008) gives six factors that contribute to deep reading. First is the reading must have an intrinsic interest to motivate readers. And the second, related to the first, is the reader must be curious about how the readings will be related to their work and study. Third, the reader must see how the readings are connected to their life. Fourth, deep reading must go beyond the scope of episodic memory and use one's semantic memory, making it easier to recall information for tests or other tasks. Fifth, the readers must take a deep learning perspective. And finally, readers must know that higher order thinking skills will be required of them. In other words, the test will be more than a mere collection of facts, but synthesis and evaluation will be required. Roberts and Roberts (2008) conclude that "students are motivated to read more carefully when they are provided with a variety of ways to respond to the text—ways that are consistent with their own learning style" (p. 135). When students are encouraged to read and process the readings in different ways, to make meaning out of the readings, then share new ideas, multiple parts of the brain are being used and deep learning is taking place.

Teachers can encourage deep learning approaches to studying even in reading required texts. Howard (2004) has put into practice the idea of Just-in-Time quizzes. He gives a two-question quiz to his students that are thought provoking and can only be answered effectively by completing the required readings prior to class. The quizzes are due two hours prior to class and classroom instruction includes submissions from his students' submissions. This altering of the lesson meets the needs of the students. If they did poorly on the quizzes, then they obviously struggled with the concepts in the reading, so he reteaches the principles to help them understand. If they answered the questions with a deep understanding of the topic, then he can instigate a higher-level discussion in class from the readings. His findings include students complete the readings and elicit strong emotional responses because of his Just-in-Time quizzes (Howard, 2004). In this situation, students are actively participating in their learning by preparing for class. This is in harmony with Yamane's (2006) class preparation assignments (CPA's). He asks each student to read and think about the assigned readings and submit a writing assignment prior to each class. Each assignment includes four elements: an introductory statement, the objective, background information on the topic, and then the writing assignment. The CPA's have led students into a higher level of engagement and involvement into the class discussion. These Just-in-Time quizzes and CPA's are just two ideas to help students get involved with their own learning on a deeper level prior to class.

Deep learning is more than just student involvement. For example, a student could play a learning game but only understand enough to play the game and not internalize the information. One study shows that students learn more by creating a game than just by playing a game (Vos et al., 2011). Deep learning involves the entire learning process. Teachers must create and organize classes to follow deep learning design principles to effectively help students achieve deep learning. Boyle and Ravenscroft (2012) express: "Deep learning design encourages the creative study of a learning problem or opportunity. It applies substantive insights from the learning disciplines to exploit the affordances of the technology in order to develop contexts that empower learners to achieve educational goals" (p. 1225).

Technology may be used to enhance learning, but technology alone does not promote deep learning and peer discussions and student contracts have been shown to lead to an increase in deep approaches to learning (Entwistle, 1991). Another factor in helping students to learn deeply is to give them time to do so. One study reveals that when students are given time for reflection and contemplating issues, they exhibited higher developmental gains (Mayhew & King, 2008).

Teachers who desire students to learn using higher-order learning processes are encouraged by Biggs (2003a) to do four things. First, define the desired learning outcomes. Second, choose learning and teaching activities that are likely to lead to the learning outcomes. Third, access the students' actual learning outcomes and see if they match the intended outcomes. And finally, assign grades based on how well students met the learning outcomes. Teachers can encourage students to take a deep approach to their learning by how the class is organized and what is emphasized. The learning environment which students perceive influences how students learn (Entwistle, 1991). Teachers can help control the perception of the learning environment with how they create learning objectives and structure the class. As Roberts (2011) explained, "if we take deep learning seriously, we must also be serious about [the] course design—the entire course must be of the same fabric" (p.11). When creating a course, the objectives, teaching, and assessments can be aligned to enhance the students learning to reach beyond the remembering level of Bloom's Taxonomy (Alexandra & Moldovan, 2010). Roberts (2011) postulates that the curriculum needs to be scaffolded to expect deep learning to take place in the classroom. Teachers need to plan learning activities that will reach students in the way they want them to understand (Biggs, 1999). Research indicates transferring control of the learning process from the teachers to students is probably the best way to construct, high-quality learning activities (Vermunt, 1998). Learning must have meaning for the students and teachers must make the lessons mean something to engage students (Shearer, 2018).

Conclusion

If there were a quiz on this reading, what should be included? If readers knew there were questions about names, facts, and details, they would read to look for these things and possibly miss the main point. However, if the reader knew the expectations of the quiz were to explain the main point and suggest application of that point, the reader would have a different experience while reading, a deep learning experience. If a student asks: "will this reading be on the test?" then a teacher focusing on deep learning might reply: "what concept in the reading do you feel should be incorporated in the test? That will be the question on the test."

Teachers really do make a difference. They can use teaching techniques that utilize all four major areas of the brain to help stimulate deep learning in the minds and lives if their students. As teachers stimulate the minds of their students, these students will experience more moments in class that will change who they are, how they think, and how they feel. They will experience deep learning.

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Interactive E-Learning Courseware for the United States Coast Guard Aviation Pilots

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Abstract

The United States Coast Guard is a unique blend of cultures comprising military, law enforcement, humanitarian efforts, regulatory, and diplomatic capabilities. E-learning content that is culturally-situated to this population must be effective and timely because large amounts of learning content and training is condensed into a short amount of time. Interactive Courseware (ICW) is used to support training and development of the USCG. This proposal consists of four strategies that can be implemented when creating training modules in Articulate Storyline that can be adapted to suit the military culture of the USCG Aviation Training Center in Mobile, AL.

Interactive E-Learning Courseware for the United States Coast Guard Aviation Pilots

The United States Coast Guard (USCG) is one of five military services that exist to defend and protect our nation. This military, multi-mission, maritime force offers a unique blend of cultures that include military, law enforcement, humanitarian efforts, regulatory, and diplomatic capabilities (Auxiliary Leadership Development Program, n.d.). The purpose of this proposal is to showcase the research in revising e-learning courses to meet the unique learning needs of Coast Guard aviators. It is appropriate for a roundtable discussion as immersive and interactive e-learning modules adapted for military culture will be included as part of a small group discussion regarding the pedagogical strategies utilized in revising learning content for USCG pilots.

To support training and development, Interactive Courseware (ICWs) modules will be created using Articulate Storyline. The training technology courseware for computer-based training and instruction incorporates expert knowledge with multimedia instruction delivered in CD form or are installed as software on desktops in the training facilities. The ICWs convey instructional content and relies on the learner's interactions to determine the pace, sequencing, and content of instructional delivery (Tsai, 2018). At the USCG Aviation Training Center (ATC) in Mobile, AL, the ICWs are used in combination with classroom instruction, performance based instruction, and practical application in simulators and aircrafts. The USCG ATC has taken on an intern to make recommendations for incorporating instructional strategies adaptive to military culture into the ICWs, as well as assist in designing and developing those ICWs. This will increase the hybridization of multiple instructional approaches for better learning retention and stronger recall when needing to make decisions in split-second, life-saving situations.

The unique military aviation culture must be noted when deciding on the instructional approaches to incorporate within the ICW. The USCG aviators are highly competitive and the trainees are motivated, high-performing individuals. Due to the criticality of USCG aviation missions, recall of important information accurately and quickly results in better flight safety in dangerous events. The training period for the aviators of CG pilots ranges from 30-45 days of intense performance based training. Ten of those 30-45 days will involve the ICWs and face-to-face lectures. Therefore, consideration of time and cognitive overload is imperative when employing instructional strategies for this culture. Evidence-based strategies I would be utilizing for the USCG ATC would include microlearning, gamification, and knowledge checks.

Microlearning

Microlearning is one of the most beneficial strategies to use for ICWs. The content-heavy ICWs will be divided into micro lessons with more interactive learning content, and only include the necessary information that would supplement lectures. Breaking content into smaller units makes transfer of learning 17% more efficient than traditional longer-duration courses (Armstrong & Sadler-Smith, 2008). Microlearning is a more successful alternative to traditional e-learning courses because it allows learners to digest content quickly, multi-task between other activities, and the learn through an adaptive experience that can be customized to their needs in a more digestible format (Gutierrez, 2018). While operations manuals contain important learning material, their format can contribute to learner disengagement. With engaging, media-rich modules that can be delivered in three to seven minutes, learners would be more successful in recall as this matches the working memory capacity of humans and avoids cognitive overload (Torgerson & Iannone, 2019). When a trainee's everyday job is made up of highly dangerous situations, several lives depend on accurate and timely recall and reinforcement.

Gamification

Gamification strategies would be another effective technique to engage learners with immersive learning experiences since ICWs contain content that supplement lectures and are employed before utilizing aircraft simulations as part of training program. Gamification applies game-design thinking for non-game applications to improve engagement and effectiveness in already high-performing learners (Pandey, 2018). This strategy plays into the competitive and motivated personalities that are highly characteristic within the aviation culture of the USCG. Gamification provides instant feedback for learners, which facilitates better knowledge retention. In addition, gamification techniques can prompt behavioral changes in learners by leveraging their natural desire for learning, mastery, achievement, and closure. Increasing engagement and positive learning experiences through rewards such as points, achievement badges/levels, and progress bars, will capture and retain learners' attention (Pandey, 2018). These techniques will not only challenge learners, but it will also teach them as well.

Some gamification techniques useful for the USCG culture include:

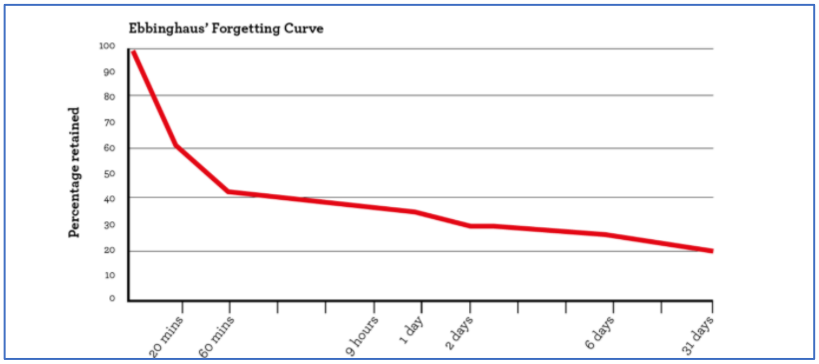
1. induction programs that serve as on-boarding training to reduce stress and anxiety
2. professional skills enhancements such as mapping real life challenges they would face in the field to measure proficiency

3. rewards and recognition using point systems, levels, or leaderboards to create a sense of progression and accomplishment

Gamification will provide aviators the opportunity to employ their knowledge in valuable experiences with immersive learning activities to aid them in solving real-world challenges in a low-risk environment.

Spaced repetition

Studies have shown that people forget 50% of new information within the first hour, and 70% of new information within 24 hours of exposure (Stahl et al., 2010). Considering the training intensity of the USCG and today's digital world, aviators are exposed to constant slew of new information from phones, computers, and other classwork multiple times throughout the day. As time passes, people are likely to forget information that is not frequently used (Murre & Dros, 2015). Spaced repetition can be used as an effective technique to bypass Ebbinghaus' Forgetting Curve (shown right) because it reviews content in gradually increasing intervals to aid in learning and recall. By teaching and testing the same information frequently over time, the retained information eventually becomes part of long term memory. This technique efficiently organizes information, which results in near perfect recall. Spaced repetition, in combination with microlearning, will help aviators conquer the Forgetting Curve in their fast-paced training period and high stress, intense environment to learn the latest skills and knowledge with strong recall where every passing moment counts.



Knowledge Checks

Research comparing online and traditional course delivery methods has revealed that online course delivery is superior to traditional delivery in terms of applied learning and process of knowledge transfer by developing skills from classroom knowledge to real-world circumstances (Hansen, 2008). Utilizing knowledge checks would give learners the opportunity to gauge how well they are learning the content. For example, knowledge checks could take the form of infographics, interactive quizzing, or mini-scenario based multiple choice questions. The benefit of knowledge checks is the instant feedback learners receive, allowing them to explore correct and incorrect choices, while gaining valuable feedback about each choice through formative assessment. For the ICWs, it is important to build interactive knowledge checks that bring static content to life to help the learners gain confidence and familiarity with the content before proceeding through the course lectures and simulations (Hansen, 2008).

Conclusion

Documentation of approaches to e-learning and the tools needed for a learner-centered paradigm are much more prevalent in primary, secondary, and higher education as opposed to military training settings. Due to the disparities in goals, outcomes, and performances of what was learned, the mission and purpose of education compared to military training have fundamental differences that require distinctive approaches. What may successfully work in education, may not yield the same results when used in a military environment where time is of the essence. Shifting the content of ICWs to effective learning experiences, rich with engagement and interaction, places greater responsibility on the trainee to learn facts, procedures, and complex skills in high-risk, critically hazardous events. Text dominant ICWs can be effectively adapted to military culture by utilizing instructional techniques, such as microlearning strategies, gamification principles, spaced repetition, and knowledge checks to create efficient learning experiences that keep USCG pilots engaged and immersed with the content.

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GOOGLE MY MAPS AS A CONDUIT TO CULTURALLY RICH LEARNING EXPERIENCES

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Introduction

The research[1] aims to understand the potential of mobile communication, and how technologic events are part of our culture. Practices of in-service teachers with mobile devices and apps are analyzed to create an integrative project that intersects technology, communication, culture and the art in education. The research-training in cyberculture (Santos, 2019) is a methodology designed in the crossings between educational processes and scientific investigation. The context is always the teaching, not isolating teaching from research and extension, which means, when there is an educational ambience proposed by the teacher, they are researching the educational movements that happen.

The context of the study is the course “Teaching Education for Communication, Culture and Art”, offered by the Federal Institute of Rio de Janeiro in Belford Roxo campus, Brazil. Research participants are teachers from the Metropolitan region of Rio de Janeiro, specially from Baixada Fluminense in Brazil. The Baixada Fluminense region’s population is about three million located in the periphery of Rio de Janeiro. The region has a reputation of poverty, crime and social injustice. In this study there here were 52 participants in total, between 23 and 58 years old.

It’s up to the teacher to take experiences and repertoire to enrich the artistic and cultural knowledges of their students. In order to deconstruct the discourse that in the Baixada Fluminense there are no points of culture, one of the results of this study was to expose experiences in diverse educational contexts with schools, artistic expositions, memory institutions, cultural centers, patrimony, recognized cultural manifests as immaterial patrimonies, social movements and diverse public and private segments of the cities.

This study changed the teachers’ perceptions towards culture and to the value of the multiplicity of cultural expressions in Baixada Fluminense using Google My Maps (https://www.google.com/maps/about/mymaps/). From those experiences, one action have been designed: the collaborative map, with curation of educational webs in the cities of Baixada Fluminense in Google My Maps. Technology contributes to the sharing of narratives and guarantees the continuity of the learning experience itself and gaining new meanings.

This study addresses the teachers’ perceived lack of access to the cultural assets in Baixada Fluminense in particular in the peripherical regions of the city. The opportunities of

[1] This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES - Finance Code 001) and in part by Federal Institute of Rio de Janeiro.

contact with the culture and art can occurred in many school visits and encouraged the teachers' development of pedagogical practices that emphasize the diversity of cultures and multicultural communities.

Research-training in cyberculture

Research-training is a methodology created by Josso (2004) for the development of a "theory of education" (Josso, 2004, p. 213) in which people are educated in the use of the autobiographic approach. It aims at understanding the knowledge produced by the experiences of the subjects at implying, transforming, and getting to know themselves in the autobiographical work.

The research-training in cyberculture is a method that researches the/in cyberculture, as it triggers ambiances and devices which are correspondent to online education, trying to understand the phenomena in cyberculture. Inquietudes generate study questions, which are transformed into educational processes and research devices in order to meet the data that allows a better understanding of the object that one intends to research.

According to Josso (2004), the research-training is funded in the life stories as project of knowledge and education, whose methodological path is the narrative of life experiences and education for the understanding of the educational experimental processes which are affective and reflexive. Narratives of such nature are fundamental for the present research.

"The position of the research-training differs or not, and in what terms from the position of the occasional learner-researcher?" (Josso, 2004, p. 214) The researcher is not placed as a specialist or superior, looking down from above at the object of study; and the performer is not in a crystalized situation as a student, they learn and teach. Their narratives are valued in the same horizontality of the bibliographic analysis, providing plural understandings to the phenomena studies.

Thus, research-training in cyberculture (Santos, 2019) is created as a method of research that considers an intercritical intervention for education, allowing to be perfectly applied to the education of teachers. A research implied with the demands of education, with the eye that considers the practical knowledge of the social group in the institution routine more relevant than the "specialists that come from outside of the ambiance of the group, the community or the institution" (Macedo, 2010, p. 160).

The teacher-researcher is the one constantly thinking about their practice, as stated by Freire (1996):

> There is no teaching without research, nor research without teaching. These doings find embodiment in each other. While I teach, I keep on searching, re-searching. I teach because I search, because I asked and wondered. I research in order to verify, and verifying, I intervein. As I intervein, I educate and educate myself. I research to know what I don´t know yet, and to communicate or to announce the new. (Freire, 1996, p. 29).

One of the authors of this article is a faculty member at the Distance Education and Educational Technologies of the Federal Institute of Rio de Janeiro, Brazil and the instructor for "Teaching Education for Communication, Culture and Art". Google My Maps was the technology used that made possible to create, edit and share personalized and collaborative maps online. As a repository for storage in the cloud, it allows the organization of different maps created or altered, with the addition of points, drawings, texts, photos and videos. It also allows teachers to save maps available on the internet, search for places, add favorite points and import maps based on spreadsheets.

Collaborative map in the Baixada Fluminense cities: curation of educational webs and urban micronarratives

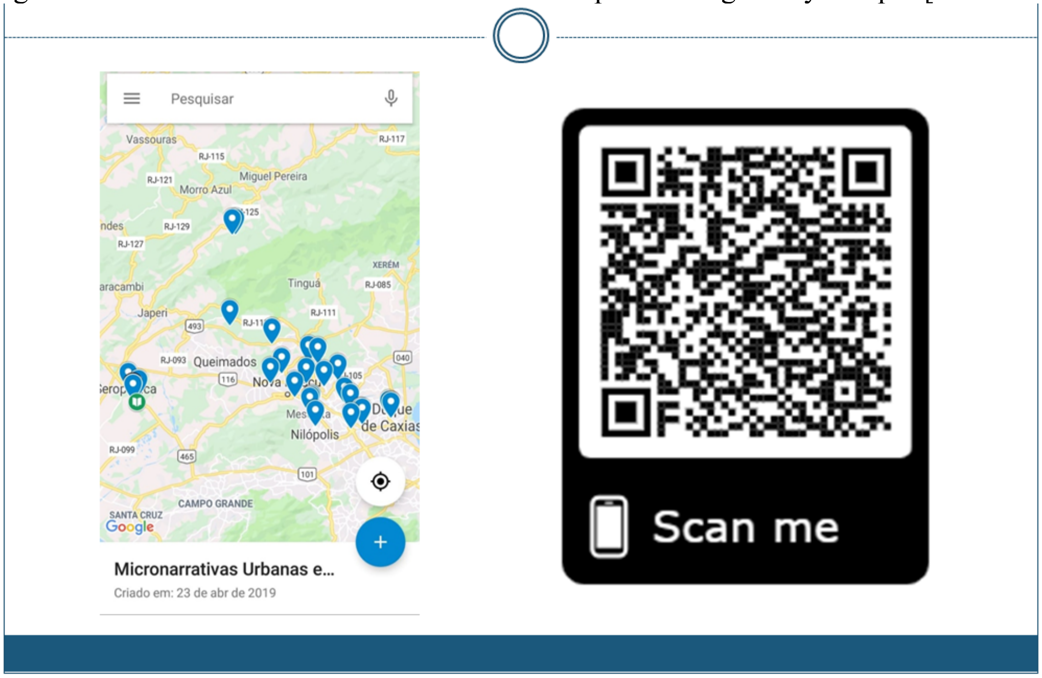
Lefebvre (2010) ponders on the urban problem, contextualizing the industrialization processes close to the world urban centers. He reflects on how the working class was expropriated from the city context, removed to suburbs and peripheries or new cities, to give way to a sovereign elite. “As urban democracy threatened the privileges of the new ruling class, it prevented this democracy from being born. How? Expelling the proletariat from the urban center and the city itself, destroying ‘urbanity’.” (Lefebvre, 2010, p. 23). In this way, in addition to basic rights, urban awareness and creative capacity decrease significantly.

However, for Lefebvre (2010), the city is not determined, static, it is the object of constant changes. Since it is impossible to reconstruct the old city, it is necessary to promote the construction of a new one, to move towards a “new humanism” (Lefebvre, 2010, p. 108), with new human beings and praxis. Transformation is urgently needed, undoing dominant strategies with a revolutionary urban revolution contrary to what is set by the working class. "Only the social force capable of investing itself in the urban, in the course of a long political experience, can be in charge of carrying out the program related to urban society" (Lefebvre, 2010, p. 115). To think about this transformation, the present study is carried out and educating cities are presented as a possibility.

Canclini (2015) highlights the importance of the study of cultural patrimony as a space of fight and memory “even if the patrimony serves as a tool to gather each nation, the inequalities in its formation and the appropriateness demand to study it as a space for material and symbolic struggle among classes, races and groups” (Canclini, 2015, p. 195). Despite of the highlight to the necessity of such study for a wide comprehension of formation, such speech is not constantly seen in Brazilian schools.

In this project teachers mapped the educational possibilities of the periphery and pedagogical itineraries that could be traced and experienced by citizens. The term “mapping” refers to a human capacity, while a map is a graphic object. And collaborative means that the curation was accomplished by everyone working together. Teachers included points they visited, with photos, descriptions and educational proposals. Twenty-five points were included, such as community libraries, theaters, museums, cultural centers, schools, community entrance exams, coworking spaces and universities. See examples on Figure 1, 2 and 3.

Figure 1 – Screenshot of a collaborative map at Google My Maps [in Portuguese]

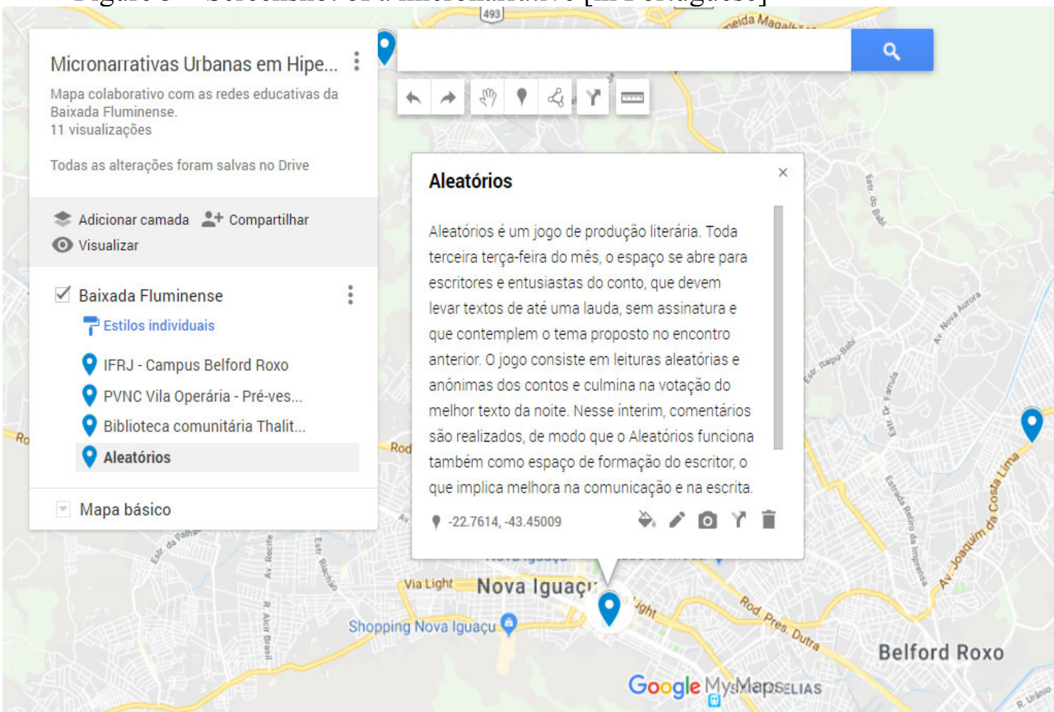


Source: produced by research participants.

Figure 2 – Screenshot of a micronarrative [in Portuguese]

Source: produced by research participants.

Figure 3 – Screenshot of a micronarrative [in Portuguese]



Source: produced by research participants.

The relevance of the essay is found in the disclosure of educational webs (Alves, 2007) in Baixada Fluminense, an area that is out of the great axes of communication, culture, art and education in Rio de Janeiro, being justified by the need to share experiences and understanding how education happens in the cities in times of cyberculture.

The notion of urban micronarratives in hypermobility emerged from a gathering of readings, everyday experiences, and narratives of research practitioners. The term "micronarratives" (Jacques, 2012) does not refer to narratives that are small or diminished in value, but the narratives of ordinary practitioners in cities (Certeau, 1984), those who experience daily practices, tactics, uses and craftiness, with which they resist authoritarian mechanisms and dominant strategies.

> These errant narratives are minor narratives, they are micronarratives in the face of the great modern narratives; they emphasize the issues of experience, body and otherness in the city and, thus, reaffirm the enormous power of collective life, a complexity and multiplicity of meanings that confronts any "single thought" or consensus, such as that promoted today by luminous media images and spectacular cities (Jacques, 2012, p. 20-21).

Jacques (2012) understands that in addition to experiencing the city, practitioners must transmit these experiences through their micronarratives, advancing from lived experiences, to shared, transmitted and collective experiences. To this author, the micronarratives can be realized in different formats: "artistic urban narratives – literary, ethnographic, photography, cinematography, musical, cartographic, etc. – realized by the wanderers from their experiences of wandering around town" (p. 30). Being with all the senses in alert, practitioners can share scents, sounds, looks, contacts, touches and different tastes, in individual and experimental meanings.

The notion of hypermobility was created by Santaella (2013), that says: “hypermobility is the physical mobility plus the mobile devices that give us access to cyberspace” (p. 15). It provides the creation of fluid and intersected spaces from the connection, in the displacements, in all daily spaces, in transit, at home, at school, in the cultural equipment in the cities (Martins; Santos, 2019).

In this way, we understand the space in agreement with Santos (1996, p. 63), who proposes the geographical space being “formed by an inseparable, solidary and also contradictory set of systems of objects and systems of actions, not considered in isolation but as the unique framework in which the story takes place”. Approaching walks in the city from the various possible interlaces, we explore contents not only directed to communication, culture and art, but to the knowledge of the different spaces, the different people, the different paths we travel, contributing to the citizen formation. The difference and the coexistence of multiplicity in cities is a power that cannot be forgotten to think about education, in this respect Rios (2012, p. 167) asks: “why build learning strategies with their backs to this universe that sticks together?”

