

41st annual Proceedings

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

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

Editors

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2018 Annual Proceedings – Kansas City: Volumes 1 & 2

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

Presented at
The Annual Convention of the Association for Educational Communications and Technology
Kansas City, MO
2018

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Preface

For the fortieth time, the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. Papers published in this volume were presented at the annual AECT Convention in Kansas City, MO. 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. Proceedings copies are also available at:

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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.

REFEREING 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
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Using Technology to Improve Migrant Adult Education Instruction

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Morehead State University

Descriptors: Migrant Adult Education (Latinx), Technology

Abstract:

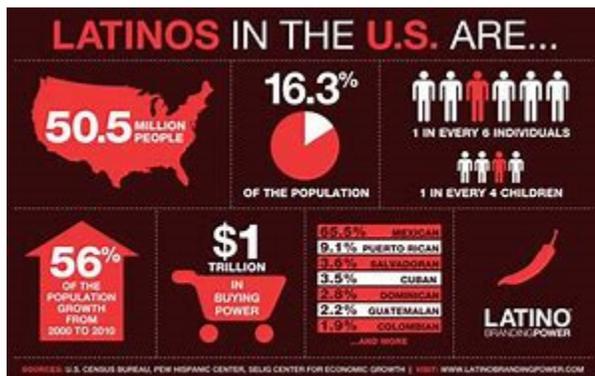
The GED (General Educational Development or General Equivalency Diploma) changed in 2014 to be computer based. Since then there has been a growing need for more educational technology in the GED/HEP classrooms. While several computer-based programs for the English GED exist, there have been few available for the Spanish GED. Since majority of HEP participants are Spanish Speakers, there is a greater need for Spanish computer-based programs in the HEP classroom. This presentation will focus on the need of Spanish computer-based programs in the HEP classroom to prepare the students for the GED exam.

Description

The roundtable session focuses on the needs of migrant adult educational programs. These programs are the HEP (High School Equivalency) programs which are funded through the Department of Education: Office of Migrant Education to educate migrant and seasonal farm workers. Since most of this population needs bilingual (English and Spanish) instruction, there is a need to incorporate more Educational Technology bilingually into the HEP classroom. The session will include a discussion of the bilingual tools and technologies available.

Disclaimer

For the purpose of this study the Hispanic and Latino (a) population will be referred to as Latinx.



Abbreviations Frequently Used in this Study

HEP: High School Equivalency Program
GED: General Education Development/Diploma
OME: Office of Migrant Education

History of GED and Latinx