The city has an educational nature, at every moment new educational scenarios are instituted in the complex urban plot and we need to explore this to promote other perspectives in education. Teachers can be artisans in the construction of the city as an educational space, proposing pedagogical practices in their educational daily lives, which include the school-city-cyberspace interface in their curricula. And also, from the perspective of their training and their willingness to learn and teach, as research practitioners did. According to Rios (2012), we cannot ignore the city experiences. In displacement, we observe, but also intervene, making proposals for pedagogical practices throughout the city, contributing to the resignification of education and the city itself, according to the micronarratives below.

Figure 4 – Example of teachers’ reflections

Julio: Google maps is a very intuitive tool for those who are already familiar with the virtual structure. I was surprised by this curation function, the user can make travel itineraries. The mechanisms of virtual georeferencing are extremely important, to work on the issue of urban, rural, local, global, gentrification, conurbation, territories, limits, networks and among other geography themes. I will contribute to the formation of new individuals who are not afraid of the new and different, in this way, subjects about art, culture and communication will be more palpable for different realities in which these devices can work. I visualize the use of this resource at the time of the execution of didactic activities, because in this way it will be developing new meanings for the elements that would be discussed in a classroom. Taking the city as an object, in which there is a cultural shock from different realities circulating in the same place, and from that we can learn more about the daily life and the development of solutions to different problems. In this way, contact with different cultures ends up expanding the individuals' world perspectives.

Thais: I believe that the use of the virtual space of the Google My Maps application was one of my greatest discoveries. I did not know this tool yet and I believe that, like the other colleagues, it effectively contributed to our training. The use of this type of technology that allows the insertion of "points" on the map, shows us how much we can be protagonists of our own cultural experiences. Places that, although public, are not popular and even unknown. From this, we can modify some teaching practices, both in the places where the classes we would teach would be held, and in the presentation of new spaces for students. I reaffirm the importance of this education outside of space, when I read Paulo Freire (1992) affirming that "the city is culture, it is creation, not only, for what we do in it and for it, for what we create in it and with it." We have a fundamental role in the environment of cities.

Source: produced by research participants.

From the teachers' narratives, several themes were identified: intuitive interface, curation, diverse cultures in the cities, local, global, gentrification, conurbation, territories, limits, networks, and protagonists of our own experiences, creations in and with the city. In addition, the use of Google My Maps contributed to collaborative experiences that did not end with the project presented in this article. The general public is also an author and who is including points, micronarratives and experiences around the city.

Teachers in this study were be inspired by practices gathered in Google My Maps and learned where to look for points of communication, culture and art in Baixada Fluminense to take their students without having to travel to the capital because of the teachers' perceptions that there is no cultural richness in their cities and local neighborhoods. And equally as learning designers have responsibilities as agents of change (Yusop & Correia, 2014). The realization and opportunities to recognize and celebrate local culture and art encourages practices that emphasize the diversity of cultures and value of multicultural communities.

Some notions themes emerged from the teaching narratives: the recognition that time-space is eminently educational, continuous learning, and a pedagogy that allows an increasing approximation between what is taught and what is learnt.

Rios (2012, p. 172-173) points out that "once this pedagogical journey is crossed, perhaps we can also undertake our own journey, trace multiple itineraries and find in the most unexpected corners of the city that we inhabit, a scene that allows us to develop our poetical and pedagogical imagination". When proposing pedagogical practices in the cities, the practitioners devised a course that goes beyond the limits of inside and outside school, proposing a practice that talks to the student in its complexity and completeness, whether to think emotions, or to think about the environment. They have proposed an effective action, in the territories where life happens, after all, the city is made up of those who inhabit it and those who inhabit it are also crossed by it, and to think in this way is to recognize the legitimacy of the knowledge produced in the different areas and spaces of life.

Paulo Freire (2013, p. 19) warns that "there is, therefore, no possibility of dichotomizing the man of the world, since there is no one without the other". When proposing that the construction of knowledge occurs through confrontation with the world, Freire (2013) inspires us to encourage a curious attitude of the subject towards the outside, in a constant search for creating and transforming what is set. We learned from the transforming relationships between men and the world, in a bidirectional action, human beings are transformed in the relationship with the city, which is transformed from the new actions of these human beings, that is, both are transformed in this reciprocal and dialogical. Therefore, believing in education in cities is a necessity.

Opportunities for producing culture and art can occur during school days, in the classrooms, with didactic, paradidactic books and other sources of consultation made official by formal education institutions. However, nothing beats the feeling of belonging and experiencing the city, the experience of feeling, touching and being touched. This kind of experiences can help us to think of cultural heritage as a space for struggle and memory, with power to reinforce the importance of integrative learning.

Final remarks

We understand that education occurs from different time spaces, not just the school. From a multiplicity of productions, we learn and teach, expanding the possibilities and knowledge, occupying other spaces in the city. From this proposal, we recognize the existence of other educational spaces, promoting a meeting between different territories and education, originating urban micronarratives in hypermobility, in different formats: imagetical, text, mapping, among others.

In this study we comprehended the experience in the city through Google My Maps as an opportunity for learning and teaching, where culture pulsates, citizenship is expressed and technologies are created. Multiple reflections are raised from the teachers' micronarratives, especially the importance of the school-city-cyberspace relationship. Teachers' micronarratives express their sense of belonging to the Baixada Fluminense city, commitment to the collective and the need to learn or relearn how to reinvent the city that shapes and transforms its citizens.

The sharing of narratives guarantees the continuity and new meaning of their own experiences, stories to be told, so that the perception that "nothing ever happens here" that is often voiced about the Baixada Fluminense city might gain new meaning. The use of Google My Maps was critical to overcome this cultural misconception and contribute to culturally rich learning experiences that recognizes local neighborhoods as cultural epicenters.

The proposal outlined in this article seeks to present some actions and teaching perspectives regarding education in the city. In a perspective of a training that comprises educational paths beyond the walls of the school, the city and its territories act as a reference for pedagogical proposals by interested teachers with the integral training of their students, connecting experiences from different areas of knowledge to everyday life.

We hope that the continuing education of teachers reported in this article will inspire other practices. Without intending to indicate recipes, we leave clues to captivate the reader for this subject that we consider to be of great importance. May more and better experiences happen, and other stories be told, so that speeches like "nothing happens here", which we hear about the education and culture of the Baixada Fluminense are reframed.

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A New Typology of Communication Configurations: Building Blocks for Lesson Design

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Abstract

Following a review of the literature on classifying teaching-learning arrangements, conducting a conceptual analysis of the basic elements of instruction, and carrying out a conceptual synthesis, the authors propose that the basic elements of instruction—learner, facilitator, resources, setting, and communication pattern—can be combined into eight different configurations, comprising a typology that encompasses all of commonly used arrangements for teaching and learning in face-to-face instruction, in online instruction, and in every other type of organized instruction. The eight communication configurations are: Presentation, Demonstration, Whole-Class Discussion, Small-Group Discussion, Tutorial, Repetition, Study, and Expression.

Review of Literature on Classifying Teaching-Learning Arrangements

In one of his early books, Robert Gagné proposed a typology of what he called *modes* of instruction (Gagné, 1965). Gagné (1965) outlined six different *modes* of instruction: tutoring, lecture, recitation, discussion, laboratory, and homework. Gagne himself did not pursue this idea in his subsequent work.

Later researchers, such as Ivor Davies (1981), David Berliner (1983), and Susan Stodolsky (1988), also proposed classification schemes for what they termed, respectively, as “methods,” “activity structures,” and “instructional formats.” None of these was based on a systematic definition of its elements nor did they specify the basis used for classifying activities into different categories. Further, all of them were developed before the era of distance education, and so were focused on the sorts of activities that take place in face-to-face (F2F) classrooms.

One of the authors began working on this problem early in his career and continued to return to it as a topic in classes he taught in instructional design; see, for example, Molenda (1972). It was not until distance education came into prominence that the flaws of earlier classification systems became apparent. The earliest form of distance education, correspondence study, consisted of little more than printed brochures sent through the mail, for the student to read and respond to study questions or quizzes, which were graded and returned in the mail. The next major format of distance education was “telecourses,” broadcast or closed-circuit television programs, coupled with print materials and tests. By the mid-1990s, online computer-based delivery became the norm—but the content tended to be audio or video lectures supplemented with textbooks or other print materials. What was new was that learners could now communicate easily and quickly with each other through discussion forums and with the instructor through forums, chatrooms, and email. In the U.S., government regulations specified that distance education required “regular and substantive interaction between the students and the instructor.” These developments placed a new spotlight on factors that had previously been lurking in the shadows—the importance of individual study and individual expression, in the form of answers to quizzes, oral or written exchanges with classmates, projects, and research papers. Plus the requirement of "regular and substantive interaction"—focusing attention on the flow of communication between and among students and instructors. These features may also appear in F2F instruction, but they tended to be overlooked because they normally took place *outside* the classroom.

The categories to be included in a comprehensive classification scheme of teaching-learning activities were now much clearer, but on what basis should the categories be defined?

Conceptual Analysis: Defining the Basic Elements

The authors realized that a sound classification system required a sound vocabulary of basic terminology. Consistency in the use of basic terms has never been a strong point of the literature of pedagogy. Even the term *instruction* itself has lacked a clear consensual definition. We propose the following definition, based on Gagné's focus on "conditions of learning." *Instruction* is a deliberate effort to provide learners with conditions suitable for achieving specified learning objectives; success criteria include being humane, effective, and efficient. Further, an *instructional event* is defined as any occasion during which one or more learners engage in purposive and controlled learning in some setting.

A review of recent findings of neuroscience—reported in detail in Chapter 3 of *The Elements of Instruction* (Molenda & Subramony, 2021)—led to the realization that even the concept of *learning* was open to new, more sophisticated interpretation. Researchers beginning with Kandel (2006) found that different types of learning follow distinctly different neural pathways, being received, processed, stored, and retrieved differently. For educators, the most fundamental distinction is between the unconscious, effortless process of *implicit* learning (acquired through everyday life experiences) and the conscious, effortful process of *explicit* learning (acquired through interventions proffered by instructors). The former could be termed *experiential* learning, the latter could be termed *instructed* learning. The analyses reported in this paper are focused on *instructed* learning, as most of the pedagogical literature and most of the conventional educational research endeavors have focused these processes.

Starting from this base, the Elements of Instruction Group, after a review and conceptual analysis of pedagogical literature, decided to base its terminology on the concrete entities that are visible during any instructional event: 1) a learner, 2) a facilitator, 3) resources, and 4) a setting, as described in detail in Molenda and Subramony (2021). Very simply, a *learner* is anyone who voluntarily enters into an instructional setting and participates in teaching-learning activities; a *facilitator* is a person or device that manages instructional events, selecting instructional objectives and methods, monitoring and guiding learner progress, and assessing achievement; a *resource* is any material or device that learners interact with during instructional events; they may be instructional resources or real-world resources. A *setting* consists of the physical surroundings in which the learner, facilitator, and resources interact.

The term *element* is used in chemistry to designate substances that cannot be separated into simpler substances; here *element* is used similarly—to indicate the simplest component of a complex whole, that "complex whole" being an instructional event. The fifth basic element of an instructional event is not a physical object, but it is observable—the communication pattern among facilitator, learner, and resources during the event. We refer to this pattern as a *communication configuration*—which we define as the pattern of the flow of information and control among learner, facilitator, and resources during an instructional event.

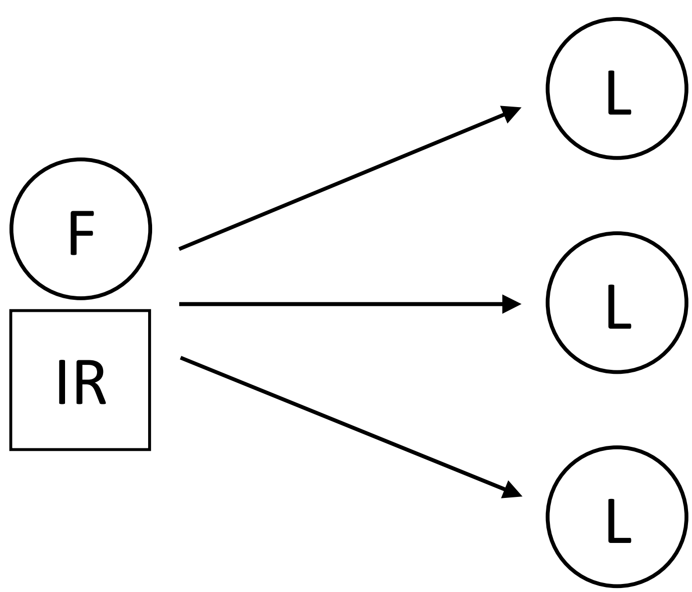
Conceptual Synthesis: Creating A New Typology

The Elements of Instruction Group proposes that the basic elements described above can be combined into eight different configurations, comprising a typology that encompasses all of commonly used arrangements for teaching and learning in face-to-face instruction, in online instruction, and in every other type of organized instruction. These eight configurations are: Presentation, Demonstration, Whole-Class Discussion, Small-Group Discussion, Tutorial, Repetition, Study, and Expression (Molenda & Subramony, 2021). Each has a distinctive pattern of information flow and control among learner, facilitator, and resources.

Presentation Configuration

In the Presentation configuration, a Facilitator (F), or some Instructional Resource (IR) playing the role of Facilitator, conveys information one-way to a number of Learners (L); the Facilitator or Instructional Resource controls the flow of communication.

Figure 1: The Presentation configuration



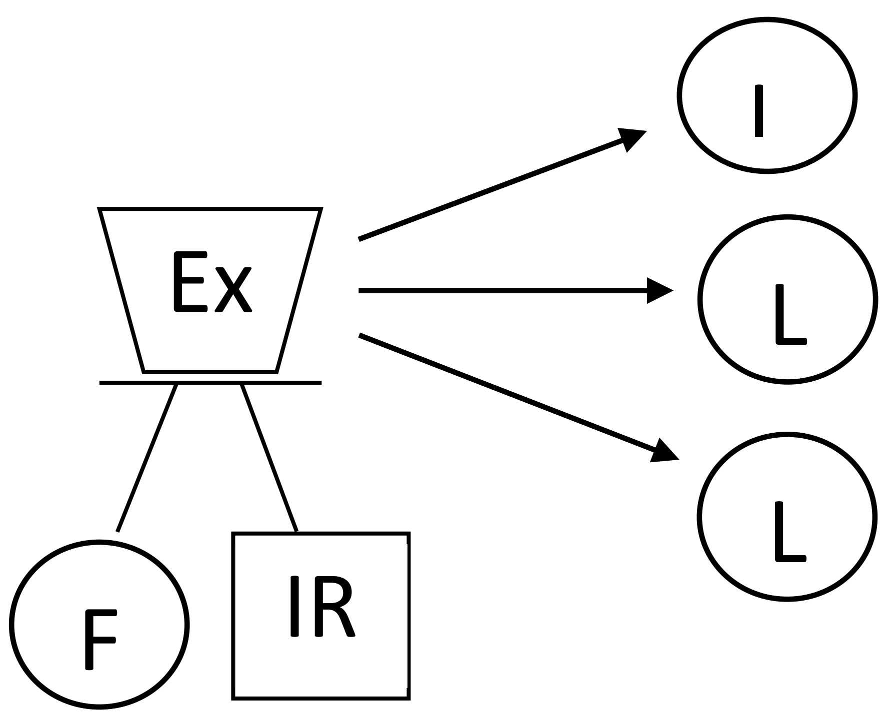
Examples of activities conducted in the Presentation configuration:

- A teacher giving a lecture in a normal classroom
- Audio or video clips inserted into a live presentation in a classroom
- A PowerPoint presentation given by a speaker in front of a live audience
- A lecture recital in a music hall—a pianist plays and talks about the music
- Instructional film or video shown to a classroom audience
- Panel discussions or debates conducted in front of an audience
- Didactic stage plays, e.g., the "morality plays" of the Middle Ages.

Demonstration Configuration

In the Demonstration configuration, a Facilitator (F) or some Instructional Resource (IR) playing the role of Facilitator displays and explains an Example (Ex) of some process, procedure, or other complex task to a number of Learners (L); the Facilitator controls the flow of communication.

Figure 2: Demonstration configuration



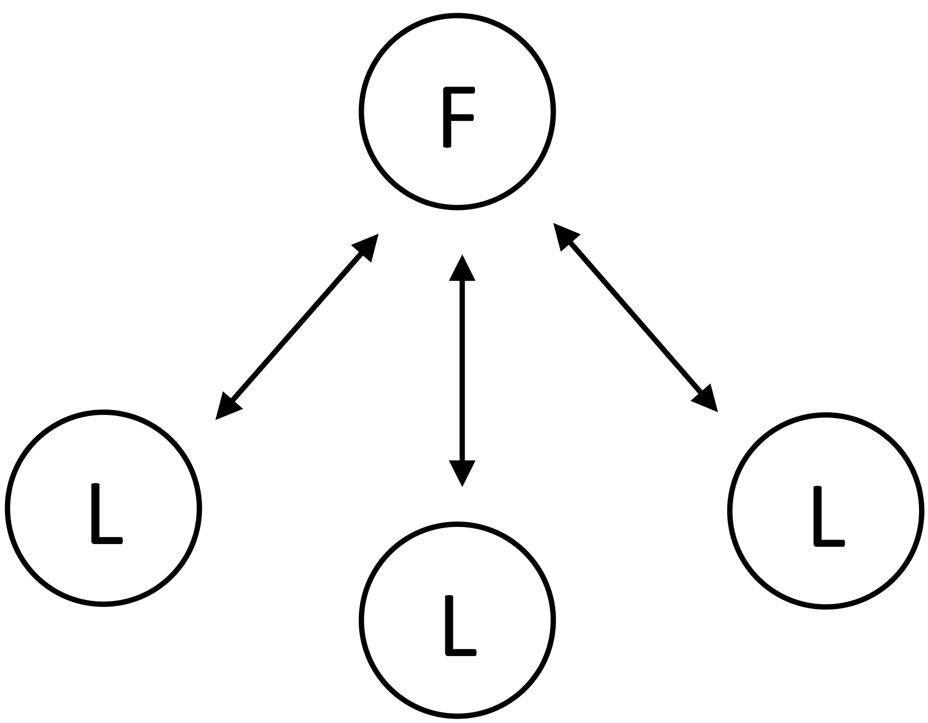
Examples of activities in the Demonstration configuration:

- Physics experiment in front of a class
- An oversize model of a clock to show hours & minutes
- A dynamic model of the solar system (orrery) showing planetary movements
- Role play of salesperson and customer conducted in front of sales trainees
- Historical re-enactments, e.g. Civil War battles
- Slow-motion video of proper free-throw technique
- Working math problems on whiteboard
- YouTube "how-to" video (some may call it a "tutorial," but it is demonstration).

Whole-Class Discussion Configuration

In the Whole-Class Discussion configuration, a Facilitator (F) engages the whole class in a conversation in which Learners (L) take turns sharing information and opinions, with the Facilitator remaining at the center, setting the agenda and controlling the flow of communication.

Figure 3: Whole-Class Discussion configuration



We distinguish Whole-Class Discussion from Small-Group Discussion because they have significantly different patterns of information flow and control. The most important difference is that in the Whole-Class Discussion the teacher or moderator remains in control. In effect, all audience members' comments are directed to the chair, who decides how to respond and what to do next.

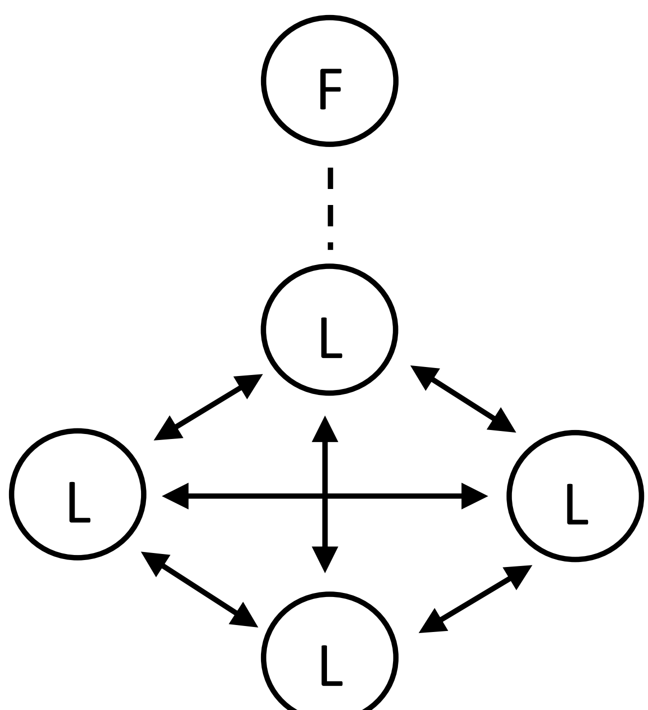
Examples of activities in the Whole-Class Discussion configuration:

- Seminar having open discussion with students guiding the discussion
- Class interaction during a pause in a lecture, e.g. brainstorming session during a lecture
- Debriefing discussion following play of a game or simulation.

Small-Group Discussion Configuration

In the Small-Group Discussion configuration, two or more Learners (L) exchange information and opinions without the intermediation of a Facilitator; a Facilitator may set the agenda and control logistics, but Learners control the flow of communication within the group.

Figure 4: Small-Group Discussion configuration



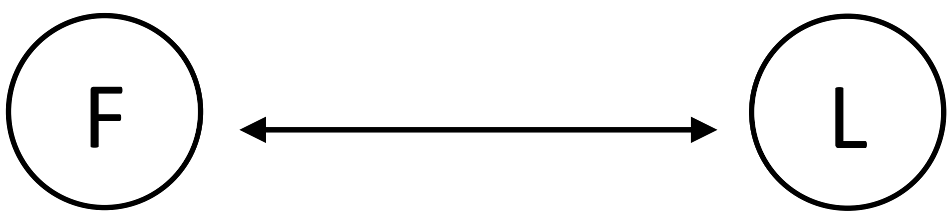
Examples of activities in the Discussion configuration:

- Buzz group or breakout session during a lecture
- Study groups, meeting live or over a Web application
- Web chatroom or discussion forum
- Dyads are also considered "small groups," e.g. "interteaching" method, "writing buddies," or conversation partners for language learning.

Tutorial Configuration

In the Tutorial configuration, a person or a device playing the role of Facilitator (F) interacts, intensively and substantively, one-to-one with a Learner (L) (or small group of Learners acting as one or taking turns); the Facilitator (tutor) and Learner (tutee) share control of two-way communication.

Figure 5: Tutorial configuration



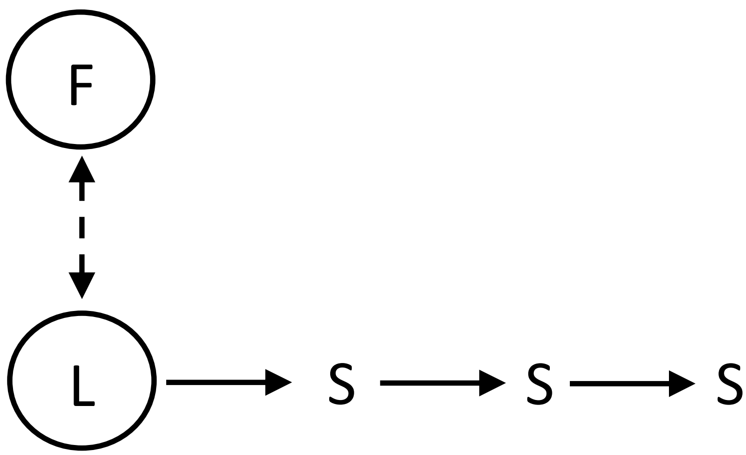
Examples of activities in the Tutorial configuration:

- Peer or cross-age tutoring
- Apprenticeship training or mentoring in the workplace
- Learner-teacher email exchanges of substantive content
- Athletic coaching, e.g., a personal trainer
- Intelligent computer tutoring systems with sophisticated response judgment and feedback capability.

Repetition Configuration

This category might also be labeled as "Practice," but that term has a more generic meaning, in that most skills—cognitive, affective, interpersonal, or psychomotor—require some sort of mental rehearsal or physical practice, but not necessarily repetitious rounds of practice, as is implied here. In the Repetition configuration, a Learner (L) performs repeatedly all or part of a specified Skill (S) in order to improve retention and proficiency. Learners may monitor their own performance, but it is often desirable to have a Facilitator (a coach) to provide corrective feedback.

Figure 6: Repetition configuration



Examples of activities in the Repetition configuration:

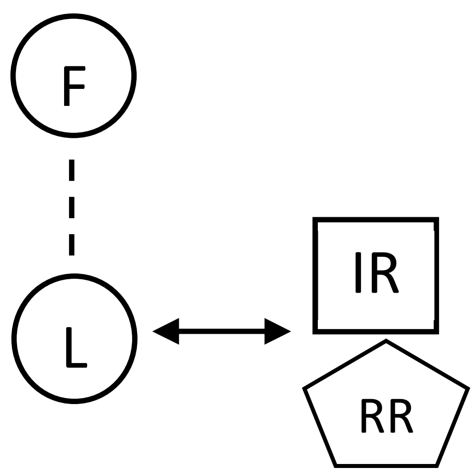
- Memorization drills, e.g. reciting multiplication tables
- Athletic practice, such as a volleyball practice session
- Written exercises, such as worksheets for math or language study
- Working as an intern or volunteer
- Conversation practice for language learning
- Games, e.g. "Math Blaster" that require repeated practice of a curricular objective
- Simulator practice, e.g., CPR with a manikin

- Most tests would also be examples of Repetition; the learner is applying the new knowledge or skill for evaluation purposes, but enhanced learning is another outcome.

Study Configuration

In the Study configuration, a Learner (L) interacts with Instructional Resources (IR), or with Real-World Resources (RR), or with their own inner resources, without the direct supervision of a Facilitator (F), but often inspired or guided by someone playing the role of Facilitator. The Learner is in control of events, deciding exactly what to do and when to do it.

Figure 7: Study configuration



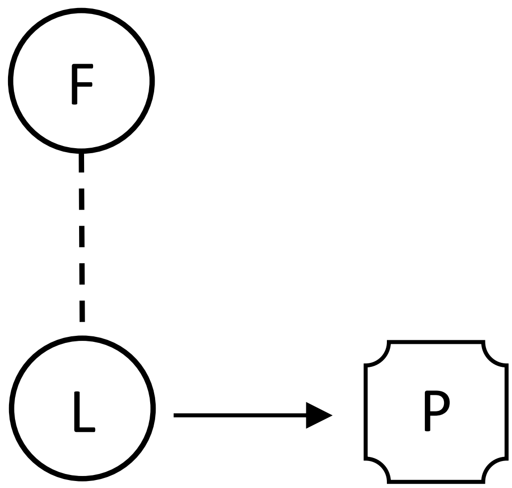
Examples of activities in the Study configuration:

- Reading a textbook (IR)
- Private listening to a podcast or video or slide set (IR)
- Reading a blog that is informative (IR) or that is an example to be critiqued (RR)
- Examining biological specimens under a microscope (RR)
- Analyzing architectural style of buildings while walking in a historic district (RR)
- Identifying artifacts at archeological dig (RR).

Expression Configuration

In the Expression configuration, a Learner (L) creates some type of tangible Product (P) in order to process some new knowledge or attitude; the experience may be structured and/or monitored by a Facilitator (F), but the Learner controls what is created and how it is created.

Figure 8: Expression configuration



Examples of activities in the Expression configuration:

- Writing a term paper
- Preparing a written or podcast book report
- Short reflection paper at end of class
- Writing a blog or memoir about one's experiences
- Creating a schematic diagram of a process
- Painting a picture using a new brush technique
- Sculpting a figure
- Designing a set for a theatrical play.

Communication Configurations as Building Blocks

Different Configurations for Different Stages of Instructed Learning

Any given lesson might combine different configurations to accomplish different stages of the learning process. Each instance would be like a photograph which, combined with others photographs, can constitute a movie of the lesson. Different configurations are suited to different steps in the process—gaining attention, stimulating motivation to learn, providing practice opportunities, and evaluating achievement of the objectives. For example, an elementary school teacher:

- holds up a jar containing a tadpole (Demonstration) and ask children to guess what it is;
- individuals call out answers (Repetition in the form of recitation);
- the teacher then states that the tadpole represents one stage in the life cycle of a frog (Presentation);
- using flash cards, the students then read new vocabulary terms in unison (Repetition);
- teacher projects images showing all the stages in the life cycle of a tadpole (Demonstration);
- as she points to each stage, students identify them in unison (Repetition);
- students work individually on worksheets, labeling the stages in the life cycle (Repetition);
- the culminating activity is a construction project: consulting a chapter in the textbook (Study) and using art supplies to create a frog life-cycle drawing (Expression).

Each Configuration Can Consist of Different Formats

As illustrated in the earlier discussion of communication configurations, any given configuration might be instantiated by a number of different media formats. For example, someone planning a F2F class may decide that a Presentation is needed to provide new information early in a lesson. They may choose among a live oral presentation, an audio recording of a lecture, an instructional video, a "chalk talk" with a whiteboard, or a panel discussion. In a distance-education course, the same Presentation need may be met by showing an existing video or a newly made audio or video recording.

Our contention is that different media formats are essentially fungible. As long as the format offers the affordances needed to convey that new information—say, diagrams accompanied by oral narration—it doesn't matter instructionally which format is chosen. One of the options may be readily available, while other options would be expensive or time-consuming to acquire or create. Different media formats offer time and expense trade-offs, but they are instructionally fungible. Thus, lesson design becomes simplified as what matters is selecting appropriate configurations for each step of the instructional process—a choice of one of eight configurations—versus sorting through scores of various media formats and teaching-learning activities.

Next Steps

The Elements of Instruction Group intends to continue to explore the applications of the Molenda-Subramony communication configurations to instructional design. Which configurations are best suited to what sorts of objectives? To what stages in the instructed learning process? What are the "best practices" for implementing each configuration, for obtaining the most "bang for the buck" when creating learning experiences within each configuration? Finally, we intend to return to the different types of learning and to explore the relationship of our communication configurations for the "conditions of learning" needed for *experiential* learning, an area that has burgeoned over recent concern for social and emotional learning (SEL), as discussed, for example, by Lopes and Salovey (2004). Much work remains to be done.

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Hierarchical Healthcare System: Measuring Pre-qualified Student Interprofessional Competency Through High-fidelity Simulations in Higher Education

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Introduction

Interprofessional education (IPE) in healthcare promotes interprofessional competency, which in turn increases team performance and positive patient outcomes. Further research is needed when combining IPE in healthcare with high-fidelity simulations (HFS) (O'Leary, Nash, & Lewis, 2015). Multiple studies have shown positive benefits such as increased teamwork and communication skills through the use of interprofessional learning within the high-fidelity patient simulation setting (Guraya & Barr, 2008; Smithburger, Kane-Gill, Kloet, Lohr, & Seybert, 2013). However, other studies have shown neutral to negative outcomes (Johnson, 2019; Reeves, Pelone, Harrison, Goldman, & Zwarenstein, 2017). Furthermore, IPE has received negative feedback from students in accelerated programs who were exposed to repeated high-fidelity simulations (Kaddoura, Vandyke, Smallwood, & Gonzalez, 2015). Due to divergences in outcomes and the hierarchical structure of healthcare, further research into the use of IPE in healthcare education through the instructional strategy of HFS is needed.

This paper explores the intersection of student interprofessional competency, views on IPE learning, satisfaction with interprofessional interaction, and thoughts about interprofessional collaboration HFSs. The exploration of these topics will include the theoretical underpinnings and their application over time and the relevance they still hold today. Topics will include the healthcare hierarchy, interprofessional teams in healthcare, interprofessional education in healthcare higher education, measuring interprofessional competency, simulation, learning, satisfaction, and collaboration.

Hierarchies of Healthcare

Healthcare of hierarchies are mainly built through licensures, certifications, governing bodies, and legislation to define standards in which a healthcare provider is designated into. Within the clinical setting there are established policies, procedures, and scopes of practice with the purpose of ensuring the best patient outcomes while mitigating legal liabilities (Weller, Boyd, & Cumin, 2014). Despite evidence-based research suggesting alterations are needed to longstanding policies, procedures, and scopes of practice, there remains a rigid system that providers are classified into; this leads to natural social affects to how healthcare providers are treated by adjacent professions (Shaw, Rees, Anderson, Black, & Monrouxe, 2018).

Research suggest social hierarchies can be viewed as simple to complex creatures, from instinctual animals such as birds (Price & Sloman, 1987) to the reasoning capabilities of primates (Weisfeld & Beresford, 1982). For humans, hierarchies can exist in various forms and arrangements of perceived value. This can include the concept of vertical and horizontal ranks and levels within a group of people or, in the case of this research, can exist within a team of student healthcare providers. During an interprofessional simulation the program of study places the student within the role of their future profession where a hierarchy of orders, decisions, and responses follow.

However, there are complexities to interprofessional clinical simulations that must be first addressed. An example of this are differing points in time of clinical exposure to clinical simulations by healthcare fields such as nursing, medicine, and respiratory therapy. Nursing and respiratory therapy majors are often well adapted to the interactive details of the clinical simulation environment long before medical students are introduced. Another example stems from how these professions are trained. For example, medical students tend to focus on solving a specific medical problem and not the more holistic approach from nursing students (Nyström, Dahlberg, Hult, & Dahlgren, 2016). When put together in a simulated environment, students often learn how differently other professions address patient care. This can lead to role insecurity and produce negative feelings towards IPE. With increased exposure and in-depth understanding of the clinical environment, medical students often grow into their leadership role. This assumed leadership role for medical students makes the simulation more realistic as it will mirror the real-world setting in certain respects. Senior nurses and newly minted medical students approach patient care differently due to differences in training and faculty guidance. IPE provides a mirror to the clinical environments that can help faculty and other educators to incorporate interprofessional competency skills required for high performing healthcare teams (Anderson, Jensen, Lippert, & Ostergaard, 2010; Baker, Day, & Salas, 2006; Leonard, Graham, & Bonacum, 2004).

Conflict within Hierarchies of Healthcare

Hierarchies in healthcare exist and so does the natural conflict that exist within these hierarchies that can unfortunately lead to poor patient outcomes. Incivility among healthcare professionals has been linked with a lowered clinical performance, safety risk for patients, and negative patient outcomes (Belyansky, et al., 2011; Katz et al., 2019). Multiple studies show detrimental outcomes to patients when conflict exist within the healthcare team (Gittell, Weinberg, Pfefferle, & Bishop, 2008; Lee & Doran, 2017). Disruptive intraoperative communication and conflict can be detrimental to patient outcomes (Belyansky, et al. 2011). It is this conflict within the hierarchies of healthcare that provides another key reason for research in this area. IPE HFSs attempt to mirror the environments these healthcare students will be entering into and allows students to develop and practice interprofessional competency and collaboration (Josi, Bianchi, & Brandt, 2020). It can be reasonably stated that IPE during pre-qualifying education could decrease future workplace conflicts created by miscommunication and general mistrust between the professions. If the healthcare team is not producing beneficial patient outcomes, then there is a dissonance with its very existence. To bring harmony to this dissonance it is crucial that early and continued opportunities are provided to healthcare students that adjust them to interactions with the multitude of healthcare workers in the clinical setting. IPE provides this opportunity for applied collaborative practice, a type of practice that can produce positive patient outcomes (Kim, Radloff, Stokes, & Lysaght, 2019).

The Need for Interprofessional Healthcare Teams

There is growing need for efficient, effective, and appealing interprofessional healthcare provider team-based models in the United States largely due to an economical supply and demand issue. On multiple levels, there are not enough healthcare professionals to address the current and increasing number of patients. One of the largest predictors of this shift is the aging population which is set to grow to about 69 million people by 2025 (Altman, Butler, & Shern, 2016). Older populations require more care due to natural aging processes, onset of chronic illness, and comorbidities which all demand increased amounts of healthcare expenditure to address in a holistic manner (Altman, Butler, & Shern, 2016). Current providers face additional stress from administrative pressures for positive Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey scores. This survey is provided to Medicaid and Medicare patients post-hospital stay. The federal government uses a Value Based Purchasing (VBP) program based on these scores in order to determine the reimbursement rate coming from the Centers for Medicare and Medicaid Services (CMS). Scores are also used to provide the public with a comparison between healthcare organizations through the Agency for Health Research and Quality (AHRQ). Depending on the scores, hospitals may be reimbursement in full, at a lower rate, or a higher rate (Shulman, Crowe, Hutzler, Karia, & Bosco, 2018). This ties together real or perceived positive patient outcomes with monetary reimbursement.

In order to attempt to meet these pressures and needs there has been a slow restructuring over the decades from (a) a healthcare system model where a physician makes the majority of the decisions one-on-one with the patient to (b) an interprofessional team-based care model where there is a larger team of a lower level providers that are managed by physicians. These mid- to lower-level providers can include nurse practitioners (NPs), Physician Assistants (PAs), Occupational Therapist (OTs), Physical Therapist (PTs), Speech Pathologist, Respiratory Therapist (RTs), Registered Nurses (RNs), Dieticians, and Community Paramedics who often have an increasing scope of practice and autonomy (Corso, Dorrance, & LaRochelle, 2018; Flaherty & Bartels, 2019). On a clinical level, allowing RNs and RTs practice to the top of their scope of practice decreases physician burden while allowing them to attend to the needs of higher acuity patients.

Further evidence of the growing need for a more rapid healthcare system change to the more interprofessional team-based model can be seen in the decline of medical school graduates who elect to go into primary care and emergency medicine. There are a multitude of reasons for these medical students to not elect to go into these professions. Of specific note is the increasingly higher student loan debt upon graduation, lower salary, and lower insurance/CMS reimbursement rates compared to other more specialized areas such as anesthesiology, gastroenterology, or orthopedics (Corso, Dorrance, & LaRochelle, 2018). Additionally, and sometimes of equal importance, the ever-increasing number of patient interactions to address, lack of work/life balance, lower patient satisfaction scores, and increased negative patient outcomes due to lack of resources. All of these contribute to physician burnout and lower retention rates (Corso, Dorrance, & LaRochelle, 2018; Flaherty & Bartels, 2019). This effect can be seen in the retirement-replacement ratio where there is currently a downward trend in the number of primary care physicians with around 8,500 retiring and being replaced by only 8,000

(Petterson, Winston, Tran, & Bazemore, 2015). Another projection for 2025 show a physician shortage in general in the U.S. of 61,700-94,700 (Altschuler, Margolius, Bodenheime, & Grumbach. 2012).

Due to lack of primary care physicians, mid- to lower-level providers in this hierarchal system have been trying to fill this gap and seizing this opportunity to increase their scope of practice and gain more autonomy. Reports from organizations like the American Association of Nurse Practitioners (2018) reported in 2017, 87% of NP students were in a primary care program while only 14.5% of newly graduated medical students entered a residency program focused on primary care. This skew towards primary care puts NPs in a position for continued employment growth where they could see more mid- to lower-level acuity patients while still under the direction of a physician or have "full practice authority" as they do in 20 states (Van Fleet & Paradise, 2015). Full practice authority simply means NPs do not have to practice under a physician. It has also been shown that NPs can handle 80 to 90 percent of cases conducted by primary care physicians (Mundinger, 1994). Therefore, in the 30 states where there is some level of physician oversight it is these two professions that must work well together. In all states, the vast majority of physicians and NPs will be working in interprofessional teams. Physicians are dominate in this hierarchy which sometimes cause conflict and lead to poor patient and professional outcomes.

Registered Nurses (RNs) are the largest licensed health professionals in the lower hierarchical levels addressing the increasing healthcare provider shortage in the U.S. As of 2011, there are around 3.7 million RNs and that number has grown to 3.8 million in 2017 with employment growth projections of 15% from 2016 to 2026 (Institute of Medicine, 2011; Smiley, et al., 2018; Tropey, 2018). RNs practice inside the hospital setting but also outside of it in areas such as home health, ambulatory care, public health, schools, long-term care, skilled nursing facilities, wound care, and hospice. Some have proposed that this group of healthcare professionals, in combination with other professionals, be used responsibly within the creation and establishment of the following: new protocols of practice, complex care management teams, coordination of services between primary and specialty, and a co-visit model with low to medium acuity patients with minor infections and illnesses that do not require a visit to a physician's office, urgent care, or an emergency room (Flaherty & Bartels, 2019; Institute of Medicine, 2011). This plan allows for physician supplementation need that can conceivably offset the increasing demand for patient care. However, implementation of this plan requires embracing of larger interprofessional teams and a culture of teamwork.

Additionally, there is an established positive correlation among interprofessional healthcare teams to increased job satisfaction, overall performance, and positive patient outcomes (Kash, Cheon, Halzack, & Miller, 2018; Janss, Rispens, Segers, & Jehn, 2012). The effectiveness in positive patient outcomes through interprofessional teamwork is further seen in the inclusion of pharmacist during hospital rounds. Hospital rounds are a dedicated period of time in which a healthcare team address complete care for each patient. It's been shown that the inclusion of pharmacists can reduce adverse patient drug reactions, resulting in positive patient outcomes (Kucukarslan, Peters, Mlynarek, & Nafziger, 2003).

The question then becomes what goes into the creation of positive healthcare interprofessional team interaction? The recent work of Josi, Bianchi, and Brandt (2020) suggests multiple factors that go into positive healthcare interprofessional team interaction and performance. These factors include conflict management, patient-centered care, communication, and role clarification. However, it is important to emphasize that out of all of the factors listed above from their study, role clarification was found to be the most important because when a person does not know their role and is placed in a teamwork environment, negative effects on interprofessional team performance has been observed at a significant level. Physicians who lack interprofessional competency may not speak up around nurses with more seniority (Markay, 2006; Sutcliffe, Lewton, & Rosenthal, 2004). Therefore, to create and maintain positive interprofessional interactions and team performance there must be careful consideration and purposeful regard to who is placed on that team. A healthcare team member who does not know enough about their role on the team will consequently be detrimental to that team. The question becomes is the lack of role clarification due to poor team onboarding, incompetence, or performance anxiety? Therefore, there is a need for continued research into interprofessional best-practices and delivery of instruction through HSF environments.

Interprofessional Competency in Healthcare

The section focuses on interprofessional competency and how it intertwines with IPE in the healthcare educational environment to make future effective, efficient, and appealing healthcare teams. High performing teams that improve patient outcomes, produce higher HCAHPS scores, and increase reimbursement rates commonly boost morale of healthcare teams and administration. However, to look at interprofessional competency it is important to step back and first look at interprofessional collaboration.

The need for interprofessional collaboration originates when two or more professions need to interact to achieve a common goal or objective. Most large organizations require multiple professions such as management, human resources, finance, accounting, and logistics working together to meet common goals or objectives. Meeting goals and objectives is important however, it becomes critical in professions that focus on healthcare and interpose immediate decisions that are often lifesaving in nature (Llewellyn & Skevington, 2015).

Interestingly, the origins of the term ‘interprofessional practice’ came from patient-centered healthcare and overtime has been applied in numerous other settings outside of healthcare due to its positive effects in training and performance outcomes (Giess & Serianni, 2018). One of these settings includes higher education. The encouragement of collaboration among students is not a new thing and has been talked about for some time. In regard to higher education, Chickering and Gamson (1987) provide seven principles of good practice in higher education that encourages cooperation between students and mutual respect. Successful cooperation suggests interprofessional competency.

To measure interprofessional competency it must first be defined, and then appropriate measurement instrument(s) must be found. Defining interprofessional competency can be difficult because the framework of knowledge and skills on display by any one healthcare discipline can be drastically different from one another. A working example of defining competency comes from researchers who studied the Japanese Association of Interprofessional Education (JAIPE) and then developed a framework (Haruta, 2018). This framework consisted of two core domains: “patient-/client-/family-/community centered” and “interprofessional communication” and four peripheral domains: “role contribution”, “facilitation of relationships”, “reflection”, and “understanding of others” (Haruta, 2018). Another example comes from a well-known interprofessional organization, the Interprofessional Education Collaborative (IPEC). IPEC’s Expert Panel (2011) states the following four interprofessional competencies:

"values/ethics for interprofessional practice", "roles/responsibilities", interprofessional communication", and "teams and teamwork".

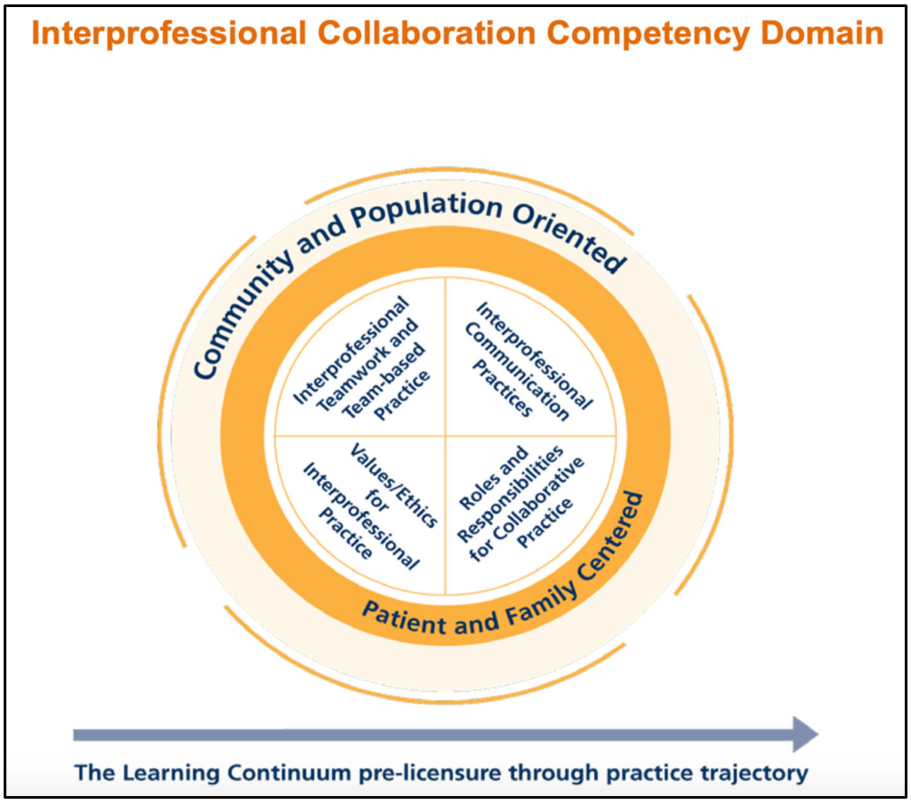

Figure 1. Interprofessional Collaboration Competency Domain (adapted from IPEC. (2016), "Core competencies for interprofessional collaborative practice: 2016 update").

Five years later, IPEC (2016) updated these interprofessional competencies for three reasons: (a) to reaffirm all four competencies, (b) to organize the four competencies under a single domain of "interprofessional collaboration", and (c) to achieve the Triple Aim of "improve the patient experience of care", "improve the health of populations", and "reduce the per capita cost of health care". Figure 1 from the IPEC (2016) update illustrates this singular domain and how the four competencies are to relate to one another which includes a trajectory for the pre-licensure learner.

All of the competencies mentioned above share very similar wordings and it is through that similarity that a search for an appropriate instrument to measure interprofessional competency was conducted. It was also important to keep in mind that the search for an instrument includes the need for it to be valid, reliable, and appropriate for statistical use and the population size.

Complex Adaptive Systems Theory in Healthcare

The application of a particular pedagogical theory has been an issue when it comes to interprofessional learning. A primary issue is the multitude of learning and performance contexts that needs to be taken into consideration throughout a simulated event. In healthcare environment there is often a level of culture shock and difference from the training environment to the workplace environment. It is a complex system that has increasingly been viewed through a variety of systems thinking lenses and social networks (Benham-Hutchins & Clancy, 2010; Nugus et al., 2019). Shepard and Burton's (2019) reviewed and evaluated the need for simulations in healthcare which resulted in the validation of a framework that follows a traditional ADDIE (analyze, design, develop, implement, evaluate) cycle.

There is an established link between a Strategic Operational Research model with a Strategy Development Process model though the use of Complex Adaptative Systems Theory in order to get a more holistic view of that system (Hammer, Edwards, & Tapinos, 2012). It may be possible to use Complex Adaptative Systems Theory to gain a more holistic approach to the development and improvement of interprofessional healthcare simulations HFSs. Below is a figure to be used as a visual guide to explain the application of Complex Adaptive Systems Theory.

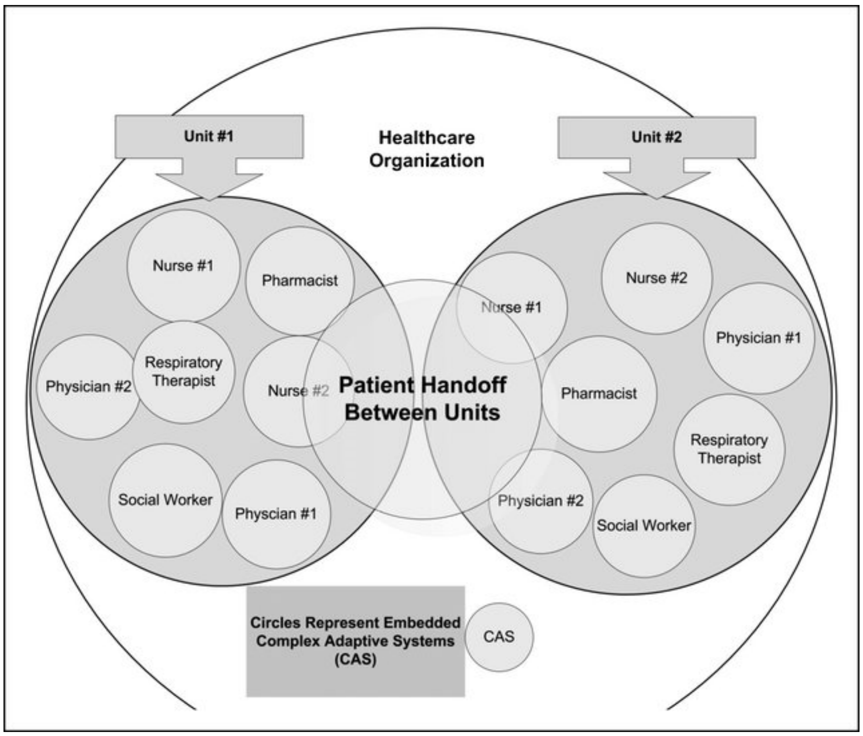

Figure 2. Healthcare organizations: Embedded complex adaptive systems (Benham-Hutchins & Clancy, 2010).

Figure 2 portrays the different parts of a patient hand-off between two units. An example of the above could easily be a shift change or a patient moving from the Intensive Care Unit (ICU) to a Critical Care Unit (CCU). There is a clear complex adaptive system and a patterned output which can be seen by the fundamentals of positive patient outcomes and the multiple interactions between all the facets in the system (Dodder & Dare, 2000). It is because of this that Complex Adaptive Systems Theory can be applied in the process of study and research of healthcare settings. Key characteristics of this theory include a large number of dynamic interaction where elements are constantly affecting each other, non-linear interactions, openness, constant energy, history, and most importantly parts of the system that aren't aware of each other. This can be summed up in the following properties: emergence, co-evolution, connectivity, nested systems, simple rules, iteration, sub-optimal, requisite variety, self-organizing, and edge of chaos (The Health Foundation, 2010). It is through the lens of Complex Adaptive Systems Theory that IPE HFSs can capture the highest fidelity and practical utility.

Interprofessional Healthcare Education

IPE in healthcare and the research behind it has over the last decade become better defined and validated. The standard accepted definition of IPE in healthcare was set by the World Health Organization (WHO) in 2010. It is as follows, "two or more professions learning about, from and with each other to enable effective collaboration and improve health outcomes." (World Health Organization, 2010). The primary purpose of IPE in healthcare has been to expose healthcare teams and students to the interprofessional teams they will be working with upon graduation. It is also worth noting the impact well researched and designed training can have in the healthcare setting (Rumball & Tober, 2013).

According to a systematic meta-analysis by Guraya and Barr (2008) IPE in healthcare promotes a positive outlook on other professions. Therefore, there has been a growing popularity to incorporate IPE into the healthcare education curriculum. However, it is important to note that that there are others that state there is no valid evidence to support the claim that IPE increases collaborative performance or improves health outcomes of patients (Reeves et al., 2017). This includes not creating a positive professional identity in the student before the introduction of IPE education can be detrimental and cause negative attitudes towards their own profession and others (Johnson, 2019; Stull & Blue, 2016). The manifestation of the lack of professional identity is seen in the interprofessional environment in which these students will enter upon graduation through the lack of role clarification which becomes detrimental (Joshi et al., 2020).

Simulation in Healthcare Education

Simulation as an instructional strategy has been in use in various forms of practice especially in the medical field for decades (Gaba, 2004; Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005). Simulations today can allow for a variety of situations including medical interventions being brought forth from interprofessional small groups (Bays et al., 2014). Multiple sources of healthcare literature and studies over the years has given the healthcare community a better framework and understanding of which to craft better and higher quality simulations (Jeffries, 2006). The primary purpose of healthcare IPE within simulations has not always been clinical competency but teamwork competency focused. The ability for the team to function took precedence over the quality of the clinical judgement. Over the past two decades there has been a remarkable increase in quality integration in terms of appropriate clinical judgements into the simulations. The definition of teamwork, what it means, and how it is enacted has changed and become a lot more complex through looking at it from a perspective of interprofessionalism (Pollard, Miers, & Gilchrist, 2004; Pollard, Miers, & Gilchrist, 2005).

High-Fidelity Simulations and the Suspension of Disbelief

There are some very important questions to ask when it comes to realism so good that a literal suspension of a student's disbelief occurs. In terms of HFSs, where is the balance to be as real as it can without doing harm to the participants? Suspension of disbelief and fidelity can be a very difficult thing to measure and there are various definitions that encompass a spectrum from low to high. A variety of sensory measures must be kept in mind and include auditory, visual, tactile, and olfactory (Cook, et al., 2012).

HFSs of patients present the healthcare student with a very realistic simulated environment to apply the knowledge and skill they've developed in a safe, no-fault environment. HFSs of patients have long been used by the medical community to help train students before they practice within the clinical setting on live human beings. To be successful in education through simulation there needs to be an understanding of the basics and how the simulation will match the learning and performance context as closely as possible.

The suspension of disbelief can be quite hard for humans when it comes to working on plastic/rubber manikins. It is possible to recreated faces and arms down to details such as pores on the skin, wrinkles, individual hairs, and various skin complexions. However, the cost to do this can be astronomical and increase the fears of cost that already exist when a program invest in HFSs. To overcome this, four themes that healthcare students identified that allowed them to suspend belief and they were: seeing beyond the plastic, knowing what to do, connection and care, and diversity (Power et al., 2016).

There is overwhelming support from students in regard to HFSs. For example, entry-level healthcare students have shown significant increases in skills and knowledge after going through HFSs and applying that practiced knowledge within the clinical setting (Jefferies, 2006). Additionally, there are significant increases in a healthcare students' self-efficacy and self-confidence in their ability to transfer that skill and knowledge from simulation to a clinical setting (Jefferies, 2005). Jeffries & Rogers (2007) state that fidelity and self-reflection are some of the cornerstones of healthcare simulation. This means there must be enough detail in the fidelity of that simulation that it stimulates the student to put together what they have already learned (Jeffries, 2005; Jeffries 2007). The positive effects of high-fidelity versus low-fidelity or paper/pencil can be seen in research that shows increased student performance and satisfaction with HSFs (Jeffries & Rizzolo, 2006). O'Leary, Nash, & Lewis, (2016) showed increases in student knowledge retention rates and self-efficacy while using HFS versus didactic presentations using PowerPoint.

Recommendations

There are drastic changes within the population of the U.S. and a global pandemic of COVID-19. Consequently, changes are being forced on our healthcare system that is causing a complex adaption to a more interprofessional team-based model in order to try to efficiently, effectively, and adequately care for patients. More research needs to look into interprofessional competency, complex adaptive systems theory, learning and performance context, high-fidelity simulations and suspension of disbelief. The following instrument of measure is recommended. The University of the West of England – Interprofessional Questionnaire (UWE-IPQ) (Pollard, Miers, & Gilchrist, 2004; Pollard, Miers, & Gilchrist, 2005) is a validated 35-item questionnaire made up over four scales. It measures communication and teamwork, interprofessional learning, interprofessional interaction, and the interprofessional relationships. The UWE-IPQ was validated and found to have a Cronbach's alpha in the 2004 study for the first three sub-scales scales of (0.76-0.84). for reliability multiple test were done and reported these three sub-scales at (0.77-0.86) with a p-value of ($p < 0.001$). The 2005 study included a Cronbach's alpha estimate for the fourth scale, interprofessional relationships at (alpha = 0.71) with a re-test reliability of (alpha = 0.83).

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Educational digital data analytics: Five research areas and Four Philosophical Divides

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Abstract

The growth of access to digital data in education has led to a massive increase in research utilizing digital data in education over the last several decades. Despite this growth, however, researchers remain unsure of the impact that learning analytics and other research areas are having on the educational landscape, or even how to measure this impact. This theoretical piece situates learning analytics within the larger research area of educational digital data analytics, summarizes different research within this larger research area, and offers a conceptual framework to situate different research within the educational digital data analytics research area that includes four philosophical divides. Suggestions are made for how this understanding of a larger research area within which learning analytics is a subset can be used to evaluate the quality and impact of research.

Introduction

Over the past two decades, the availability of big data has fundamentally transformed human consumption and analysis of information. This change has directly affected fields such as statistics and machine learning, (Gantz et al., 2012) as well as education. To accommodate the influx of digital data, new research areas and fields have been created within the educational research landscape. This is evidenced both by the rise of terms such as *educational data mining* and *learning analytics* (Sin & Muthu 2015), and by the creation of new research societies and journals such as the Society for Learning Analytics Research (SoLAR), and International Educational Data Mining Society (IEDMS). As this growth has taken place, criticism has also grown that this research remains unapplied in nature (Knight et al., 2019). This criticism suggests that there are two bodies of growing and related research: the more technical, mathematically focused research, and the more theoretical, educationally focused research (Xie et al., 2020**)**. It has been suggested that this split in the research has led to a lack of practical, applied, and evaluable learning analytics models (Baker, 2019).

While there is merit to these criticisms, much of this confusion may simply be due to a lack of agreement as to what the boundaries are for these new research areas. For example, one of the most quoted definitions of learning analytics is given by SoLAR. They define learning analytics research as "... the measurement, collection, analysis and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs" (SoLAR, 2019a para. 1) While this definition is simple in theory, in practice it does not accurately capture what is commonly considered learning analytics research. One issue is that this definition is too broad. It could be argued that much research in fields such as problem-based-learning, curriculum and instruction, and educational policy (Site

Justin) could fall under this definition. The Handbook of learning analytics further clarifies the boundaries of learning analytics by suggesting common methods and practices within the field (Hoppe, 2017), but no new definition is suggested.

The ambiguity of the definitions of learning analytics and related research creates confusion among researchers that inhibits the free flow of information throughout academic research. This theoretical piece suggests a new area of research: educational digital data analytics research. After briefly defining this research area, five prominent research areas that fall within the bounds of EDDA research are summarized. Next, four philosophical divides between these research areas are identified. Finally, this information is synthesized into a conceptual framework of the current landscape of EDDA research, and current gaps in EDDA research are described. The view of learning analytics as a sub-field of EDDA research may help to understand the true impact it is having on educational research, and the conceptual framework suggested allows for a common set of vocabulary that can be used to evaluate and understand all EDDA research.

Educational Digital Data Analytics Research

EDDA research is here defined as any educational research that utilizes digitally-collected data to understand and improve student learning. This data can be directly generated by students, such as when trace data is collected from a learning management system, or may be collected and aggregated by teachers and administrators. EDDA research has grown exponentially since computers with network-connectivity capabilities began to be integrated into education in the early 2000's (Hew & Brush, 2007**)** This growth in research has taken place in an organic, unorganized fashion (Calvet Linan & Juan Perez, 2015**)**. While this organic growth has allowed for unique ideas and multiple outlets for researchers, it has also led to a lack of cohesion and communication between researchers who may benefit from collaboration and greater awareness of each other's work. The idea of a single community of educational analytics researchers in education research is not common in the literature. Instead, literature reviews and meta-analyses focus on smaller groups of literature such as learning analytics (Avella et al., 2016), educational data mining **(**Dutt et al., 2017), and intelligent tutoring, (Crow et al., 2018) treating each as a unique and discrete research field. Each of these terms, along with its accompanying research society(s) and journal(s), represents a unique area within the EDDA landscape, all with their own philosophical and practical orientations.

Five research areas

Any simplification of the EDDA landscape will fail to capture all the opinions present in the literature. Not only are there thousands of publications each year that focus explicitly on EDDA, because the use of digital technologies such as learning management systems and computerized tests is common place in both K-12 and higher education, (Lochner et al., 2015) there are many more publications that implicitly involve EDDA in some way. However, there are large and/or distinct groups of research that are easily identifiable in the research, and it is those areas that this section focuses on.

Learning analytics

Learning analytics research is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs **(**SoLAR, 2019**)**. The

Society for Learning Analytics Research (SoLAR) is the foci for this area of research. They are the publishers of the Journal of Learning Analytics Research, and host the yearly International Conference on Learning Analytics & Knowledge (SoLAR, 2019). The learning analytics research area of EDDA research was born out of collaboration between computer and learning scientists, and so takes a relatively technical approach to EDDA research (Dawson et al., 2014). Hoppe (2017) identifies three main methodological approaches that are central to learning analytics: Content-oriented analysis of learner artefacts using information and text mining techniques, Process-oriented analysis of action logs to detect temporal patterns in learners data, and network analysis to show the relationship between actors within the learning process. The 2017 publication of *The handbook of learning analytics* codified many of the methods, concerns, and philosophies of this strongly united research area.

Educational data mining

Educational Data Mining is an area of EDDA research that focuses on creating methods that take advantage of the large amounts of data created by students in order to better understand these students and their environments (IEDMS 2019 [1]). The foci of this research area is the International Educational Data Mining Society (IEDMS), which also publishes the Journal of Educational Data Mining and hosts an annual conference (IEDMS 2019 [2]). Educational data mining is often grouped with learning analytics, (Du et al. 2019) and the two fields do collaborate closely (Siemens & Baker 2012). Educational Data Mining concerns itself more with data in large-scale settings than learning analytics (IEDMS, 2019 [1]).

Intelligent tutoring

Intelligent tutoring systems (ITS) is centered around the development of individualized computer software design to give students immediate and operable feedback on their work (Clancey, 1981). The foci of Intelligent tutoring research is the Intelligent Tutoring System Conference hosted by the Institute of Intelligent Systems (ITS, 2019). ITS research differs in many important ways from the aforementioned research in that it is focused on a specific educational context— the use of computerized tutors. Some scholars (Pardo et al., 2018) differentiate ITS from related research in Artificial Intelligence in Education (AIED). The main goal of AI in education, as stated by the International Journal on Artificial Intelligence in Education is to aid in the design of computer-based learning systems (IJAIED, 2019). Because of the similarity of the two areas, they will be considered together in this paper.

Teacher analytics

While not a large or well-known research area, teacher analytics is theoretically distinct from all the other research areas so far mentioned. While the methods employed may be similar to those of other research areas, especially learning analytics, teacher analytics has a distinctly different goal (Mor et al., 2015). Data collected may use student achievement as a benchmark but focuses on capturing teacher actions. The goal of teacher analytics is to allow teachers to improve instruction *before instruction is delivered,* (Sergis & Sampson, 2017) often through the study of past iterations of the instruction. Synthesized data is seldom designed for student consumption and feedback. Instead, teacher analytics utilizes a framework of continuous teacher self-evaluation to improve their teaching methods, referred to in the literature as the process of teacher inquiry (Check & Schutt, 2012). The research area of teacher analytics is small and relatively new. There is no journal or society expressly focused on teacher analytics, but it does offer a unique perspective in the EDDA landscape.

Integrated analytics

When reviewing the literature on EDDA, creating the four research areas mentioned above left a large group of literature unaccounted for. This literature included many areas that utilized digital technology, but only occasionally or incidentally used analytics as part of their research. Instead, the use of analytic methods was ancillary to the main research questions or goals of the study. One prominent example of this research area is Massive Open Online Courses (MOOCs). While research on MOOCs often utilizes analytics, and some research conducted by researchers in other research areas is often conducted utilizing MOOCs (Wise et al., 2017), the field in and of itself is concerned with improving the design and use of MOOCs, with analytics mainly considered an ancillary concern or available analysis tool. Research areas with similar paradigms are plentiful, including Computer-Supported Collaborative Learning, Interactive Digital Storytelling, and eLearning (Row et al., 2019; Atwell, 2007). While analytics is not the focus of these research areas, they contain scholarly knowledge that may be critical in the development of mature EDDA research. To be inclusive of this research, we broadly defined a research area within EDDA called *integrated analytics*. This encompasses all research that, in an ancillary or embedded fashion, utilizes and interacts with EDDA. It is possible that it is within integrated analytics that the impact of other areas, such as learning analytics and educational data mining can be seen.

Four philosophical divides

Because of the continued growth of EDDA research, new trends and areas are regularly emerging. In order to offer a framework with more longevity than a simple definition of current research areas, below a philosophical framework that attempts to explain what it is that philosophically divides different research areas is set forth. After review of the EDDA literature in conjunction with key papers exploring the different philosophies of education research, it was determined that four main philosophical factors could be used to delineate EDDA research.

This framework is designed to be more generally applicable to EDDA research, even beyond the five research areas defined above. This framework may be useful for researchers who are attempting to place their research within the EDDA landscape, critically evaluate the research of other scholars, or make comparisons between different EDDA research that uses different vocabulary and writing norms.

Measures of Long-Term Success

The first philosophical divide between EDDA research areas is different measure of long-term success In their review, Morel et al. (2019) found that in educational research in general, different researchers and stake-holders frequently use “scale” as a measure of success, but neglect to define the term. Morel et al. continued by defining four different definitions of scale:

1. Adoption, a measure of how many people are using a certain educational tool.
2. Replication, or how reliably an educational tool produces a desired outcome.
3. Adaptation, or how easily a tool can be modified to meet local needs.
4. Reinvention, or the use of a tool as a catalyst for further innovation. This measure of scale is most commonly used when considering near-ubiquitous tools.

This implicit use of different definitions of scale seems to be occurring in EDDA research. In the context of EDDA research, adoption (definition 1) is considered a worthwhile goal (Baker, 2016; Shum et al., 2019). There is no evidence of discussion of the use of EDDA tools as catalyst for reinvention (definition 4). This is consistent with Morel et al.'s observation that reinvention tends to be used only with more mature education tools.

When measuring success, researchers most commonly differ on their consideration of replication and adaptation. For example, Wise and Vytasek's (2018) paper on the implementation of learning analytics systems identifies three main principles for implementation: coordination between stakeholders, comparison against local benchmarks, and customization. This paradigms aligns with the idea of adaptation as a measure of success. Wise and Vytasek's paper is indicative of the stance of learning analytics researchers, whose tools are often designed for specific contexts, not for large-scale deployment (Elbadrawy et al., 2016; Macfadyden & Dawson, 2010). Teacher Analytics favors a similar philosophy of scale, desiring tools that allow teachers to decide what data is most important for their specific teaching context (Sergis & Simpson 2017).

The focus of learning and teacher analytics on adaptation is in direct contrast to a focus on replication by both the intelligent tutoring and educational data mining research area. This allows for a distinction between educational data mining and learning analytics, which are often grouped together (Papamitsiou & Economides, 2014; Ihantola et al., 2015; Sin & Muthu, 2015). Where adaptation focuses on customizing tools for local contexts, using replication as a measure of long-term success focuses on tools giving students consistent results across contexts. This is most pronounced in intelligent tutoring systems, which attempt to create a single tool that can be applied across a broad array of contexts (Kulik & Fletcher, 2016). If a tool is successful, it should require little to no modification by researchers and developers. Educational data mining is not expressly focused on replication, but by nature of its focus on large scale data, inherently finds itself using methods that focus more on replication than customization. For example, Acharya and Sinha (2014) focused on using an algorithmic approach to large-scale student data to select variables of interest for predicting student grades. These algorithmic approaches are, inherently, blind, and besides the selection of the algorithm, researchers do not influence the selection of model features and equations.

It is important to note that these two measures of success are not always in direct competition. For example, intelligent tutoring systems, while focusing on replicability across contexts, often achieve this replication by creating tools that customize themselves to individual student needs (Kulik & Fletcher, 2016). However, there are many cases where these two goals are directly competing with one another. Predictive tools like those often created in the learning analytics research area are tightly tuned to the specific context they are being applied in, and thus may not be statistically valid outside of that context (Gong et al., 2010; Dietterich, 1995).

EDDA researchers should remember that there is one measure of long-term success that almost all stake-holders agree on: greater adoption. In order to reach this goal, researchers must balance concerns of both replication and adoption. There are many examples of this within the research area of integrated analytics. This balance is achieved both through a diversity of opinions as well as an internal balance within individual studies. MOOCs offer a prime example of this balance. Research into student performance in MOOCs often utilizes natural language processing techniques instead of manual coding, and thus creates statistical models that can be more easily adapted to other contexts (Kloft et al., 2014; Robinson et al., 2016).

Augment vs. automate

Here, automation of learning is defined as any use of technology to perform a task that previously would have been performed by an instructor. The augmentation of learning is defined as any use of technology to increase the quality or quantity of learning taking place. Both goals attempt to solve different problems. Automation can increase the affordability of education (Scandura, 2010**).** Augmentation is not as expressly defined or explored in the literature but in the context of EDDA often aims at giving students better feedback and teachers greater insights (Gasevic et al., 2015; Check and Schutt, 2012).

One of the reasons that augmentation may not be as expressly defined is because it represents the bulk of research in learning analytics, educational data mining, and teacher analytics as these fields all aim to enhance the understanding of student learning (and in the case of teacher analytics, teacher processes) in order to increase the quality of existing education (Gasevic et al., 2015; Ihantola et al., 2015; Mor et al., 2015**)**. One reason more focus may be placed on augmentation is because the attempt to automate learning has often utilized a model often criticized by researchers. This model views learners as simple containers, and learning as chunks of information to be packaged and delivered to students (Velesianos & More, 2017). One of the leading critiques of the automation movement is that it has been led mainly by private companies with vested interests in selling software, (Veletsianos & Moe, 2017) with little involvement from researchers. Currently, the research area of intelligent tutoring is the only group performing research on automation (Niehaus et al., 2011; Aleven et al., 2010**)**. Some individual studies do exist in various research areas that suggest or apply automation techniques in a pedagogical justified fashion (Baker, 2016**)**. It has been suggested that researchers "explore how human and non-human teachers might work together," (Bayne 2015, p. 460) in such a way that the important aspects of the human instructor are not automated away.

The study of learning vs. teaching

Ertmer and Glazewski (2013) state that "[the question of studying learning vs teaching] determines where you place emphasis in your investigation and guides your research question, research design, data sources, analysis, procedures, and interpretations" (p. 61). This divide can be seen in EDDA research through the decision of what data source to use. The vast majority of EDDA research bends towards the study of learners. Learning analytics, educational data mining, and intelligent tutoring systems rely almost solely on student action and achievement data for analysis, and frequently focus on individual student success (Gasevic et al., 2015; Ihantola et al., 2015; Mor et al., 2015; Baker et al., 2004). Teacher analytics lies in most direct contrast to this overwhelming focus on student data. While even teacher analytics frequently relies on student outcomes for success, this data is often aggregated and used as a proxy for teacher success (e.g. Hansen and Wasson, 2016). Other data sources, such as the corpus of teacher created content, are also often central to teacher analytics (Timperley et al., 2010). Integrated research contains a variety of approaches, and often focuses more on teaching data than other research areas. For example, in determining how online classes impact undergraduate degree completion, Wavle and Ozogul (2019) used whether or not students had taken online courses during their freshman year (i.e. interfaced with a certain type of teaching) as the main factor of interest. Part of the lack of teaching focused research may be a function of the lack of teacher-level data sources.

As more large-scale data sources are opened for analysis, there may be greater opportunities for EDDA research to focus on teaching.

Design vs. discovery of knowledge

The idea of design vs. discovery stems from EDDA research's close ties to statistics. One side of the argument asserts that: "social science research at its best is a creative process of insight and *discovery* taking place within a well-established structure" (Keohane 1996, p. 12, emphasis added). The discovery-based argument states that scientists should follow existing methods in an effort to uncover objective truths about the learning process. However, it is also well established in modern statistics that such perfect objectivity is not possible. In contrast to the discovery argument, the design argument asserts that "there is an apparent conflict in statistics between the need to be objective, and the need to… make progress… through following up subjective insight" (Blyth 1978, p. 20). Some argue that it is impossible to have a blind, objective mathematical model, and that research requires the consideration of the design of the model in use **(**Begoli & Horey, 2012**)**.

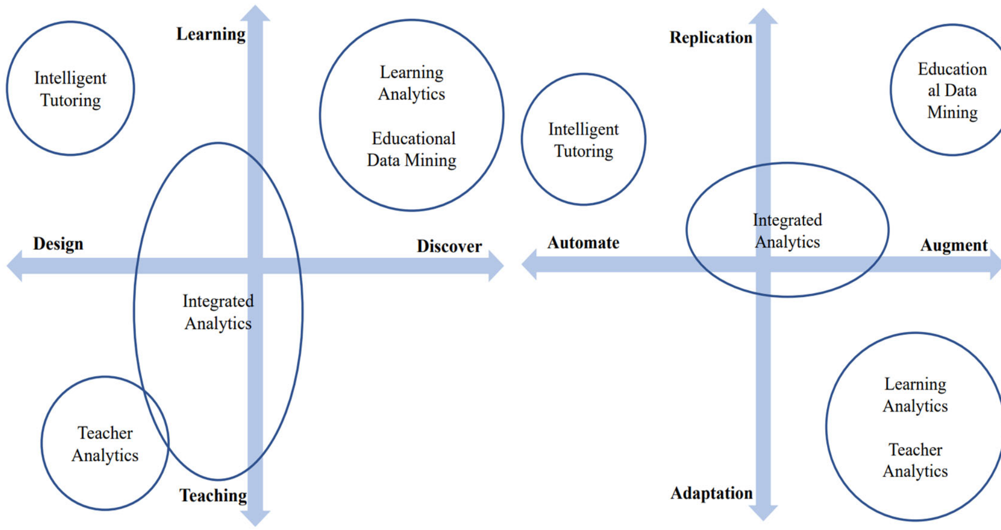
Researchers commonly discuss model selection as a design process (Liu 2017; D'mello et al., 2014; Dong, 2005), however, when explaining results, the goal of EDDA research is often to gain objective "insight into learning and vital educational practices" (Siemens 2012, p. 4). When dealing with simpler, more established modes of modeling (such as regression and basic natural language processing) there are best-practices for quantifying the error established with the claims being asserted, including familiar methods like p-values, and confidence intervals **(**Cobb, 1998). When dealing with complex machine learning models that are inherently non-probabilistic and often uninterpretable, validity of the research claim can often only be measured by how closely the model predicts the data (Japkowicx & Shah, 2015**)**.

When researchers use these methods, they must decide between making objective claims about the nature of a psychological phenomena or making a design-based claim where claims about changes in some behavior are made, but claims about psychological phenomena are omitted. The research areas of intelligent tutoring (Chabay et al., 2020**)**, integrated analytics— particularly those tied to instructional design (Park & Jo, 2019**)** and teacher analytics **(**Sergis & Sampson, 2017**)** tend to favor design-based claims. These researchers are more concerned with measuring outcomes than interpreting or discovering base psychological factors. This leaves the research areas of learning analytics and educational data mining to attempt to make discovery-based claims (Gasevic et al., 2015). Educational data mining particularly faces the difficult tasks of attempting to make sense of big-data while retaining objective interpretability in their models.

Conceptual Framework

In order to simplify these four philosophical divides into a more concise form, the figure below frames the four philosophical divides as a conceptual framework of the EDDA research space. This conceptual framework groups the four philosophical debates into two general categories. The first is research-centric concerns (teaching vs. learning, design vs. discovery) and the second is philosophical divides based on design (automate vs. augment, replications vs. adaptation).

Figure I: Divides in research paradigms (left) and design paradigms (right)



In each of these two visualizations, one of the four quadrants is empty, suggesting a gap in current research. Because teacher analytics adopts a reflective, more subjective approach to teacher improvement, (More et al. 2015**)** there is not a large body of EDDA research that utilizes digital data to uncover discovery-based, objective claims about teachers. Some integrated analytics research bleeds into this area, (e.g. Wavle & Ozogul, 2019) but there appears to be an opportunity for greater research in this area. Because the study of teaching and pedagogy tends to be discipline specific, (Abell 2013; Tu 2003; Eisner & Day, 2004) there may not yet be a method in place for the sharing of information on EDDA research that deals with objective claims about teachers and teaching.

Also noteworthy, though perhaps less explainable, is the gap in design paradigms. It may be that the goals of creating an automated system that is also adaptable to different contexts at scale is not feasible with current technology. It is also feasible that as intelligent tutoring research continues to expand, it will fill this gap. Roll and Wylie (2016) suggest that artificial intelligence may develop into a tool that can adapt to students everyday needs, becoming embedded in all processes of education, instead of being localized to certain learning contexts, like intelligent tutoring systems.

Discussion

Currently, learning analytics, educational data mining, and related fields, are often treated as separate and self-contained. However, when viewing each field as a member of a large EDDA community, we can begin to better understand the impact of research in these areas. For example, one of the earliest methods developed in learning analytics was the use of student grades and demographics at an administrative level to predict student collegiate success (Pistilli & Arnold, 2010). In this initial 2010 paper, Pistilli and Arnold report on how interventions based on predicting student success increase grades during the first several years of college. They included some basic percentages, but either lacked the sample size or statistical power to report findings of statistical significance. In a paper published a few years later (Arnold & Pistilli, 2012) the same intervention system is shown to significantly increase retention of students.

However, there are some issues with validity within the study— teachers at the universities chose whether or not to participate in the intervention, and it is reasonable to assume that those teachers who opted in to a time-intensive intervention may simply tend on average to be higher quality instructors. In short, it is difficult to evaluate the effectiveness of this learning analytics study when viewed in a vacuum. However, when viewed within the broader EDDA landscape, we see that this study has had significant impact on learning analytics and the use of administrative interventions. Google Scholar reports that Arnold and Pistilli (2012) has been cited more than 800 times as of June, 2020, by empirical studies in as varied publications as varied as *Computers & Education,* (Asif et al., 2017; Cerezo et al., 2016), *Journal of Universal Computer Science,* (Park & Jo, 2015) and *The Journal of Interactive Media in Education* **(**Rienties et al., 2016).

In evaluating learning EDDA research, it is important to thoughtfully measure the impact that these studies have as they permeate into the large EDDA research landscape. The relatively recent release of the *Handbook of learning analytics* (2017) suggests a stable body of methods is being developed, and learning analytics is shifting towards a more practice-centered paradigm. This shift may lead to a more cohesive EDDA research area as the research- philosophical positioning (Figure 1) of learning analytics moves closer to integrated analytics research. Even if this shift does not happen, it is important to consider all EDDA research when evaluating the impact of learning analytics. Though vocabulary may continue to vary across related EDDA disciplines, the conceptual framework suggested above allows for critical comparisons and evaluations of EDDA research.

Conclusion

This paper introduced the idea of educational digital data analytics (EDDA) as a single research area with many different research areas, each with different philosophical viewpoints. It identified five major research areas emergent in the literature: learning analytics, teacher analytics, educational data mining, intelligent tutoring, and integrated analytics. A set of four different philosophical principles that divide these research areas was presented. Two of these divides were design oriented: measurements of long-term success, and automation vs. augmentation. Two of these divides were research oriented: the study of learning vs. teaching, and the design vs. discovery of knowledge. Using these philosophical divides to construct a conceptual framework of the EDDA research landscape. Two major gaps in the literature were identified, the first at the intersection of the study of teaching and the assertion of objective knowledge claims, and the second at the intersection of automating teaching and creating tools that can be adapted at scale.

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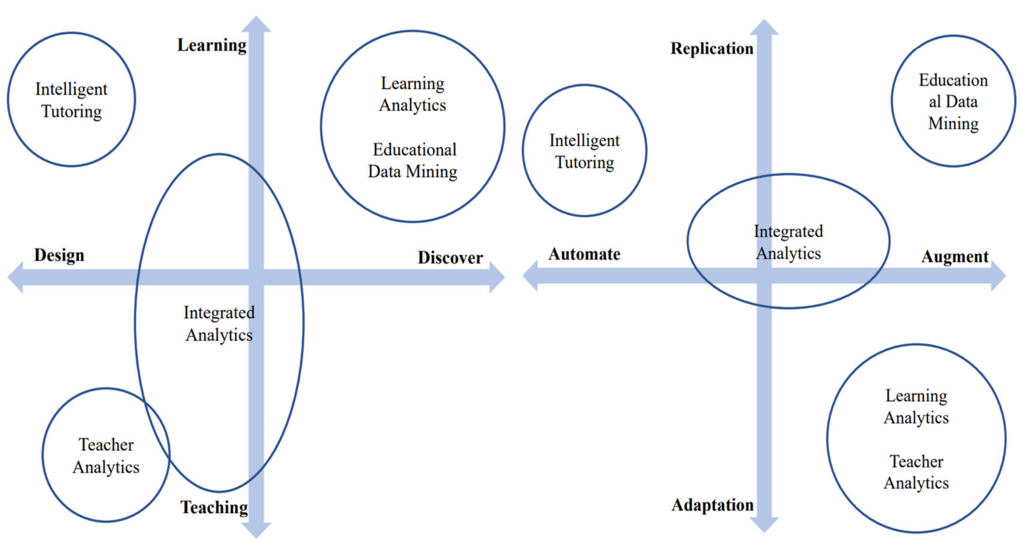
Figure I: Divides in research paradigms (left) and design paradigms (right)



Students Writing Their Own Textbook, A Successful Situational Learning Case Study

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Abstract

Culturally-situated learning is the creation of learning environments where theory is tied to contextual practice, such as students authoring a textbook on instructional message design during an online instructional design graduate course. From this perspective, learning is enhanced when it is imbedded in an authentic system of shared beliefs, values, goals, customs, and behaviors. This class project tied theory to practice, and the result is now available as a hardcopy from Amazon, as a Kindle e-book, and as a free PDF from the host institution's Digital Commons. This AECT presentation and proceedings paper illustrates a successful process where the affordances of Google Docs and Amazon Kindle Direct Publishing were used to coordinate, communicate, and create the book. Lessons learned and best practices are offered for attendees and readers, and thoughts, comments, and suggestions for the second volume are welcome.

Introduction

Culturally-situated learning applies theory to real-world contexts where learning is enhanced through practice, feedback, and collaboration (Brown et al., 1989). This project describes a creative instructional design that expands upon previous work, an innovative application of technology tools, and an effective culturally-situated instructional strategy. Culturally-situated learning is the creation of authentic learning environments where theory is tied to practice, such as students authoring their own textbook on instructional message design during an instructional design graduate course. From this perspective, learning is enhanced when it is imbedded in an authentic system of shared beliefs, values, goals, customs, and behaviors. As an added motivation, students did not have to buy a textbook for this class because they were writing the textbook during the class. This AECT presentation illustrated a successful process where the affordances of Google Docs, Creative Commons copyright options, and Amazon Kindle Direct Publishing were used to coordinate, communicate, and create a course textbook.

Literature reviews are a popular assignment in graduate courses and give students an opportunity to research, analyze, synthesize, and summarize a class-related topic. However, it has been this instructor's experience that these literature reviews have limited or no direct application after the course. That effort commonly goes into a binder to collect dust or takes up storage space on a hard drive somewhere never to be seen again. Along with a comprehensive textbook for the class, another goal of the course was to turn a classic academic literature review assignment into a published book chapter with best practice guidelines for the practical application of a self-selected topic (see Figure 1).

Figure 1. Each chapter was written by a graduate student and peer-reviewed by the instructor and all other students in class. The result was the course textbook *Instructional Message Design: Theory, Research, and Practice, Volume 1*.

The Culturally-Situated Learning Activity

The graduate course, "Instructional Message Design", details and describes a critical aspect of design models for instructional designers and human performance technologists. Instructional message design is the use of theory, tools, and techniques to convey information to learners to create knowledge and understanding (Fleming & Levie, 1993). There are several textbooks on the topic, though the foundational text has been out of print for over 25 years. The instructor also wanted to include contemporary applications such as simulations, augmented and virtual reality, cultural aspects, and empathic considerations. Other textbooks cover significant aspects of the course's learning objectives, though this collection would require students to spend a small fortune buying nearly half a dozen books (or the instructor navigating the legal copyright implications of scanning and posting online multiple chapters from each book). The instructor was uncomfortable with either prospect. However, the instructor was inspired by similar research, projects, and other ongoing work with student-generated books (Kidd et al., 2011; Mays et al., 2017). The instructor revised the structure of the course to focus on the student chapters being the main, culturally-situated deliverable.

The process started with the instructor creating a list of nearly 24 topics in Google Docs and sending the link to their students. Topics ranged from theories, models, and cultural aspects of message design, to contemporary tools and techniques. Students self-selected a topic based on their specific research agendas or their general interests. The topics not selected became the focus of the instructor's chapters, class presentations, and other learning objectives throughout the course. Several milestones were worked into the course to ensure students stayed on pace to finish their projects. These milestones were paced several weeks apart and included their selection of a topic, initial chapter outline, initial chapter draft, working draft, then their final draft. The instructor's introduction chapter served as a starting point for students and a basic template for their chapters. This chapter was written before class started, introduced students (and future readers) to the main topics (and future chapters), and was read by students as one of the class's early assignments. The chapter was posted to Google Docs, and students were asked to provide feedback via Google's "Suggesting" and add "Comments" features as they would when they reviewed their peers' chapters later in the course. The format of the chapter (and the example for student chapters) employed APA version 6 formatting with the use of single-spaced, 14-point font size and 1-1/2 inch margins to aid in readability when color printed and bound by Amazon.

Each student's working chapter draft was posted and shared online as a Google Document, and each student was required to read and provide their peers with feedback on each chapter. The instructor wrote one of the theory chapters and also provided each student with feedback. The student authors could see their received input via the Suggestions and Comments features in Google Docs. These features work very similarly to Track Changes and New Comment features in Microsoft Word where students can compare their original work with suggested edits, feedback, and comments. The students then used this feedback to edit and create their final draft. Learners were also required to analyze and synthesize each chapter in a reflection assignment to confirm that all students had read every chapter. The final activity of the class was the student authors voting and selecting the book's front and inner cover (a PowerPoint slide sized to about 11x17 was used to create the front and rear cover of the book).

While the final draft of their chapters completed the requirements of the course, the instructor served as the book editor after the class was complete. The instructor integrated the book chapters together into a single cohesive document, addressed image copyright issues, and initiated the upload process to Amazon using Amazon's Kindle authoring tools (the book was made available at the lowest cost Amazon would allow). The instructor also partnered with the host institution's library to upload each chapter to that university's Digital Commons (with a Creative Commons Attribution-NonCommercial-NoDerivs license). The book and each chapter are now publicly available as a free open source PDF, as a hardcopy from Amazon, and as a Kindle e-book (see Figure 2).

Figure 2. The finished book is now available as a hardcopy and a Kindle e-book from Amazon, and as an open source PDF.

Conclusion

Culturally-situated, real-world projects create authentic learning activities that connect theory to application. The purpose of this AECT presentation and paper was to describe how the lack of an available course textbook and the desire for applied literature reviews led to the creation of a culturally-situated, open-source, student-authored book. A lot of work goes into a thorough literature review, and it would be a shame if the efforts of talented students and future scholars did not extend beyond the graded deliverables of a class. Adult learners are also motivated when they can see the real-world relevance of their work, and creating a book that will benefit others and live on after class was definitely motivating. Each student now also has a published chapter that can be listed and referenced in their professional portfolios and in their growing curriculum vitae and resumes.

Writing a book takes a significant investment of time and effort (Ben-Ari, 2002; Kerr, 1978). However, the overall workload can be lessened when a group of interested authors work together. The online access and shared affordance of Google Docs allowed for a level of communication where co-authoring, reviewing, and editing book chapters was much easier than managing files sent to and from the authors. Meanwhile, the authoring tools in Amazon's Kindle Direct Publishing service opens other avenues for student-authored books besides an institution's Digital Commons and other open resource collections. The use of Google Docs, Amazon’s authoring tools, and Word and PowerPoint meant that expensive or custom software was not required to author or assemble the book. Several other lessons learned includes to leave more time for students to revise their final drafts, review the use of open source figures and diagrams, and for the instructor to plan for a lengthy editing process when creating the book. For instance, after the class was complete, the instructor was still contacting students for edit feedback, was replacing figures that were not open sourced or were previously copyrighted, and organizing the book into its final form. This final process took several weeks after the end of the class. However, this project worked well, students provided feedback that they enjoyed the process and the final result, and the instructor looks forward to a second volume that should be created in the Summer of 2021. This model can successfully be applied to other disciplines in other classes, especially when the instructor is sensitive to the cost of textbooks and wants to motivate adult learners with an authentic and culturally-situated project.

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Four facets of needs assessment and analysis for the design of online learning systems.

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Abstract:

As instructional systems designers, we need to consider and take a holistic systems approach when designing our solutions. This review analyzes and synthesizes the literature from four specific online learning contexts: K-12, trade training and industrial education, higher education, and corporate training. The characteristics, social structures, environments, and expectations of each of these cultures are very different. This review will summarize the research related to each context, discuss best practices, and areas for future research.

Introduction

As instructional designers, systems designers, and technology leaders, we need to consider and take a systems approach when designing our solutions. However, a system that works well in one organization or context may not be effective in another. This review analyzes and synthesizes the literature from four specific online learning contexts: K-12 education, higher education, career and technical training, and corporate training. The client characteristics, social structures, environments, and expectations of each of these cultures are very different. While a thorough needs assessment and analysis is critical in any instructional systems design scenario, it is equally critical to understand that assessment models that work well in one of these contexts may not work well in another. This review will present and summarize the latest research and findings related to systematic needs assessment in each online context, discuss the current state of best practice, and suggest areas of future research and areas for future collaboration.

Culturally situated systems design can be operationally defined as instructional systems created specifically for the authentic contextual needs of the learners. Situated learning is the applied theory that learning is inextricably linked to the culture, context, and environment that utilizes that knowledge (Brown et al., 1989). A needs assessment is the first step towards designing an instructional system and a need is the gap or discrepancy between an existing result and a desired result (Altschuld & Watkins, 2014; Kaufman, 1972). A system is the organized effort of an organization or entity to achieve a common goal (von Bartalanffy, 1972). The systemic idea of a bounded organization or network that has interconnected layers and subsystems that work toward an achievable goal is an integral aspect of a successful needs assessment. When these concepts are combined in online learning, distance learning, or e-learning, this gap is the learning or training objectives of the course or program and the instructional system is the means to achieve these objectives. Designing for culturally situated contexts will enhance the effectiveness of our instructional systems.

In addition to identifying the results based gaps, a needs assessment and analysis also determines the type of human performance intervention required to address that gap. In the case of instructional design interventions, the needs assessment and analysis defines the instructional problems, identifies goals, analyzes the learners, and leads to specific learning objectives (Dick, et al. 2001; Morrison et al. 2019). Needs assessment models that consider microsystems (individuals), macrosystems (organizations), and megasystems (society), are particularly suited to transformative change and positive impact (Leigh et al., 2000). In addition to the layers of impacted systems, it is important to also consider the layers of stakeholders within each system. For example, a thorough needs assessment should consider the needs of the level one clients, the level two service providers, and the level three service provider support infrastructures (Altschuld & Kumar, 2010). Other needs assessment models from the field of human performance technology and improvement also implement a structure that considers individual change and well as change of the overall system or organization of individuals (Gilbert, 1978; Rummler & Branche, 1995; Wedman 2014). While these models (and newer models that trace their evolution to these foundational models) can be used to study an organization, the facilitator risks a failed needs assessment if they do not consider the culturally situated context of that assessment. For instance, a needs assessment in an online K-12 context would have to consider the layer one students, the layer two teachers, as well as the layer three administrators. The uniqueness of these stakeholders and their needs will differ in significant ways from layer one adult students, layer two instructors, and layer three faculty, staff, and administrators in e-learning higher education environments. The layer one adult learners, layer two instructors and trainers, and layer three support systems in online career and technical training institutions will also require a different focus. In addition to K-12, higher education, and technical and career training scenarios are corporate training needs. The layer one working adult learners in this context do not need a degree or industry recognized certification but do need to advance their knowledge, skills, and abilities to maintain or immediately benefit their careers. These adult learners, as well as the layer two trainers and layer three support systems, will have different needs as compared to other instructional systems.

K-12 & Technology

With more than $726 Billion spent on public K-12 education in the United States (Snyder, de Brey, & Dillow, 2019), the need that each piece of technology fills should be seriously considered before the first dollar is spent. The difficulty lies in the lack of preparedness of administrators and district coordinators to conduct rigorous technology focused classroom needs assessments. Typical school administrators are former classroom teachers and have rigorous training in pedagogy; school administration preparation and licensure programs typically neglect instruction on needs assessment generally and technology needs assessment in particular. Technology is after all a tool and not a teaching style and should receive special attention as to how it is used.

Few students take online and blended courses because this method of instruction is preferred by the learner, but because online courses afford students an opportunity to take classes that are not otherwise offered at their school or to fulfill some other student need (Picciano, Seaman, Shea, & Swan, 2012). Credit recovery is one such opportunity that technology supports, providing inexpensive second opportunities for students who have failed a class. A study of ninth grade students in 17 Chicago public high schools who had previously failed Algebra 1 found that students who participated in online credit recovery had significantly poorer outcomes than their peers who participated in face-to-face remediation classes (Heppen et al., 2017). Only 66% of the students in the online recovery course ultimately received credit for the class as opposed to a 78% pass rate for students in the face-to-face classes. If credit recovery is the more pressing goal and not cost reduction as discussed in Picciano (2012), a needs assessment should be done to consider if technology is a viable answer to solving this particular problem.

Results like this are not surprising in light of how little technology instruction is involved in teacher preparation programs (Admiraal et al., 2017). Teachers are often forced to find out what technology does and does not work in the field. Reactive implementation of technology can be costly, time consuming, and demoralizing for students, the teachers who are trying to help them, and the administrators who hold accountability for the interventions enacted in their schools.

Technology needs assessment may be one solution to closing student performance gaps and relieving teacher stress and anxiety around technology use in the classroom. Unfortunately, many technology integration plans initially focus on which tools will be used and not how the tool will be used, even when implementation is a primary concern of educators (Gülbahar, 2007). Needs assessment that involves all stake holders, from students to administrators and families could shed light on the disconnect between the desires of teachers to educate 21st century students and the ability of students to be educated with appropriate accessible 21st century tools.

Training Trade and Industrial Education

With many education programs moving online, it is important to assess how the transition from in-class learning to online environments will change for both students and teachers. In career and technical education (formerly referred to vocational education), programs are designed to provide learning opportunities with a focus on occupational endeavors (Carver & Kosloski, 2015). Trade and industrial education is one aspect of career and technical education that relies on the use of industry technology and equipment to prepare students for the workforce. The technology and equipment can be very expensive and is often difficult to keep current. Education systems are under increasing pressure to reduce costs while maintaining or improving outcomes for students, and in order to improve educational productivity many districts are turning to online learning (Bakia, et al., 2012). In programs within trade and industrial education, several factors need to be considered before moving to such an online platform. Culturally, these courses have been held in the traditional classroom environment. The issue with this perspective is that technology improves so rapidly that schools have a difficult time keeping up with the demands in industry. Due to the scarcity of resources as well as cost pressure, the increased need for this type of training cannot be feasibly taught in the classroom alone (Belaya, 2018). This is where needs assessment can play a critical role in the success of the in-class to online transition.

A needs assessment is designed to better separate the perceived need and the actual need. Groups tend to jump prematurely to solutions before identifying and prioritizing needs or delving into what really underlies them (Altschuld & Kumar, 2010). For this reason, following a needs assessment model can be critical to finding a long-term solution. The online environment needs to be able to give students the ability to understand skilled-based objectives, and students need to feel that they are getting what they need from the course. Teachers and students must understand the working of the online learning environment and understand how to incorporate skills-based learning and create a learning community in the online environment. Safety must also be considered if there is a need to practice those skills outside the online environment. This section of our review will look at each of these from a needs assessment perspective to better understand how programs can transition to an online environment while providing the skills necessary for the job.

One needs assessment issue in online training for trade and industrial education is how to move skilled based training to the online environment. Many programs in trade and industrial education require practicing skills that may be difficult to learn online. There is limited literature on the impact the delivery method has on experiential or skilled-based learning (Arbaugh, et al., 2013). Since trade and industrial education is skilled based, a needs assessment may help discover ways to implement this type of delivery method without losing the practical application that these programs provide. Another consideration could be how moving to an online environment could benefit the workforce after completing a trade and industrial program. Research suggests employers of trade and industrial education graduates could benefit from students learning better computer skills. For example, employers in manufacturing say prospective employees do not have the skill set required to perform necessary functions such as math and computer abilities (Robertson & Aquino, 2016). A needs assessment could work to bridge this gap by providing online solutions that not only teach the workforce skills associated with a student’s chosen field, but also provide valuable computer skills that can decrease the skills gap employers are seeing.

Another issue where needs assessment is critical to trade and industrial education is teacher preparedness to teach skilled based learning online and accessibility for students in the online environment. Creating a meaningful and successful learning experience for students in an online environment is key to a program’s success (Lane, 2013; Frass et al., 2017). For teachers, it is important to build a community of learners from the very beginning of the course to enhance learning outcomes (Yuan & Kim, 2014). A needs assessment would be able to identify what resources and programs may be available to assist teachers new to online teaching in ways to create this sense of community for their students. For students, accessibility must be assessed to ensure students have access to online resources. Research suggests that in order to be successful in the online environment, both teachers and students have to make a joint effort to create an online community (Sun & Chen, 2016). Assessing and understanding the needs of both teachers and students is critical to establishing an online community that promotes the same value as in the classroom.

Safety would have to be a consideration when looking at how to implement online learning for these types of education programs. Since much of the curriculum is skilled based, would students be working on any tasks outside the classroom that may introduce safety issues? An example of this would be culinary arts where students are learning a cooking technique and then practice their skill in their own home. Secondary school resources such as pupil spending, class size, teachers and quality of content of curriculum are factors that could influence safety and health for students (Shendell et al., 2018). If a student becomes injured while attending an online class, how would it be handled? A needs assessment would be able to identify safety risks that come with moving this type of curriculum online so schools can be cognizant of these risks and make sure students and their families understand those risks if skills are to be practiced outside of the classroom.

There is not a lot of research on moving trade and industrial education to online environments, but a needs assessment could be beneficial in helping schools identify if there is any possibility or benefit to looking into online learning. Trade and industrial education can be very expensive for school districts due to the amount of equipment and resources needed, assessing alternatives that may be more cost effective could assist schools in ways to implement some form of online learning while still upholding the rigor of the coursework and provide a safe environment for students to practice their skills.

Higher Education Curriculum and Faculty Development

Needs assessment is a systematic process for analyzing a process and finding where the process is lacking. The areas that are lacking are known as "gaps" and they define where the organization or process currently stands and where it should be. These defined areas are identified as the need to be addressed. In higher education, needs assessment can be involved in many different ways. Higher education is such a vast world that assessing needs can be done in many different areas (Grant, 2002). When discerning these areas, higher education can be branched into areas of curriculum planning, individual problems, student progress, accountability for the university population, safety needs, and the online learning sector are only a few of these areas (Grant, 2002). It is not enough to do a needs assessment on "higher education," the specific field needs to be identified, research why it is lacking, and then conduct the assessment. Everything works in unison to create an effective higher education experience (Grant, 2002). It should be cautioned that, while needs assessment provides a detailed process, some of the rigidness can render out the creativity that is needed in the world of higher education. Education, in general, possesses both elements of art and science and limiting it down to nothing more than a tool would do be doing it a disservice (Grant, 2002). Among the many ways that needs assessment can fit into higher education, two crucial areas that it can have a profound impact on is curriculum development and faculty development.

Needs assessment has a key role in the world of higher education. Higher education is most effective when it is consistently evolving to hone professional development (Grant, 2002). The main purpose of needs assessment in this realm is to provide assistance in educational planning without falling into a trap of narrow vision (Grant, 2002). A crucial portion of educational planning comes through curriculum development (Grier, 2005). As a base need, it is important to understand that curriculum development creates an organized path, in a way, closing the "gap" that the students possess in their current knowledge of a topic and where they need to be by the end of the course (Williams, 2019). Since curriculum documents are not easily created the assessment helps in outlining how to evolve the lesson in the university setting. An example of this shows how assessing the need is embedded in its framework (Williams, 2019). Analyzing the curriculum could yield that students may benefit from breaking down larger learning goals into smaller, more precise, goals to better translate the overarching concept (Williams, 2019). This need could be translated as understanding various parts of the forest to understand how it works coming together as opposed to trying to understand the whole forest from beginning to end.

Addressing needs in curriculum will continue make sure that the content does not become stale. In a way, curriculum needs will never fully be addressed because the lesson will always have new requirements with current sources being updated and new sources emerging (Williams, 2019). Information gathering tools can be used to obtain data, this could involve surveying students, consulting with faculty, analyzing assignments, and student observations (Benesch, 1996). The logic for performing this analysis is that by identifying various elements of the situation, professors can continue to change and update their curriculum so that their students succeed (Benesch, 1996). Another benefit that accompanies consistent needs assessment in curriculum is the advancement of scholarly research in a particular field (Wang & Ashcroft, 2012). These studies promote interest and display other institutions and their methods for handling their needs assessments in expanding and revamping curriculum.

Needs assessment plays another significant role in higher education in the realm of faculty development. Developing curriculum is an important aspect to higher education but faculty need to continue to grow as well. The aim of faculty development is to promote advancement in their field of expertise and foster understanding of where the state of their field currently stands (Bahar-Horenstein et al., 2014). Environments evolve and new curriculum must be developed to stay current, however, that does not work without faculty piloting the program to impart those lessons to students. Encouraging faculty to respond to the various forms of needs assessment can be a challenging effort (Bahar-Horenstein et al., 2014). There can be an ego element involved in which professors fight against the need to admit that, as time passes, a gap can begin to develop between their possessed knowledge and the current state of their field (Bahar-Horenstein et al., 2014). Professors can be extremely protective of their responsibilities and authority over the subjects that they teach. If the needs assessment is not with proper considerations toward faculty, the process could be seen as gathering information to show that the professor is not living up to the standards of their universities (Bahar-Horenstein et al., 2014).

With proper care taken, many avenues exist for institutions to meet these needs for their faculty. These gap-closers can come in the form of seminars, continuing education, opportunities for faculty to conduct their own research, and in-house programs devoted to the betterment of faculty (Bahar-Horenstein et al., 2014). For instance, the University of Florida conducted a study in which they provided different types of opportunities ranging from various trainings, administration, and leadership skills. Results of the study were depicted in faculty outlook by which areas that faculty were proficient in, and which areas they believed to be low priority. The results imply that faculty may not consider an area of study important when they have knowledge of it, even when it should still be considered important (Bahar-Horenstein et al., 2014). Interviews were held to investigate thoughts that poor experiences in development from the past had skewed many views on the validity seeing faculty development as a need (Bahar-Horenstein et al., 2014). The end result for University of Florida was quite positive. The university shared the results of their needs assessment, along with the methods taken, with the rest of the school and this sparked further professional dialog in which faculty could continue to develop in more effective ways (Bahar-Horenstein et al., 2014).

Needs assessment is an important component of higher education. Even though curriculum development and faculty development were the two main components observed in this review, the fact is that needs assessment can help an educational institution provide the necessary training, planning, and implementation strategies necessary to resolve gaps in the organization (Nugraha et al., 2018). Needs assessment plans identify important objectives and sets goals for the institution to accomplish to continue to evolve in a way that is appropriate. It can be easy to think that it is okay to skip the needs assessment and go straight into implementation of what one thinks is necessary, but this is a fallacy many people buy into (Centor, 2019). In the long run, significant amounts of money and time will be wasted by paying attention to areas that are not necessarily the problem. A key problem with supplying information being used to all individuals involved, leads to the institution developing faculty or keying in on curriculum not relevant to a specific gap (Centor, 2019). When time and money are interchangeable colleges, universities, trade schools, and other areas of the educational realm can increase their efficiency by applying the right tools to the right situations.

Corporate Online Training

Driven by cost efficiency, the globalization of business, and advancements in learning technologies, online learning has been widely adopted by corporations. Studies show that 98% of all U.S. companies have implemented some type of online distance training technology (Bose, 2017). Despite the wide adoption of online training in corporations, the determination of success for online programs has been largely focused on return on investment (Keen & Berge, 2014; Strother, 2002). For many corporate distance training programs, dropout rates remain high for voluntary courses and evaluation of training transfer is lacking (Derouin et al., 2005; Park & Choi, 2009). This would suggest that corporate online training programs are not always being designed in a way that serves the organization or its employees.

Needs assessment in online corporate training can facilitate better program planning, decision making and training design. The instructional design process, for example, which takes a systematic approach to training design, implementation, and evaluation, advocates needs assessment as the first step in the design process (Dick & Carey, 1977). Needs assessment can help justify and identify both organizational and individual needs (Watkins et al., 2013) to deliver efficient and effective online training programs.

In this section of Four Facets of Needs Assessment and Analysis for the Design of Online Learning Systems, we examine literature that looks at two aspects of needs assessment in online corporate training. The first reviews needs assessment research that demonstrates the value of aligning online training programs with an organization's strategic and environmental goals. The second looks at a less-explored body of literature that focuses on the use of needs assessment in identifying and addressing the learning needs of corporate learners with varying skills, backgrounds, and levels of motivation in a corporate distance learning environment.

Using Needs Assessment to Align Online Corporate Training with Organizational Goals

Needs assessment addresses three important areas: organizational, environmental, and the performer analysis (Rothwell, 1999). Organizational analysis looks to understand the vision, mission, values, and strategies of an organization. The environmental aspect of needs assessment looks at the workplace, the resources, procedures, and tools. Needs assessment applied to the performer or worker seeks to understand the knowledge, skill, and motivation of the employee (Watkins, et al., 2013). Needs assessment systematically focused on all elements can potentially align a corporate online training program with all aspects of an organization.

With the maturation of online corporate learning, much has been written about the need to align corporate strategy and online corporate training. Extensive work by Watkins and Kaufman demonstrate how needs assessment can be used in this process. Watkins, Kaufman, and Odunlami (2013) provide an important connection between all aspects of needs assessment, the strategic planning process, and online corporate training. In context, the strategic planning process focuses on guiding an organization toward delivering results. Organizations should assess what they wish to accomplish and determine what initiatives will help them deliver on those goals. Online training may be just one of those initiatives. Before investing time and resources in an online training program, organizations should conduct a needs assessment to determine what gaps online training can close.

Unfortunately, for many organizations, the promise of scalability and cost efficiencies hurried investments in online training technologies before organizations were ready (Borotis & Poulymenakou, 2004). Little or no needs assessment was done before technology implementation, which has led to multiple problems that have hampered corporate online training effectiveness (Derouin et al., 2005).

For organizations that have already made the technology investment without the initial research, scaling needs assessment to address narrowly defined aspects of organizational, environmental, and performer needs can assist in advancing an online corporate training program. As an example, companies could use a framework like a model developed by Borotis and Poulymenakou (2004) to direct their needs assessment efforts. Borotis and Poulymenakou (2004) in their research identified seven key components that should be analyzed to ensure organizational effectiveness and readiness in corporate online training programs.

1. Business Readiness – the link between organizational business priorities and characteristics to online training efforts

2. Technology Readiness – technical infrastructure

3. Content Readiness – understanding how content will work in the technology stack

4. Training Process Readiness – the ability to create, design and evaluate content in the online framework

5. Culture Readiness – organizational culture preparedness to accept online training

6. Human Resource Readiness – the ability of employees (learners) to function and navigate available training technologies

7. Financial Readiness – organizational resources in implementing and maintaining a system

Because the Borotis and Poulymenakou framework crosses many aspects of needs assessment components, organization, environment, and performer, their work is one example of an approach that can be used to help an organization understand where specific gaps exist in an online corporate training program.

Addressing Learner Needs in Online Corporate Training

There exists a large body of research done specific to the use of needs assessment in addressing performance gaps in employee knowledge and skills. Work by Gilbert, Rummler and

Brache, Rossett, Kaufman and many other pioneers all provide guidance on the use of needs assessments to find and solve performance gaps for individuals and small groups (Leigh, Watkins, Platt & Kaufman, 2000). While not extensive, this initial literature review shows, however, that little has been written on needs assessment as it relates to addressing worker performance gaps in skills and knowledge for a heterogeneous employee population in online corporate training delivery.

Because of the quick adoption by corporations of online learning technologies, much of the focus in the development of online programs has been on the technology, ignoring the pedagogical issues needed for effective online learning (Ali, 2003; Park et al., 2009). Rather than understanding the needs of the learner, corporations have attempted to reverse engineer the technology, translating their existing instructor-led programs into online delivery (Wang, Vogel & Ran, 2011). Training to a one-size-fits all methodology has tainted the user experience which has led to high dropout rates, issues with training transfer, and overall dissatisfaction with online corporate training (Derouin et al., 2005).

The challenge for online corporate training programs is how to remain scalable, while still serving a heterogeneous population of learners. Normal learning interventions benefit from needs assessment at the individual performer or small group level (Rothwell, 1999), but can be difficult in designing self-directed online programs.

Granger and Bowman (2007) in their work on constructing knowledge in a distance learning environment, propose that addressing learner-centric needs can be done by focusing needs assessment and design on the online learning setting and allowing learners to create their own learning experience (Granger & Bowman, 2007). Granger and Bowman (2007) take a constructivist approach, advocating that the online ecosystem should be designed to allow learners to progressively build toward their own learning goals. To do this, it is important that companies understand the scope of their learning population and various learning preferences of that population. Needs assessment can assist in this process.

Wang, Vogel, and Ran (2010) take a similar view and believe that the success of an online workplace learning program requires a focus on aligning corporate interests with individual needs and work performance. Their work recognizes that employees are adult learners with distinct learning characteristics. They propose a Key Performance Indicator model that provides each employee with learning goals that align with corporate goals. Like Granger and Bowman, they believe that because adult learners are more apt to be self-directed, constructing an online training environment that offers a learner the ability to create their own learning experience is critical to program success.

In both research examples, application of a needs assessment at the organizational, environmental, and performer level can assist with the creation of a more learner-centric corporate online training offering that serves the interest of the firm and its employees.

Accelerating the Design of Corporate Online Training

Preliminary findings of this literature review demonstrate that there is a depth of research on broad application of needs assessment. Within the field of performance improvement, several models have been developed to assist the practitioner in aligning organizational, environmental and performance with training in general. We would advocate much more research is needed on two fronts specific to online corporate training. The first is recognizing and addressing learning needs of less-homogeneous corporate learners with varying skills, backgrounds, and levels of motivation in online corporate training. The second centers around real-world application of needs assessment models to address a broad group of performers.

Summary

As systems designers and leaders, it is truly unfortunate when we see that the needs assessment and analysis phase of a systems design is often the phase glossed over the quickest, is stacked with assumptions, or rushed in an effort to reach a solution quickly. This review advocates change by focusing on the importance of that initial gap in results. Culturally situated needs assessment and analysis will be more effective than a generalized approach that does not specifically consider the context and distinctiveness of the learners. For example, when designing an online learning system it is essential to understand the motivation, available support, technology and Internet bandwidth availability, learning goals, and other needs of the learner. It is critical when conducting a needs assessment to consider the learning environment as a system of interrelated components and subsystems. For instance, considering different layers or levels within a larger system can help ensure that specific aspects of the system are not neglected by a needs assessment.

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Adopting ADDIE and SAMR Models for Developing Hybrid Onboarding Experiences for Library Student Employees

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Abstract

The article aims to introduce the process of designing a hybrid onboarding experience for student employees who are working at university library. Because of the dissatisfaction of the previous onboarding experience, there was a need to develop an effective training program for student workers to better serve library patrons. Guided by the ADDIE model, the design process included analysis, design, development, implementation, and evaluation (Morrison et al., 2010). Previous research findings showed the benefits of relying on mobile devices to promote "personalized, situated, and connected" learning experiences (Romrell et al., 2014, p. 2). The SAMR model, including "substitution, augmentation, modification, and redefinition," was used to guide the development of mobile training to supplement the limitations of the self-paced training experience (Romrell et al., 2014, p. 79). After working with subject matter experts (supervisors), the onboarding experience was designed to include both online and face-to-face sessions. The online training modules were built on the Top Hat, and Twitter was used to further enhance student workers' online training experiences.

Introduction

On-campus employment is usually viewed as an opportunity for many students to gain work experiences and skills before entering the labor market. Multiple types of on-campus jobs were able to provide students with opportunities to gain both hard and soft skills, such as culinary services, dormitories, libraries, and administrative offices. Amongst these employment opportunities, university library is often regarded as one of the popular spots which many students are interested in working at. For instance, there are 30-40 students working at the target library each year. Because of a high turnover rate among these student employees, the supervisors need to provide training to newcomers at the beginning of every semester. The training process can be extremely overwhelming when there are only two to three supervisors; and sometimes, they have other commitments to work on.

Because of the lack of staffing, the previous training was mainly delivered through a spreadsheet checklist and some face-to-face instruction. For instance, student workers were required to do a self-paced training during their shift and ask for face-to-face guidance if need. In the spreadsheet checklist, the training content was divided into seven weeks, and students need to go through each page and click the links to complete tasks (see Figure 1). According to the survey results, a majority of student workers expressed their dissatisfaction or negative attitudes with regard to their onboarding experiences (Ren, 2019). However, in terms of the important role that student workers play in providing services to library patrons, the need to develop an effective training program was urgent.

Time Frame	Tasks	Links or Training Materials	Notes or Questions	Task Status
Week 1: Most of these tasks can be learned at the desk but you can also find directions (where) or you can talk to any staff member at the desk, or talk to your Supervisor/Mentor.	**Student:** Learn how library printing works	https://www.library[redacted]/services/computing-printing/printing/		To do
	Student: Learn how to find out whether the library has a textbook for a particular class	http://www.library[redacted]question/textbook-for-my-class/		To do
	Student: Learn policies and procedures for library study room reservations	http://www.library[redacted]/about/administration/policies-and-procedures/room_reservations/		To do
	Student:Meet with Nedra to review technology available in Alden. Printers: Jam recovery/toner location & replacement Peripherals Cabinet: Items that are checked out & usage of those items Study Room Tech: TV's & laptop connections			To do
	Student: Learn how to check out items at your desk.			To do
	Supervisor/Mentor: Give the student a quick tour of the library to show them other desks and important locations for them to know.			To do
	Student: Learn how to enter questions into the LibAnalytics form.	Access from link on the Staff Portal https://staff.library[redacted]/portal		To do
	Supervisor/Mentor: By the end of the week, find your student at the desk and see if they have questions about completing any of this week's tasks. Talk about why we keep track of questions in LibAnalytics.			To do

Figure 1. A screenshot of the training spreadsheet

Onboarding Experience

Onboarding, or initial training, is served as a way for newly hired employees to be familiar with organization and prepared to successfully handle tasks in the work environment (Graybill et al., 2013; Keisling & Laning, 2016; Lisbon & Welsh, 2017). An effective onboarding experience could not only equip employees with needed skills but also increase their engagement and positivity in their future work. In the library context, student employees are viewed as valuable assets to achieve the library mission (Evanson, 2015). Therefore, onboarding training plays a crucial role in not only equipping them with needed knowledge and skills to better serve patrons but also increasing their positive attitudes while working at the university library.

Onboarding Experience Design

The ADDIE model was widely applied to develop courses and training programs in various contexts. In order to design an effective onboarding program for student workers, the design process was based on the ADDIE model, including analysis, design, development, implementation, and evaluation.

Analysis

To start the design of the model, analysis focused on contextual analysis and learner analysis (Morrison et al., 2010). Contextual analysis was used to analyze available resources in the work environment, such as existing training materials, facilities, and work procedures. Leaner analysis was used to understand the characteristics of learners, such as who are the learners, their knowledge and skills, and their learning preference. In terms of the contextual analysis, the designer conducted a document analysis to better understand the weaknesses of the old training materials and interviewed supervisors to identify available resources in the library and work procedures that student workers need to perform. In terms of the learner analysis, the designer sent a survey to student workers to understand their backgrounds, knowledge and skills, and learning preference.

As a result, 24 of student workers completed the survey, and the response rate was 80%. The survey responses indicated that all of student workers were undergraduates, and more than

90% of them did not have any library working experience before the training. In terms of their learning preference, 16% of students reported that they had positive learning experiences while using social media. A majority of students mentioned that Twitter was their favorite social media, and about 70% of the students reported that they checked their social media more than once per day.

The existing training materials are mainly stored on a spreadsheet checklist, and the training content were divided into seven weekly modules. The document analysis indicated the weakness of the training materials, including lack of training objectives, learning flexibility, and interactivity and engagement. Moreover, the interviews with supervisors were used to better understand the training process and work procedures. Supervisors further pointed out the problems with old training program, including inconsistency and communication issues.

Design and Development

Based on the findings from the contextual and learner analyses, the designer worked with supervisors to design and develop an engaging onboarding experience for student workers. The purpose of training is to provide needed information for the target learners to be proficient in performing specific tasks (Morrison et al., 2010). Thus, task analysis was used to determine what knowledge need to be included, including topics, procedures, and potential critical incidents. After working with supervisors, the newly designed onboarding program included six weekly modules, and topics covered library policies, library services, facilities, library website, and customer service.

Training objectives were used to design the training modules and evaluate trainees' learning outcomes (Morrison et al., 2010). They were developed based on three categories, including cognitive, psychomotor, and affective domains. For example, an example of cognitive objective was: to name right library services to solve patrons' problems. An example of psychomotor objective was: to perform right steps to check out/in items. An example of affective objective could be: to develop a friendly relationship with library patrons.

Because of different work shifts and class schedules that student workers had, the training was designed to deliver in a hybrid manner, including self-paced online training and face-to-face instruction components. The self-paced online training was built on the Top Hat, an active learning platform (see Figure 2). The online component included: Introduction and Overview, Consumer Service, Library Service 1, Library Service 2, Library Website 1, Library Website 2, and Summary and Evaluation.

The face-to-face component was mainly used to teach about step-by-step tasks and conduct role-playing simulation exercises. One of the supervisors would provide the training, and the topics included: Library Tour, Customer Service, Reference Interview, Technical Issues, and Checking In/Out Items.

In order to overcome the limitations of self-paced training, the SAMR model, including substitution, augmentation, modification, and redefinition, was used to develop the mobile learning component for student workers. According to the findings of the learner analysis, student workers were familiar with using social media to communicate and interact with others. A social media, Twitter, was used as a supplemental platform to increase student workers' engagement, interaction, and connection (see Figure 3). Meanwhile, social media could be used as an alternative platform to maintain communications between supervisors and student workers.

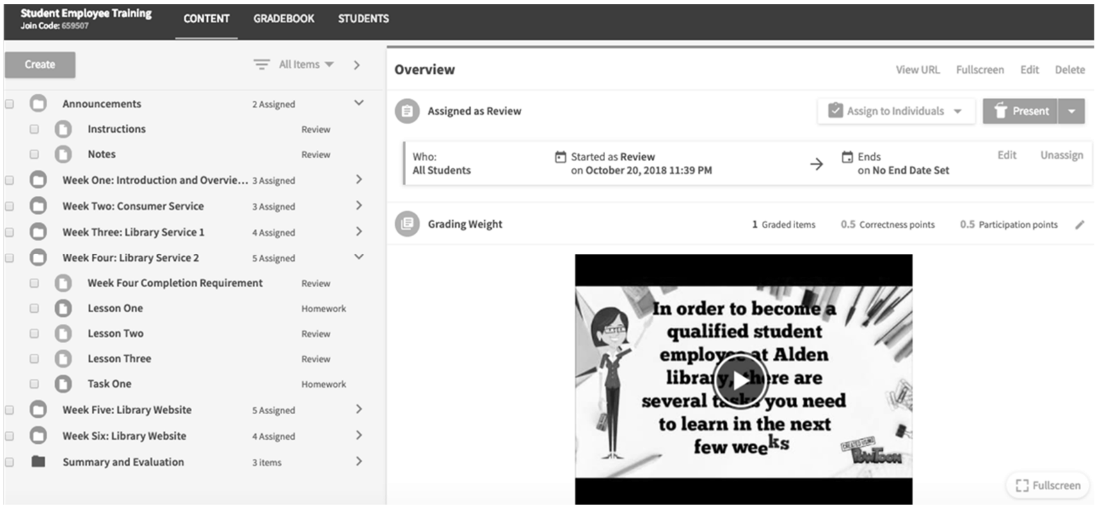

Figure 2. A screenshot of the online training on the Top Hat

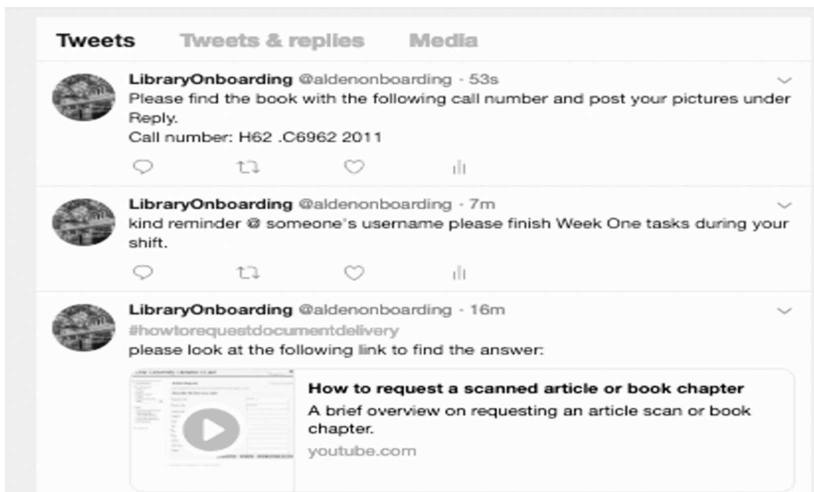

Figure 3. A screenshot of the Twitter page

Implementation

To ensure the success of the implementation of the training program, the CLER model, including configuration, linkages, environment, and resources, was used (Morrison et al., 2010). First, configuration and linkages were used to identify the relationships among entities to ensure effective communication. For example, supervisors would be responsible for explaining the onboarding program to student employees and monitoring their progress to ensure the completion of the program. Environment and resources were used to analyze needed recourses to support the onboarding training, such as staffing, facilities, and multimedia training materials. For example, the supervisors could send an email to student workers to invite them to complete the online training and provide a guideline or instruction on how to start the self-paced training.

Evaluation

Based on the predefined training objectives, the evaluation methods were used to analyze student workers' learning outcomes, work performance, and the effectiveness of the training program. At the end of the training, summative evaluation was used to assess the efficiency of the training program. Scenario-based questions and problem-solving questions were used to evaluate objectives in the cognitive domain, such as to name library services. Observations with rubrics were used to evaluate objectives in the psychomotor domain, such as to perform reference interviews. Observations and surveys were used to evaluate objectives in the affective domain, such as attitudes while taking the training or interacting with library patrons.

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Toward a Unified Computer Learning Theory: Critical Techno Constructivism

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Schools are not known as places that move quickly in response to changing philosophies, burgeoning innovations, or marketplace attitudes outside of themselves (Educational Technology in the 21st Century, 1995; Micheuz, 2009). While innovations in the fields of art, medicine, and science evolve, the re-imagined classroom of the future that many have dreamt of and written about for nearly forty years has yet to take hold (Harel & Papert, 1990). Most people would leave a doctor's office upon seeing that the most current and available tools were from fifty years ago. Most people would have their doubts about the effectiveness of the doctor's approach if the office visit talk consisted of old strategies about which you had read many criticisms. In schools, however, students, teachers and families alike have grown to tolerate the anachronism (Feenberg, 2002).

Technology use in education can certainly speed up our use of paper and how we process and access information. In fact, that is the most understandable and basic goal of using a computer and the one that brings most novice users to convert their workflow to digital. However, replacing paper simply maintains things as they are. For decades, the machine has had the potential for more uses than yet discovered. Why invent a new gadget to teach the same material in the same way (Papert, 1972)? To disrupt the norm, the thoughts within this paper aim to urge the conversation about how to get students to learn together *with* computers and technology, not isolated individually in a corner *at* a computer terminal. Shifting the emphasis of computers in the classroom to a blended or mixed reality will empower the students and undermine the critics (Educational Technology in the 21st Century*,* 1995). Noting that the preposition change from "at" to "with" is more than a decorative device of language, the entirety of the approach with children and computers needs remodeling.

Again, and even at a glance, one can readily accept as true that the institution of school is known to move slowly in response to changes in society at large, but this pace does not match the students themselves who change rapidly and frequently in response to those same changes. Students daily bring to campus an abundance of microprocessors and have grown reliant on the widespread availability of high fidelity wireless Internet connectivity (Yoo, 2015)—school communities have witnessed a "new normal" with student familiarity of computing devices, computing literacy, and multi-user engagement in online virtual environments. This near-silent shift has occurred over the last ten years, during which time, some observed a widening gap between the kinds of jobs available and the relevance of subject matters studied in schools (Kellner & Kim, 2010). Additionally, schools and classrooms faced a greater number of restraints placed on curricula and student outcomes due to accountability and funding policies that largely dictate how administrators allow their teachers to use class time for what is sold as "in the interest of students." Students at earlier and earlier ages were far more flexible with more complicated tools than what their schools provide (Kafai & Burke, 2015). This indicates a gap between student readiness and school preparedness that often went unrecognized and undiscussed. As schools set their "June outcomes" during the previous June, educators and administrators may then end up with predetermined outcomes that limit student growth and creativity, as well as their critical thinking and problem-solving skills. The growing mismatch and divide happens as a direct result of decision-making that disregards available data.

Global interconnectedness via Internet and pocket-sized devices to create, distribute, and access information has grown exponentially. The explosion of available information as well as an ongoing reliance on computing to access, collect, and share information, has resulted in an amplification of the already well-documented "digital divide" (Attewell, 2001) that politicians, philosophers, and philanthropists have worked on for at least two decades. A recent study (Araque et al, 2013) indicated an important reminder: increased availability of Internet access and computer hardware alone still did not improve the chances for low-income families to emerge from poverty. Training and support along with leveling the playing field had a greater chance for helping families to improve their station. This same equation for helping people to help themselves applied not only to families in their homes, and communities at large, but also students in a classroom. Teachers were often given a single computer for their classroom, or perhaps a school had a single computer lab for many classrooms, but even when a 1:1 computer program was implemented, training and support were still often lacking. As a result, the computer hardware and software were not utilized to transcend or transform lives, minds, curricula, or schooling. In other words, the yet unrealized vision of computers in schools as a radical liberation tool still awaits us: "High quality hardware and educational software alone cannot make this change and will not result in better educated students: educators need to change for this transformation to begin" (Troutner, 1991, p. 14). Fundamental shifts in daily classroom life for students can happen with guidance from research and theory, which has had great potential for decades to influence school leadership at the highest levels.

In a 1995 Congressional hearing on Education and Technology, Dr. Seymour Papert said, "I think there's an education establishment that has its head wedged in a culture that grew up over a century during which there was the most lethargic progress in education of all fields of human activity and they continue to suffer from being part of that culture" (Educational Technology in the 21st Century, 1995). This paper is founded on established writings that encompass the field, even reaching into some texts that were written before the advent of the computer; those authors discuss relevant fundamental principles and attitudes that directly relate to a reimagining of classroom computer use. Further, many articles have been written by educators, social critics, pundits, philosophers, parents, and industry moguls. New ideas are prevalent, perhaps in an overwhelming abundance, but how many of these ideas make their way to teacher and administrator credential programs? How many of them assist in guiding the work of training the very people charged with creating experiences for student growth and learning? And how many ideas penetrate the very heart of the system itself and position themselves in opposition to the status quo?

Computers today have incredible processing power far beyond most of the utilitarian purposes they serve in schools today. This is not entirely surprising given the history of teaching machines and learning machines, which were created as rote learning devices reliant on behaviorism as the main teaching strategy. Presenting students with stimuli to which they must respond represents the majority of both the historical and the current usage of computers in classrooms. Missing are the expectations that when students work with computers that they can create original content and explore problems or develop critical thinking skills through the process of following their own inquiries.

In this age of test scores tied to budgets, typically only that which would increase test scores would survive a budget cut—dreaming up a new curriculum or pedagogy with computers does not have guaranteed funding nor very many promises of funding. An experimental program where students "learn by doing" in a shared experience with a three-dimensional creative space sounds intriguing, but it will typically lose the funding face-off with a program trusted to keep the core subject standardized test scores reliably strong and growing. Furthermore, many people might expect students to figure out how to use computers on their own outside of school, given the preponderance of devices and websites and apps readily available.

And while some schools and educators work with the guidance of International Society for Technology in Education (ISTE) and Partnership for 21st Century Learning (P21) in their lessons and outcomes, it is certainly not the order of the day nor the requirement at most school sites. To push at this some more, all of this occurs in a simultaneous space where educators, scientists, and parents often acknowledge the unmet needs of students to find their voice and style, and to find individualized pathways of learning. In other words, we have more tools and venues available than ever before for students to discover an individualized interest and focus, but are slow to let them have greater value, weight, time, and space in our classrooms. The rhetoric of meeting students where they are is at odds with the diagnostic tools used to determine that location.

Digital Learning Environments (DLEs) that are safe and sanctioned by schools can offer opportunities for students to develop essential 21st Century skills, such as cognitive flexibility, electronic civic engagement, computer science literacy, judgment of source material, collaboration, and complex problem solving. Further, DLEs can help provide spaces for students to remix concepts and objects in search of new innovations to help better serve humanity. As cultures and societies change, new needs for systems emerge, towards which students could be working with real data to produce ideas and prototypes. Too often the benefits of creative collaboration receive short shrift when pitted against one's individual academic progress.

Digital learning environments (DLEs) can also be powerful creative places for students to create, share, and explore a variety of cultural expressions in a diversified and meaningful manner. Underrepresented students are most often the marginalized voices in our classrooms. Educators seek pedagogies that emphasize inclusivity of all student ideas and experiences into the central narrative of the classroom. Using DLEs with a methodology steeped in critical theory and techno constructivism allows schools to create more places and pathways for students to express themselves, develop critical inquiries into their own assumptions and interests, challenge the assumptions of others, and deepen their connection to a lifetime of learning. It is incumbent upon schools to not only create and nurture these spaces for students, but to also train their faculty on how to use them and rethink their methods from previous years. The culture shift has already rapidly occurred outside of schools; now we must find a way to follow suit inside of schools.

This paper exists to lend its voice toward a unified learning theory for computers, computing, and digital learning environments for others to implement in their own practices and studies. There exists a two-headedness of behaviorism and constructivism in education, with particular focus on classroom computer usage and classroom computing. There is a high incidence rate of behaviorism alongside a high interest rate in constructivism. The relative absence of critical theory in techno constructivist thinking is a dilemma to explore and directly address for the purpose of finding unification of these ideas, hence the title of this piece and the ideas herein—Toward a Unified Computer Learning Theory: Critical Techno Constructivism.

The larger significance and purpose here is also practical in looking for and asking for new approaches to school and the perpetually changing needs of students. In a digital learning environment, teachers and students have enormous potential for multimodal and multivalent approaches, as well as multiple entry points. Many classrooms today have access to incredibly powerful machines that can create an immersive and effective John Dewey-inspired learning environment that honors the students and the teachers, and even more, honors the process of creativity in pursuit of knowledge and production.

It is impressive to find that so many elements of the great constructivist thinkers instead of conflicting with one another can commingle and co-exist in our modern computing era. Once superimposed on each other, these elements begin to point toward a new approach, a new theory, a new classroom experience, and even a new graduation standard.

Looking back at the roots of computers in education, the main use and pedagogical design of the Pressey "teaching machines" was to encourage automaticity of skill and content in narrowly defined sets of data (Pressey, 1926). As the processing power of computers became powerful enough to allow for new designs in software and approaches with pedagogy, constructivism and constructionism were looked to for new possibilities and potential for how to use computers in schools. With all these changes in the potential and power of the "teaching machines," however, the approach many schools take has remained more closely aligned with behaviorism and cognitivism. The ideas derived for this piece were created from a document analysis (Bowen, 2009) of seminal works from John Dewey (1916), Paulo Freire (1970), and Seymour Papert (1980) for the purpose of adding to the existing theories of computer use in classrooms and further developing a unified learning theory for computers, computing, and digital learning environments.

In sum, the words "technology and education" all too often means "inventing new gadgets to teach the same old stuff in a thinly disguised version of the same old way" (Papert, 1980, p. 353). Most software used in classrooms for the past four decades has relied on closed loop situational data simulations and narrowly focuses students on predetermined sets of information—this is "edu-tainment", not education. Put another way, this is a transactional approach and not a transformational approach. Today's modern learners are ready for educators and leaders to figure out a new and comprehensive approach to effectively teach with the Internet in digital learning environments (DLEs)—and keep in mind that the power, the reach, the accessibility, and the information contained there within expands each month with no foreseeable limit. That students should be subjected to a model of education that strips them of their natural intellectual and creative value is itself a crisis. In its place, Critical Techno Constructivism can help create nurturing and meaningful learning environments for all students.

Critical Techno Constructivism abides by the following principles:

- Social justice is a goal, not a topic.
- Predetermined outcomes limit creativity, intellectual growth, critical thinking, and problem-solving skills.
- Student inquiry must drive curricular choices and learning outcomes.
- Downloaded, purchased, or otherwise imported curricular materials and solutions are inadequate substitutes for developing original and relevant course materials.
- Computer programming is a mediating language between ideas and people.
- Guidance, coaching, and formative assessment replaces testing.

- Computers and electronics are objects-to-think-with, and should not merely be used as replacements of analog tools.
- School is a laboratory, a studio, and an incubator for students to develop ideas into public-ready products and artifacts, or mimic what professionals create.

Critical Techno Constructivism holds as a central belief that we doom progress and innovation once we insist on reaching an externally defined outcome fed by imported curricular material and strategy; and that at the center of student-driven, problem posing education we must place the computer as an object-to-think-with.

Critical Techno Constructivism asks that educators and students work together instead of at odds in pursuit of real work that has real impact on problems posed and questions asked by the students.

Critical Techno Constructivism operates on the principle that all digital tools must be mixed up with humans and their reality, and that no student should be asked to work *at* a computer, but rather that people and technology work with each other.

Further, Critical Techno Constructivism was created to undo school as we know it; therefore putting these ideas into action is a conscious effort by the people involved to seek new relationships to knowledge, to seek new innovations that impact their community, to seek new social structures to provide financial freedom, and to counter traditional methods that have been used, consciously or not, for dehumanization.

The externally imposed outcomes for graduation and the rigid rules of college admissions translate into a ready-to-wear experience for most students. Whether or not students understand what they are asked to study is often of little concern. And another test is around the corner. The prescribed curriculum is so normal that it does not faze our sensibilities. Certainly students could learn something they do not previously know or understand, that is not in question, but just what is it that they are learning? Educators discuss multiplicity and diversity in the abstract, but our traditional teaching methods mostly do not help produce diverse and divergent thinkers. We continue to allow predetermined aims and outcomes to take precedence over the experiences and ideations of the child.

Many times the constructivist classroom is seen as a “free-for-all” for those untrained in what to look for when the classroom is de-centered. A teacher evaluator may come in and see that a teacher is not lecturing from the podium or forcing students to move “lockstep” through a downloaded and reproduced worksheet of problems, and for these “crimes” would be considered as going too slowly or not meeting performance standards: one might wonder where exactly this evaluator gets her ideas for what qualifies as quality work happening in school. Nevertheless, these are real glimpses of how schools operate—the fear that a teacher is non-performing has more to do with a misinformed perception of meeting the needs of all students. When the teacher is involved in the process of each student’s pathway in the work, that teacher might be thought of as not teaching, and as strange as that sounds, it is true simply because teacher and administrative training courses do little to provide opportunities to practice anything but traditional methods.

Starving teachers of the opportunity to co-construct experiments with their students robs everyone. To stifle teacher creativity and autonomy can nearly ensure student misery: when the teacher is a lifeless robot, do not expect the students to accidentally find joy in their learning experience. We are suffering from a lack of imagination with how to run our schools, and most “solutions” are attempts to redirect or reinvent a traditional informational instructional model of teaching and learning—we stop short of reinventing school itself.

At the heart of the analyzed works of Dewey, Freire and Papert, is a belief that we always retain a portion of our wonder as children explorers of the world. Through conscious engagement with that wonder and the natural inquiry that ensues, schools have a chance to think with students about knowledge and learning in ways that can reactivate everyone's excitement for study and production of products or artifacts. The computer is only but a part of this approach and is not where learning ends; the computer is the strongest augmentation tool we currently have available to shift what we do when engaging in learning.

Seymour Papert saw that the default nature of how schools and educators and families think of computers was what doomed its categorical use. Students will, students will, students will—the outcomes and standards are full of sentences about what the students will do but nowhere does it state what the administrators and the faculty will do. Why is this? What promises ought to be made to students about what will be done by the school in their favor? I would like to start right there.

A powerful new classroom space starts to emerge when we rethink the resources and activities with students' freedom at the center. A class where if you are not wrong you cannot go forward in your work, that is a wholly different model. The trauma of failing in front of your peers would simply not exist because the errors in computer programming are necessary to find useful solutions to build the desired product. Thinking with the computer is considered a radical act, though there will likely come a time in human history that looking back at 2020 will provide a good chuckle at our stubbornness in insisting on a traditional model when we have the tools and philosophies to do otherwise. Included in this paper is an educator toolkit (see Table 1) that will hopefully contribute to accelerating our progress towards new learning theories and schools and experiences for students.

Classroom experiments of this nature could occur globally; the only barrier to entry is the will of one person. The computer is the kingpin in this untethered universe of learning potential for it alone can be used in a manner dreamt up by its user, and the biggest dreamers are children, if we leave them enough space to be just that. It is incumbent upon us to unmask the corporate and political takeover of Education. It is incumbent upon us to empower students and teachers to engage in authentic discovery and study. It is incumbent upon us to transform school in opposition to predetermined outcomes, planned curriculum, and standardized testing.

The fractured curriculum serves the specialist teacher and the accounting system more than it does the student. Freire contends that the fractured curriculum also further isolates people's minds and prevents them from engaging in the natural play of human imagination and conceptual strength. With authentic dialogue at the center of the work in school, it would be impossible to predetermine the curriculum and the outcomes. Viewing a learning environment in this manner liberates us from the stranglehold of testing and textbook companies. The re-education of the public might need to start right at this point, for it has many far-reaching implications that impact a community. But again, posing school as a problem for a community to solve will allow for the local needs to be heard and addressed. Leadership is essential in the creation of this approach and guidance through it, though that leadership must be of a transformative, not transactional, nature.

My vision for the future is less about using particular applications, clients, programs, and data sets, and more about my desire for the freedom that students and teachers together could have to choose and chart a path. Schools are hanging on for dear life to a traditional model of what Paulo Freire termed "banking education" (an idea that John Dewey wrote about many decades prior) and this is due mostly to how we, in the USA, are still tethered financially to the

Educational Testing Service (ETS). What happens with technology in education or educational technology today is often still recognizable as that which happened since the 1980s –- once a week "pull out" computer lab time, individual "one and done" projects, or digitizing work that was previously completed with pencil and paper or typewriters. As of yet, we have not toppled the political money machine that shackles well-intentioned creative people in schools. If we did, and allowed for a shift in graduation outcomes and the manner in which we ask students to engage in work and be assessed, then we would help unleash innovation in ways that we could not predict but would positively change how we think and live.

For future research, I recommend that educators study the students who do not fit the traditional mold and track their progress through colleges and careers. Additionally, I recommend that more research be done on how to create and maintain schools as nurturing places for student engagement, since that is the central component of many pedagogies and theories vying for prominence in traditional schools. And finally, I recommend that we spend time researching how experimental use of computers can augment human thinking. Studies have been performed to demonstrate that an alternative approach via computer programming can produce higher student test scores on traditional assessments than students who covered the material in a traditional manner (Harel & Papert, 1990). But what we have not yet done is to fully explore and study a constructivist, inquiry-based, student-driven computer and computing focus in an academic course.

What happens when we consciously counter the traditional narrative of school and schooling? What happens when students bring their own real-world situations to pose as problems for study? What happens when we make room for student control of the artifacts they produce? What happens when we use computers as objects-to-think-with? What happens when we learn computer programming languages to create software solutions of our own? What happens when we naturally and organically collaborate? What happens when we remove from school the artificial barriers of age grouping, grade levels, time spent, content areas, content sequencing, and testing measurements?

Schools can change. Administrators can change. Teachers can change. Classrooms can change. The students are waiting.

Table 1
Tenets of Critical Techno Constructivism with Suggestions for Operationalizing the Theory.

Tenet	Question	Action
Personal Inquiry	Did the student develop the learning task?	Engage in open dialogue with students with the explicit purpose of developing together new assignments or topics of study. Work with students to define audience, purpose, resources, tools, and goals of the learning task. Think big with students about possible uses and aims of their work beyond the classroom and the confines of school. Encourage students to follow through and develop to its end what they pose as a problem to solve.
Compelling Problem or Question	Did the student arrive at an answer that led to more questions or problems?	Coach students as they work to keep a log of their progress, handwritten, typed, audio or video recorded, for the purpose of tracking ideas as they occur. Encourage students to spot potential new paths or questions to chase as they work. Develop with students some methodologies for addressing conflict and dissonance in their work and studies and possible applications.
Technology as Tool to Think With	Did the student use technology in the thinking process?	Choose technology wisely with students. Remember that analog tools may provide instant freedom in expression. Demonstrate how to think with the computer. Use machine learning, graphical statistics, programming language, and concordances or natural language processing. Make certain the computer remains an object-to-think-with, not a replacement of paper or a push-button terminal.
Formative Demonstration of Learning	Did the student demonstrate learning throughout the process?	Develop guidelines, rubrics, and expectations of outcomes with students. Adjust these as necessary throughout the process of their work, sometimes abandoning them when students find them restrictive. Consult with students about progress and engage in conversations less as an evaluator and more as an interested peer. Sparingly make suggestions so that students retain ownership.
Reflection as Learning	Did the student demonstrate a reflective approach in the formation of knowledge?	Explicitly teach the skills of mindfulness in short lessons. Engage wholeheartedly in the process of looking for student interest and joy in their work. Emphasize to students the importance of caring about their own interest levels. Engage in reflective questions that are genuine. Avoid leading statements about what you would do as this not-so-subtly shows teacher judgment.
Social and Cultural Critique	Did the student demonstrate a critical awareness of the larger established modes and forms of thought that shape thought?	If an understanding of larger social constructs does not yet show in their work, make a weighed decision to point them out. Building consciousness more authentically through self-realization is the most powerful, however, students will need coaching and guiding. Avoid moralizing or hijacking student work with your own politics, values, or experiences. Make mention of historical events, people, or concepts that students might consider for study on their own.
Sharing and Collaborating	Did the student actively seek out collaborators in the process of acquiring knowledge, testing theories, and creating a shareable artifact?	Demonstrate methods, procedures, and styles of communicating with people. Seek out experts and amateurs as guest speakers or consultants. Show the crossover of work done in school and out of school. Practice presentation skills. Create space and time in class to talk together about student progress. Explicitly teach and coach how to communicate respectfully with operationalized critique. Engage with students to develop multiple venues and audiences for sharing.

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A framework for understanding the role of sociocultural issues in instructed learning

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Abstract

This paper zeroes in on the role of sociocultural issues in instructed learning, as part of a larger, exhaustive discussion—presented as the 'Molenda–Subramony Framework'—of the myriad proximal, distal, and environmental factors impacting the latter. Given that human society comprises a multitude of individual and institutional actors operating within multiple, overlapping environmental settings and contexts, our Framework features key actors—the learner, the facilitator, the learner's home/family members and peers, and the media—operating within the setting of classroom and school environments, important *frame factors*, and the larger sociocultural environment. This paper is devoted to examining in detail the sociocultural issues, aspects, and dimensions pertinent to each of the aforementioned key actors and settings.

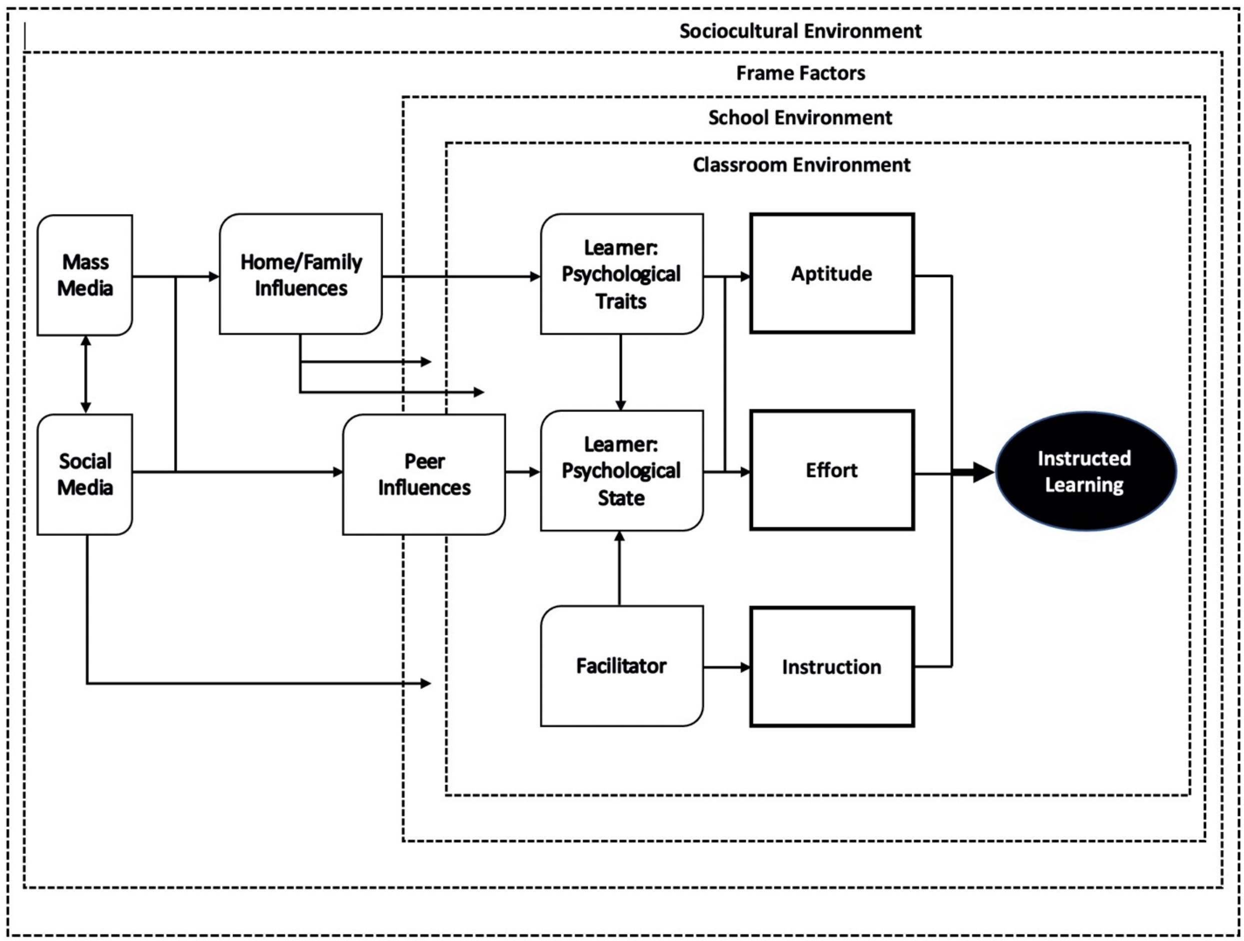
Introduction

The role of sociocultural issues in learning have, until very recently in the field's history, attracted very little interest and attention amongst educational technologists; the extraordinary magnitude and all-pervasive nature of this neglect has been documented in vivid, painstaking detail in Subramony (2004), Subramony (2017), and Subramony (2018). As Jamison (1992) described, the roots of this collective blindness goes all the way back to our field's—particularly its branch that deals with instructional systems design (ISD)'s—origins within the deeply patriarchic milieux of the military, industrial, and medical spheres. These origins prompted it to traditionally look at the stakeholders targeted by our scholarship and praxis as uniform beings suited to uniform solutions; after all, our earliest target learners wore actual uniforms, whether on military bases or on factory floors. ISD thus started off as mere manipulation of content, following linear, restrictive, lock-step models that failed to comprehend the true nature of human learning as complex, multilayered, and messy. To its credit, ISD did eventually evolve somewhat from there; Schiffman's (1986) classic essay carefully traced ISD's development from a primitive media-selection approach to a more *systemic* one that better befitted its *instructional systems design* moniker.

Molenda-Subramony Framework

Our recently published book (Molenda & Subramony, 2021) presents a pathbreaking new Framework outlining the myriad factors—from proximal, to multiple levels of distal, to environmental—that directly or indirectly impact what we call *instructed* learning, a term borrowed from neuroscience that distinguishes human learning which occurs as a consequence of deliberate, planned, premeditated instruction from that which spontaneously occurs in response to various life events/experiences. Fig. 1 below visually represents this Framework, which we call the ‘Molenda–Subramony Framework of the Forces Affecting Instructed Learning.’

Fig. 1: Molenda–Subramony Framework of the Forces Affecting Instructed Learning



The above Framework constitutes a crucial part of our overarching argument that an *ecological* approach to educational technology scholarship and praxis is a logical next step in the evolution of our field into one that is 21st-century-ready. This entails extending the systems metaphor in a manner that allows us to see personal and social relationships as part of meaning making in an increasingly diverse, interconnected, globalized world; recognizing learning as spanning multiple human contexts, such that ours and our stakeholders’ history, culture, race, politics, etc. *all* matter and need to be taken into account within our scholarship and praxis; and thus acknowledging that—at the risk of sounding cliched—appropriate instruction truly requires a metaphoric 30,000-foot view, a capability to see the BIG big picture. The Molenda–Subramony Framework incorporates many elements that have traditionally not been taken into consideration by instructional designers, presenting a comprehensive, holistic view of the myriad factors that affect instructed learning—and therefore ought to be taken into account while designing, developing, and implementing instruction.

Key Actors and Settings

Human society comprises a multitude of individual and institutional actors operating within myriad, overlapping environmental settings and contexts. The Molenda–Subramony Framework features the following key actors: the learner, the facilitator, the learner's home/family members and peers, and the media. These actors operate within the setting of classroom and school environments, important *frame factors*, and the larger sociocultural environment. The rest of this paper is devoted to examining in detail the sociocultural issues, aspects and dimensions pertinent to each of the aforementioned key actors and settings.

Learner

Let us start by focusing on the sociocultural issues pertinent to the learner, who is the focus of instruction within the Molenda–Subramony Framework. As Fig. 1 shows, two of the three proximal factors that most *directly* impact instructed learning relate to the learner—namely, their Aptitude, and the quantum of Effort they put in towards learning. Directly feeding into these two proximal factors are two 'first-level distal' factors also pertaining to the learner—viz., their Psychological Traits and their Psychological State. Taken together, these four factors encompass a wide range of learner attributes, including the learner's prior achievement, prior subject knowledge, self-efficacy, locus-of-control, maturational level, personal interests, expectancies, valuations, situational interest, and motivation to learn. In terms of their sociocultural aspects/dimensions, it is important to recognize certain crucially important issues/phenomena when considering the four aforementioned factors.

One of these phenomena that significantly impact the learner is their *cultural capital*. The eminent Bourdieu (1990) describes how learners with higher socioeconomic status (SES) origins inherit significantly different cultural capital—cultural background, knowledge, disposition, and skills—than those with lower SES origins. Learners growing up in environments where culturally valued activities like reading, travel, museum visits, and concert- and theatergoing are frequently practiced get socialized into the dominant culture that the educational system requires for academic achievement. Schools—where most instructed learning takes place—value and reward the cultural capital of the dominant classes, facilitating their easy translation into superior academic credentials. We will revisit this when discussing the classroom/school environments.

Besides, learners also acquire a distinct *habitus*—"a subjective but not individual system of internalized structures, schemes of perception, conception, and action common to all members of the same group or class"—along with their cultural capital (Bourdieu, 1990, p. 86). Functioning constantly as a matrix of perceptions, appreciations, and actions—as a system of lasting, deeply internalized, and transposable attitudes, beliefs, values, and dispositions integrating past experiences—a learner's habitus impacts their perceptions regarding self-efficacy and locus-of-control, as well as their interests, expectancies, valuations, and motivation. The learner's habitus engenders their aspirations—internalizations of objective probabilities that reflect the learner's view of their chances of success. Lower-SES learners raised in environments where success is rare are less likely to develop strong ambitions than upper-SES learners inhabiting environments where the connection between effort and reward is infinitely clearer.

Meanwhile, learners' cultural capital and habitus are closely linked to their privilege and intersectionality—both important sociological concepts that must be comprehended in order for us to better understand where our learners are coming from and how they relate to instructed learning. In her seminal 1988 paper, McIntosh outlined her influential concept of a "knapsack" of *privilege*, which she formulated as a direct repudiation of the myth of meritocracy that constitutes a basis of modern capitalist society. She characterized privilege—conferred through one's belonging to a 'dominant' group based on any given criterion such as race, gender, sexual orientation, culture, citizenship, etc.—as "an invisible weightless knapsack of special provisions, assurances, tools, maps, guides, codebooks, passports, visas, clothes, compass, emergency gear, and blank checks" (p. 1-2) about which its possessor is meant to remain oblivious, and ignorant of his obliviousness. Furthermore, the existence of a matrix of privileges enjoyed by the dominant groups invariably engenders a corresponding matrix of oppressions experienced by the subjugated groups; some take "active forms which we can see" and others take "embedded forms which as a member of the dominant group one is taught not to see" (p. 17).

Logically extending McIntosh's arguments related to privilege and oppression, Crenshaw (1991, p. 1245) coined the term *intersectionality* to describe how different forms of discrimination can interact and overlap, and to emphasize the need to account for multiple grounds of identity when considering how the social world is constructed. While originally employed to explain how race and gender intersect and compound each other as forms of oppression in the lived experiences of women of color, the concept of intersectionality has since broadened to encompass the entire gamut of pertinent social variables including sexual orientation, nationality, socioeconomic class, disability, etc. (Emba, 2015). Intersectionality reminds us that our identities based on race, gender, class, and sexuality accompany us in every social interaction (Collins, 1993)—including instructional activities. It helps us understand that human beings are complex beings who experience oppression in ways that are deeply intersected, in ways that cannot be disassembled and their parts analyzed separately; their myriad aforementioned sociocultural identities are thus profoundly interconnected with all other parts of their experiences and identities (Richards & Barker, 2015)—once again including educational experiences. An intersectional perspective allows us to see that we cannot begin to understand the contexts, experiences, issues, and needs of learners if we ignore and fail to take into account some very important parts of their identity and experience as human beings, parts that are inextricably interlinked with every other part thereof.

Furthermore, since the dawn of the current Information Age, a persistent and deeply impactful symptom of socioeconomic inequalities among learners has been the so-called *Digital Divide*—the widening and increasingly calamitous gulf between those who are appropriately positioned to effectively harness the puissant emancipatory potential of the myriad media technologies that are key to socioeconomic success and upward mobility within Information Age societies and those who are not. Borrowing McIntosh's theoretical lens, Subramony (2014, p. 7) proposed that the individuals belonging to those social/economic/cultural groups that are located on the "right" side of the Digital Divide could be seen as the largely oblivious beneficiaries of a vast matrix of privileges, unconscious possessors of a significant knapsack of gifts, when it comes to their relationship with media technologies. Evoking Crenshaw's concept of intersectionality, Subramony described these individuals as occupying "happy intersections" of demographic, economic, political, social and cultural factors that make it possible for them to harness the full emancipatory potential of these technologies to get even further ahead within today's Information Age socioeconomic framework. In contrast, those on the opposite side of the tracks vis-à-vis the Digital Divide do not possess said knapsack, but instead remain trapped under multiple layers of oppressions.

Meanwhile, the learner's Psychological Traits and States are substantially influenced by their *self-identity* vis-à-vis the dominant class/cultural/economic systems that they construct based on their lived experiences within those systems. Willis (1977) saw learners as social agents who view, inhabit, and construct their own world. Some construct self-identities that aspire to upward socioeconomic mobility and comply with dominant rules and norms. Others construct oppositional self-identities—based on their profound insights into the economic condition of their social class—that reject the dominant achievement ideology; they become subversive nonconformists, believing that their chances for upward mobility are so remote under the current socioeconomic power structure as to render any attempts at good behavior and conformity pointless. Giroux presented his theory of student *resistance* (1983), explaining how students' opposition and nonconformity towards the educational system were responses rooted in their moral and political indignation and critique of school-constructed ideologies and relations of domination rather than any sort of psychological dysfunction.

Finally, the impact of the learner's sociocultural environment extends to their prior achievement and subject knowledge (factors of their Aptitude), since prior achievement and mastery of prerequisite skills—including literacy and numeracy—depend on their access to learning resources and ability to extract the benefits of said resources, which again are a function of their cultural capital and habitus, self-identity, privilege, and intersectionality.

Facilitator

Let us now move our focus to the sociocultural issues pertinent to the facilitator, who implements instruction within the Molenda–Subramony Framework. When facilitators possessing socioeconomically more valued cultural capital and more effective habitus are put in contact with learners from socioeconomically marginalized backgrounds, this throws up potential opportunities and pitfalls. Consequently, the facilitator must navigate adroitly and skillfully, figuring out how to nudge learners along pathways to emancipation and empowerment without making them feel devalued or disrespected. This requires the facilitator to check some of their tacit/explicit assumptions with regard to teaching and learning. Two common assumptions among professional educators are that the current ideological, structural, and media/technological frameworks within which most instructed learning takes place are (a) morally/ethically well-intentioned, and (b) culturally neutral.

Critical scholars argue, however, that neither of these assumptions is warranted, and that they both reflect the obliviousness that characterizes privilege. For those unfamiliar with the term critical scholars interpret the acts and the symbols of society to understand how various social groups are oppressed, believing that understanding the ways human being are oppressed enables one to take action to change oppressive forces. These scholars align themselves with the interests of those opposed to dominant order of society, and explore how competing interests clash and how conflicts are resolved in favor of particular groups (Seiler, 2006) .

A specific group of critical scholars—whom one may call “social reproductionists”—argue that modern schools are set up and operate in a way that perpetuates the intergenerational reproduction of socioeconomic inequalities, rather than promoting the empowerment and upward mobility of learners from socioeconomically marginalized backgrounds by providing them with appropriate pathways to meaningfully harness the emancipatory potential of instructed learning.

Meanwhile, and this is ever more germane given the increasing time, effort, and material resources accorded to the integration of media technologies into teaching and learning, many professional educators persist in believing that instructional methods and technologies are ideologically objective and culturally *neutral*. However, Bowers—see Bowers, Vasquez, & Roaf (2000)—reminds us of the "multibillion dollar reasons" (p. 184) that the vendors of media technologies have for maintaining the myth that these technologies are culturally neutral. Said technologies in fact encode Western ideals of individualism and a rootless form of existence (Howe, 1988) . As Bowers, et al. (2000) explain, the myth of the cultural neutrality of technology was important in hiding the forms of cultural transformation that needed to take place in order to enable the spread of the Industrial Revolution; and technology-mediated learning is currently reinforcing the same modern, Western pattern of individual-centered relations and forms of consciousness—equating greater individual autonomy, consumerism, and technological development with progress—during what is essentially the Industrial Revolution's digital phase.

That neither of the two sets of issues introduced in the preceding two paragraphs have historically attracted much attention or interest among the dominant, mainstream voices within professional educator communities—especially educational technologists (see Subramony, 2004; 2017)—speak to the privilege enjoyed by the latter. As a gender, sex and sexuality activist within the U.S. computer gaming industry—famously put it, privilege "is when you think that something's not a problem because it's not a problem for you personally" (Gaider, 2013) . The intergenerational reproduction of socioeconomic class inequalities—and the role of schools in perpetuating it—will naturally not be pressing, foregrounded issues for a given individual if they and their family currently enjoy a high SES and actually look forward to its intergenerational reproduction. Similarly, the cultural non-neutrality of technology will not be negatively consequential for a given individual if the cultural values embedded in the former are compatible with their own cultural values.

Learner's Home/Family & Peers

Two other sets of actors—Home/Family members and Peers—are represented in the Molenda–Subramony Framework as second-level distal influences, in that we do not see them as affecting instructed learning directly, but rather as underlying the first-level distal factors.

Home and Family values are largely determined by the ways in which learners and their parents/relatives are shaped by their SES and cultural identity. Everything we discussed with respect to the sociocultural issues pertinent to the learner earlier in this paper logically applies to their home/family members as well. Learners acquire a significant portion of their cultural capital from their families, with high-SES children inheriting substantially different, and more valued, cultural capital than low-SES children, whose families are often immigrants, ethnic minorities and/or language minorities (Bourdieu, 1990) . Learners also acquire much of their habitus (Bourdieu, 1990) from their families. Family background hugely informs an individual learner's socioeconomic and cultural privilege (McIntosh, 1988)—or lack thereof—and is a crucial element of their intersectionality (Crenshaw, 1991).

Meanwhile, learners' relationships with peers also greatly hinge on the self-identity constructed by the individual learner vis-à-vis the educational system that represents the dominant class/cultural/economic system (Willis, 1977; Giroux, 1983) , as well as the respective self-identities constructed by their peers both within and outside the learner's own socioeconomic class and cultural group. These relationships are also determined by the learner's—and their peers'—relative privilege (McIntosh, 1988) and intersectionality (Crenshaw, 1991). Learners also acquire varying degrees of cultural capital and habitus (Bourdieu, 1990) from their peers.

Media

The Molenda–Subramony Framework sees mass media and social media as third-level influences; that is, they do not influence instructed learning directly but rather underlie the second-level distal factors, which impact the first-level distal factors, which in turn directly influence the proximal factors of Effort by the learner and Instruction by the facilitator.

Mainstream mass media—print, radio, and television, along with the advertising industry—are invariably owned by society's dominant group(s)—those with economic and political power over the rest of society—and openly embody the latter's sociocultural values. The phrase "All the News That's Fit to Print" that appears on the masthead of the New York Times represents a cultural determination and also an expression of power; these most famous seven words in American journalism indicate that a certain group of people have the power to decide—based on their own sociocultural values—what is fit to print and what is not. Mass media by definition engage in the powerful cultural processes of news *framing*, *agenda setting*, and *priming* (Scheufele & Tewksbury, 2007). They routinely *stereotype* human groups that are socio-culturally distant from themselves (Subramony, 2000), and decide whom to represent or marginalize. When advertisements for socio-culturally desirable products/services across Latin America, Africa and Asia feature light-skinned, light-haired, light-eyed actors who bear no physical resemblance to the target audience of said advertisements, unmistakable sociocultural messages are being transmitted, a logically extreme outcome of which is the burgeoning market for skin-, hair-, and eye-lightening products and procedures across the Global South.

Social media, on the other hand, are more complex in their intentions and efforts. Firstly, Western social media platforms unabashedly serve as agents of *digital colonialism*—extracting data from citizens of the Global South without the latter's explicit consent (Marker, Vestergaard, & Hendricks, 2019), and subsequently processing and using said data to create manufactured services to sell back to the latter (Kwet, 2019). In terms of peer influences on learners, social media are a well-known source of peer pressure and platform for cyber-bullying (see Subramony, 2018). On the other hand, social media can also be seen as a mode of resistance, a la Giroux (1983); that which is not considered fit to print by the mainstream mass media can be disseminated via social media, thus subverting and undermining the mainstream media's role in preserving the political, social, economic, and cultural hegemony of society's dominant group(s).

Classroom/School Environments

The classroom and school environments are depicted in Fig. 1 as the two smaller dotted boxes surrounding the proximal and first-level distal factors towards the right-hand side.

The school environment is, at its most basic level, a consequence of (a) how schools are fundamentally conceptualized and structured, and (b) the kind of cultural capital they are set up to reward—both of which are functions of the complex socioeconomic and cultural forces that created the educational system. Bowles & Gintis (1976, 2002) have long upheld a social reproductionist view of schooling; they have maintained that modern public school systems are set up to reflect the interests of capitalist business owners rather than any democratic or pedagogical ideal. In their view, schools (a) primarily serve to socialize future employees to work uncomplainingly within hierarchical corporate structures—by structuring social interactions and individual rewards in ways that mirror workplace environments, while (b) doing precious little to stop the intergenerational reproduction of social inequality, i.e., to break the cycle of low socio-economic status (SES) children growing up to be low-SES adults.

Bourdieu (1990), in contrast, focuses more on cultural processes as opposed to structural determinism to explain how schools work to foster the intergenerational reproduction of social inequality. According to him, schools embody the interests of dominant classes by acting to reward the cultural capital of said classes while simultaneously acting to systematically devalue that of marginalized classes. Schools thus become the marketplace where the cultural capital of dominant classes is exchanged for the currency of academic credentials, which is subsequently converted back into economic capital via entry into highly remunerated professions—representing a perfectly legitimized cycle of social reproduction. Giroux (1983) puts a finer point on it when he explains that schools reproduce existing power relations "via the production and distribution of a dominant culture that tacitly confirms what it means to be educated." (p. 87)

Frame Factors

The Molenda–Subramony Framework also takes into account a set of *frame factors* that indirectly impact instructed learning—namely, (a) Official laws, policies, and regulations; (b) Funding; (c) Official/explicit and unofficial/tacit moral and ethical norms; (d) Physical environment; and (e) Learner health and well-being. In Fig. 1, these frame factors are represented by the second-largest dotted box, located just inside the 'Sociocultural Environment' box, and encompassing all of the other elements featuring within the Framework.

The sociocultural facets, dimensions, and ramifications of the aforementioned frame factors should be clearly self-evident to the reader. Consider the impact of the U.S. government's post-9/11 educational policy changes, assorted travel bans based on religious background and national origin, and recent animus-fueled restrictions placed on international students, on the learners that these legal initiatives have targeted. Consider the impact of basing school funding on property taxes on learners living in low-income, low-net-worth neighborhoods. Consider whose cultural, moral, and ethical values are reflected by the codes of conduct, honor codes, professional standards, and licensing requirements governing various professions and professional bodies. Consider the physical environment of underfunded inner-city and rural schools—the impact of inadequate heating/cooling/ventilation, mold, and broken/nonfunctioning equipment on student learning. The infrastructural divide between rich schools and poor schools and the Digital Divide between rich students and poor students—along with the unequal health and financial impact upon rich students v. poor students—have all come into sharp, brutal, unignorable focus during the current COVID-19 pandemic.

Sociocultural Environment

It will be clearly noticeable from our preceding discussion of the multiple distal factors influencing instructed learning that all of these factors are underlain and impacted by the sociocultural environment within which they are situated. In fact, all of the elements that must come together in order to make instructed learning possible—viz., learners, facilitators, resources, settings, teaching-learning arrangements, and organizational structures—are embedded and operate within a given sociocultural environment.

It is in light of this that Fig. 1 depicts the Sociocultural Environment as the largest dotted box encompassing all of the other elements featuring within the Molenda–Subramony Framework. Our perspective here is congruent with that of the National Academies of Sciences, Engineering, and Medicine (2018, p. 22), who also approach the whole subject of human learning from a sociocultural perspective, pointing out that learning cannot be separated from the culture in which it takes place. "Culture" is defined here in its sociological sense: as a way of life of a group of people—the behaviors, beliefs, values, and symbols that they accept, generally without thinking about them, and that are passed along from one generation to the next.

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Cultural perspectives on utilizing social media to improve foreign language learning and teaching: A literature review

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Abstract: Positive attitudes towards social media in foreign language learning are found in literature but few studies have addressed the cultural perspectives on the roles of social media in foreign language learning. This article aims to explore how cultural perspectives on the roles of social media in foreign language learning have been addressed in literature by reviewing the theories and frameworks of integrating social media into foreign language learning and exploring the empirical evidence regarding the effectiveness of social media on foreign language learning. Results revealed that theoretical development of integrating social media into foreign language learning was quite slow and there was no solid evidence that social media was effective on foreign language learning, especially on academic performance. This article concludes with recommendations for future research and potential opportunities for international collaboration.
Keywords: cultural perspective, foreign language learning, literature review, social media

Introduction

With the development of technology, more and more language educators have considered using technology, especially social media, to assist with language instruction (Chun, Kern, & Smith, 2016; Golonka, Bowles, Frank, Richardson & Freynik, 2014; Yang, Crook & O'Malley, 2014). Social media are the internet-based services that allow individuals to create a public profile, share connections, and track individual updates (Nadkarni & Hofmann, 2012). There are six types of social media platforms used for educational purposes, including functions for social networking (e.g., Facebook, LinkedIn), bookmarking sites (e.g., Delicious), social news (e.g., Reddit), media sharing (e.g., Instagram, YouTube, Flickr), microblogging (e.g., Twitter), and blogging (e.g., blog website). The ubiquity of social media (e.g., Facebook, Twitter) in educational settings prompts foreign language educators to utilize social media to mediate and enhance foreign language instruction (Hattem & Lomicka, 2016). For example, mobile devices and social networking sites (SNS) were examined in Aladjem and Jou's (2016) study. Facebook was investigated in Aydin's (2014) study to learn learners' interactions with the teachers. Wang and Kim (2016) also studied Facebook to examine the effectiveness of foreign language learning. Instant messenger was used in Baek, Yoo, Lee, Jung and Back's (2017) study to create a peer-tutoring environment that improved students' performance. Twitter posts were investigated in Harmandaoglu's (2012), Lim and Fussell (2017), Liu, Evans, Horwitz, Lee, McCrory, Park and Parrish (2013), and Solmaz (2017) studies.

The relationship between culture and foreign language learning has been widely recognized. The cultural aspects of countries where a foreign language is common in surroundings, plays an essential role in that foreign language's acquisition (Ambrossi, 2015). With the surrounding of the foreign language learners have some immersion to learn how to use words, rules, and knowledge to see, understand, and communicate through multicultural and cross-cultural activities (Heidari, Ketabi & Zonoobi, 2014; Keesing, 1974). Brown (1994) described that "language is a part of culture and culture is a part of language (*p*. 165)". Language is one of the visible parts of culture and it is shaped and influenced by the culture (Jiang, 1994; Zhong & Xu, 2019). Language serves as the media to make people understand the beauty of diverse culture. In other words, culture and language cannot be independent of each other. Although there is no clear definition of culture, in foreign language learning, culture was interpreted as the deposit of knowledge, beliefs, and artifacts (Samovar, Porter, & Stefani, 2000), the ability to communicate with people in other cultures (Lusig & Koester, 1996; Tananuraksakul, 2015; Zhong, 2016), four senses (Adaskou, Britten, & Fahsi, 1990), and four perspectives (Robinson, 1985).

However, when social media was utilized to design foreign language learning environments, culture as an essential role in learning a foreign language learning has been rarely discussed. Research regarding social media mainly focuses on the effectiveness on academic performance (Barrot, 2016; Jones, 2014; Kamnoetsin, 2014; Mompean & Fouz-Gonzalez, 2016; Wang, 2017; Zhong & Hartsell, 2015), attitudes towards using social media in foreign language learning (Akbari, Eghtesad, & Simons, 2012; Bafõz, 2016; Gamble & Wilkins, 2014; Lin, Warschauer, & Blake, 2016; Momcilovic & Petrovic, 2016; Rahimi, Azhan, Normeza & Baharudin, 2015; Sorensen, 2013), motivation and anxiety (Akbari, Naderi, Simons, & Pilot, 2016; Hsiao & Broeder, 2014; Gabarre, Gabarre, Din, Shah & Karim, 2016; McCarty, 2011), engagement and interaction (Akbari, Naderi, Simons, & Pilot, 2016; Boonkit, 2011; Fewell, 2014; Mondahl & Razmerita, 2014), and online identity (Dressler & Dressler, 2016). Studies regarding the roles of culture in social media environments as well as whether the integration of social media in foreign language learning has improved the language learners' cultural understandings of that new language are scarce. It is still unknown that how instructional designers and language educators should address culture in social media learning environments.

In order to gain a full picture of the effectiveness of foreign language learning in social media environments and to understand the cultural perspectives on the role of social media in foreign language learning, this study (1) reviewed the theories and frameworks of integrating social media into foreign language instruction, (2) examined the empirical evidence of the effectiveness of social media in foreign language learning, and (3) investigated culture's roles in social media environments in foreign language learning. In this study, investigation of foreign language learning focused on four aspects: listening, speaking, reading, and writing. Culture in this study was interpreted by using Robinson's (1985) conceptualization, which includes behaviorist, functionalist, cognitive and symbolic. Robinson's (1985) definition is adopted in this study because this framework considers culture not only as a process of understanding and interpreting a phenomenon but also a cultural product that can be passed from generation to generation. Robinson (1985) noted that the development of cultural versatility is important to help learners meet the demands of an increasingly multicultural world. According to Robinson (1985), behaviorists consider culture as a set of patterned behaviors. Functionalists believe culture is to make sense of the behaviors. Foreign language learning is to understand and make sense of the patterned behaviors through listening, speaking, reading, and writing. Cognitivists view culture as a process of interpretation and symbolists define culture as the product of interpretation. For cognitivists, foreign language learning is to interpret the incoming data from the culture through listening, speaking, reading, and writing. For symbolists, foreign language learning requires the understanding and interpreting of cultural products, such as literacy achievement, artistic achievement, and historical development, through listening, speaking, reading, and writing. Thus, the following questions are explored in this study:

1. How are theory and framework used to integrate social media into foreign language learning and how have these been developed?

2. What empirical evidence of the effectiveness of social media in foreign language learning is found in research?

3. How have the cultural aspects of countries that use the language been addressed in literature?

Method

This study systematically searched the following specialized database: EBSCHOhost, ERIC, and Education Abstract. Additional Google Scholar searches were performed. Search keywords included Facebook, Twitter, Google plus, foreign language learning, language and cultural learning, social media, social media in language learning, social networking, and blogs. Social media (i.e., ResearchGate) was also used to outsource to other researchers inviting their collective input. Content analysis was performed to identify all the literature published in refereed journals from 2009 to 2018. Content analysis was chosen as the data collection method because this method helps researchers combine the articles that are similar to each other in the light of the themes and helps to convert the themes into readable forms for readers (Bauer, 2000). The article selection criteria are:

(a) Academic publications, including academic journals, conference proceedings, and workshop proceedings;

(b) Articles that focuses on foreign language learning, including reading, writing, listening, and speaking;

(c) Articles that have integrated social media into the foreign language instruction.

There were 221 articles that met the inclusion criteria after duplicated articles were excluded. The quality of the article was assessed with the following rubrics:

(a) Sampling method is representative of the population;

(b) Findings are clearly presented.

After the selection and assessment of the articles, 64 articles were identified for this study. Among the 64 articles, only six articles were identified as empirical studies, most of which were quantitative studies. Most qualitative studies did not meet the requirement of triangulation, which is a common effort to ensure validity and reliability of research. The identified 64 studies were examined based on the research questions. Also, theoretical frameworks, context in which the study was conducted, names of social media, purposes of using social media in foreign language learning, frameworks or theories used in the study, research methods, and the effectiveness of the utilizing social media tools were analyzed in detail to generate possible themes. Next, researchers conducted another round of analysis to check the classification accuracy of the articles. Descriptive analysis was utilized to synthesize all the articles and interpret the emerging themes.

Results

The review of the selected articles identfied 22 different theories and frameworks. Among the 22 theories and frameworks, social constructivist theory is the mostly used theory, following by technology acceptance model (TAM), sociocultural theory, and social presence & learning community. Other theories, such as self-determination theory, computer-assisted language learning, and social cognitive theory, are also used to study foreign language learning in social media supported learning environment. It is also noticed that most theories and frameworks (69%) were utilized to investigate online interaction, online collaboration, emotional satisfaction such as motivation and confidence, and attitudes towards the ease and usefulness of social media in foreign language learning. Only nine theories or frameworks (31%) were used to examine student's learning performance (see Table 1).

Table 1

Theories and frameworks used to integrate social media in foreign language learning

Theory/Framework	Social Media	Country/Context	Purposes	Literature Sources
Asynchronous learning	Twitter	Saudi EFL learners	EFL writing	Ahmed, 2015
(a) the Input-Interaction-Output (IIO) model (Block, 2003); (b) the sociocultural/activity theory (Lantolf, 2000); (c) current L2 grammar learning theory (Ellis, 2006); and (d) computer-assisted language learning (CALL) theory (Levy & Stockwell, 2006).	Wiki site	Taiwan undergraduate EFL students	Undergraduate EFL grammar achievement	Singman, 2012
E-portfolio theory	Facebook based e-portfolio	Philippine	ESL writing	Barrot, 2016
Task-based language teaching	Facebook	Thai undergraduate students	EFL undergraduate students reading	Boonkit, 2011
Socio-cognitive learning	Facebook	Thai students	Writing behavior	Kamnoetsin, 2014
Mobile learning	WeChat	Chinese EFL students	Utilization evaluation in English pronunciation	Wang, 2017
Long's (1996) social interaction hypothesis	Facebook group	Iranian EFL learners	TOEFL score	Khoshnoud & Karbalaei, 2014

Self-Determination Theory	Facebook	Iranian PhD students	TOEFL score	Akbari, Pilot, & Simons, 2015
Astin's theory of student engagement	Facebook	Iranian PhD students	TOEFL score	Akbari, Naderi, Simons, & Pilot, 2016

From Table 1, Facebook was the most widely used tool which accounted for 73% of the entire social media tools. The study subjects were mainly Saudi EFL students, Iranian EFL students, and Thailand EFL students. However, social media tools used to examine foreign language learning performance as shown in Table 1, Facebook only counts for 50%. Other tools such as Wiki site, WeChat, and Twitter were also used to improve foreign language learning performance. The contexts of using social media tools in foreign language learning were different. Twitter was used in Saudi EFL to improve students' writing while WeChat was utilized to help Chinese EFL students with English pronunciation.

Researchers then examined the six empirical studies that contained social media usage in foreign language learning. The six empirical studies are organized in Table 2 according to different countries, research method, and the effectiveness on foreign language learning performance.

Table 2

Empirical evidence of the effectiveness of social media in foreign language learning

Theory/Framework	Social Media	Country/ Context	Research Method	Effectiveness	Literature Source
Asynchronous learning	Twitter	Saudi EFL learners	Quantitative	Writing	Ahmed, 2015
Long's (1996) social interaction hypothesis	Facebook group	Iranian EFL learners	Quantitative	TOEFL score	Khoshnoud & Karbalaei, 2014
Self-Determination Theory	Facebook	Iranian PhD students	Quantitative	TOEFL score	Akbari, Pilot, & Simons, 2015
Astin's theory of student engagement	Facebook	Iranian PhD students	Quantitative	TOEFL score	Akbari, Naderi, Simons, & Pilot, 2016
Technology Acceptance Model (TAM)	Facebook	Thailand undergraduate students	Quantitative	Writing	Kitchakarn, 2016
(a) the Input-Interaction-Output (IIO) model (Block, 2003); (b) the	Wiki site	Taiwan undergraduate EFL students	Quantitative	Writing	Singman, 2012 (dissertation)

sociocultural/activity theory (Lantolf, 2000); (c) current L2 grammar learning theory (Ellis, 2006); and (d) computer-assisted language learning (CALL) theory (Levy & Stockwell, 2006).

As shown in Table 2, effectiveness of social media on foreign language learning was found primarily in English writing among the six studies. The other three studies reported effectiveness on TOEFL score. When research methods were examined, all the six articles were found to be quantitative studies. Although qualitative empirical studies were found in literature, no qualitative studies qualified as empirical studies due to methods of validity, especially triangulation. Thus, qualitative evidence was not found from our review. In terms of the context, three studies were conducted in Iran (50%). The other three studies were separately conducted in Taiwan, Saudi Arabia, and Thailand, separately.

Discussion

Research question 1: How are theory and framework used to integrate social media into foreign language learning and how have these been developed?

Result reveals that large amounts of different theories and frameworks have been utilized for different purposes to assist with the integration and utilization of social media in foreign language learning. For example, TAM was used to predict a students' attitudes towards the ease of use and usefulness of using social media in foreign language learning, while social constructivist theory was used to understand students' online interactions and collaborations. Empirical evidence found that social media had the potential to improve students' writing skills, especially grammar and writing fluency (Kitchakarn, 2016). Dizon (2016) reported that students made significant improvement on writing fluency when Facebook was introduced in class. If TOEFL score could be considered as learning performance as reported by Akbari, Pilot, and Simons (2015), Akbari, Naderi, Simons, and Pilot (2016), and Khoshnoud and Karbalaei (2014), we could also make the case that social media, especially Facebook, could improve a student's learning performance.

The utilization of social media was found to have contextual features (Derakhshan, & Hasanabbasi, 2015; Richards, 2015). The use of social media is different and depends on the context. It seems that there was a relationship between the choice of social media tools and the context of using those tools. The analysis also revealed that theoretical development was quite slow in foreign language learning supported by social media. Theoretical understanding of these frameworks and interpretation for subsequent application relied heavily on theories from other disciplines, such as social constructivist theory. However, the borrowed theories may not be not sufficient and appropriate to understand the unique characteristics of the foreign language learning process in social media settings. For example, Akbari, Naderi, Simons, and Pilot (2016) utilized self-determination theory in the study and TOEFL score was examined to determine the effectiveness of Facebook. Social media environments require foreign language learners to not only remember the language codes but also utilize those codes immediately to make sense of people's behaviors, interpret the symbols, and understand the culture. However, self-determination is a theory of motivation and is concerned with people's inherent growth; it is insufficient to understand the foreign language learning process and conclude that social media is effective in improving foreign language learning performance. Unfortunately, theories or frameworks regarding the foreign language learning process are scarce in literature.

Research question 2: What empirical evidence of the effectiveness of social media in foreign language learning is found in research?

The analysis reveals that the effectiveness of social media in learning depended on the characteristics of the tools chosen and the instructional goals as shown in Liu, Abe, Cao, Liu, Ok, Park, Parrish and Sardegna's (2015) study. Most social media, such as Facebook and Twitter, are text-based tools that require users to make written posts (Dogoriti, Pange, & Anderson, 2014). Students could develop writing skills through making their own posts and reading other students' posts. Few studies have carefully considered the characteristics of the tools and how these tools' characteristics could be utilized to achieve the instructional goals. This may be the reason that why much empirical evidence was only found in English writing, not in the areas of speaking, listening, and reading. Although empirical evidence was found in writing skills, it cannot be generalized that social media was effective in improving foreign language learning and specifically, it cannot be generalized to other areas of speaking, reading, and listening. For future research the effectiveness of social media in reading, speaking, and listening needs further investigation.

Research questions 3: How have the cultural aspects of countries that use the language have been addressed in literature?

Regarding the culture in foreign language learning, although the link between culture and foreign language learning has been widely recognized, the roles of culture have rarely been addressed in the studies focusing on social media supporting foreign language learning. However, there are theoretical discussions in literature that support the potential of social media in the area of functional and cognitive perspectives of the culture. Hasan, Rashid, Yunus, Mohamed, and Zulkifli, (2016) advocated that sociocultural theory could be used as a framework to understand how social media facilitated students to make sense of people's behaviors in another culture. They explained that sociocultural theory emphasized the social and cultural impact on human behaviors and social media was found to provide an environment to understand those social and cultural impacts through social interaction and collaboration. In Saaty's (2015) study, social constructivist theory and affective filter hypothesis were discussed, suggesting that social media could reduce students' risk-taking and enhance motivations and sense-makings of personal experiences, histories, and beliefs through meaningful interactions. However, empirical evidence was insufficient in demonstrating the effectiveness of social media in supporting the functional and cognitive perspectives. Although effectiveness of social media was found in EFL writing and TOEFL scores as shown in Table 2, behavioral and symbolic perspectives of culture were not found in those studies if the details of the exams were investigated. For example, Ahmed (2015), Dizon (2016), and Wang and Chen (2013) examined students' writing but the details of those writing tasks were not included. Thus, we could not determine whether cultural perspectives were considered; consequently, the studies could not be considered as evidence to support the notion. The same issue was found in the Singman's (2012) and Kitchakarn's (2016) studies, which examined students' grammar but details of the grammar exams were absent.

In terms of behavioral and symbolic perspectives of culture, neither theoretical discussions nor empirical studies were found in literature. The possible explanation is the absence of learning activities' details in the studies. Thus, it is difficult to determine if researchers have considered behavioral and symbolic perspectives or not. However, the research team for this study believes that these two perspectives have been addressed to some extent in the studies. In addition, Kitchakarn (2016) mentioned that the instructor gave students the writing topics. Therefore, some of the writing topics may have contained the task of describing the reasons of some patterned behaviors or cultural products, such as artistic achievement. A further instructional content analysis is required to determine behavioral and symbolic perspectives of culture in social media supported foreign language learning.

Summary

In summary, research of social media in foreign language is still in infancy stage and the effectiveness of using social media to improve foreign language learning is not as positive as expected by the authors. Although this article only considered foreign learning performance in empirical studies, it was noticed that positive findings are reported in other areas, such as motivation, engagement, interaction, and collaboration. However, in terms of performance, positive finding in foreign language learning was only found in EFL writing.

This contradicting finding may be attributed to the low transformation rate between foreign language learning performance and motivation, engagement, interaction, and collaboration. It has been demonstrated that there is positive relationship between foreign learning performance and motivation, engagement, interaction, and collaboration (Kitchakarn, 2016). However, how much motivation, engagement, interaction, and collaboration can be transformed to learning performance is uncertain. Based on the studies we have reviewed in this article, it seems that the transformation rate from increased motivation, engagement, interaction, and collaboration to learning performance is quite low. Although students are motivated and highly engaged in social media supported foreign language learning environment, effectiveness was only found in EFL writing because most social media are written communication tools and interaction and collaboration occur in written form. It provides more opportunity for students to observe and practice writing, which has improved student's writing performance.

Conclusion

Although culture does have impact on the choice of social media tools and the subsequent effectiveness of social media in foreign language learning, the main goal remains the same. That is, empowering students with the abilities to communicate with people in other contexts and understand the world from different perspectives through improving students foreign language learning skills, including reading, writing, listening, and speaking. This review has raised some questions that need more research. For example, does social media's presence in foreign language learning classrooms indicate that students are using different ways to construct foreign language in the context of social media? Does the emerging empirical evidence from literature across different cultures confirm the fundamental change of foreign language learning process? More theoretical and and empirical explorations are needed to answer these questions.

Thus, future research can be directed to (a) explore theories and frameworks that developed specifially for integrating social media into foreign language learning, (b) conduct more rigorous qualitative studies to explore the foreign language learning process, (c) explore the effectiveness of social media in other areas of foreign language learning performance, especially in speaking, listening, and reading, (d) switch the research interest from examining students' attitudes, engagements, and motivations to understanding foreign language learning process in social media environments and appropriateness of characteristics of social media in supporting the learning process, and (e) understand the digital culture in social media environments and whether exposing foreign language students to the social media environments will enhance their understandings and interpretations of the "true" culture.

In addition, potential international collaboration opportunities are provided in this article to help foreign language educators better support students' learning needs. First, international partners are called to notice the importance of using social media in foreign language learning, along with cultural concern. Second, the lack of theoretical and empirical studies on using social media in foreign language learning needs the world's attention. Last, but not the least, Social media helps students break the geographic boundaries in foreign language learning. We encourage instructors, teachers, scholars worldwide to work together to build an integrated foreign language learning environment via social media, in order to provide a place where our students could have a better access to the foreign language, to the culture of the foreign language, and to the people who speak the language.

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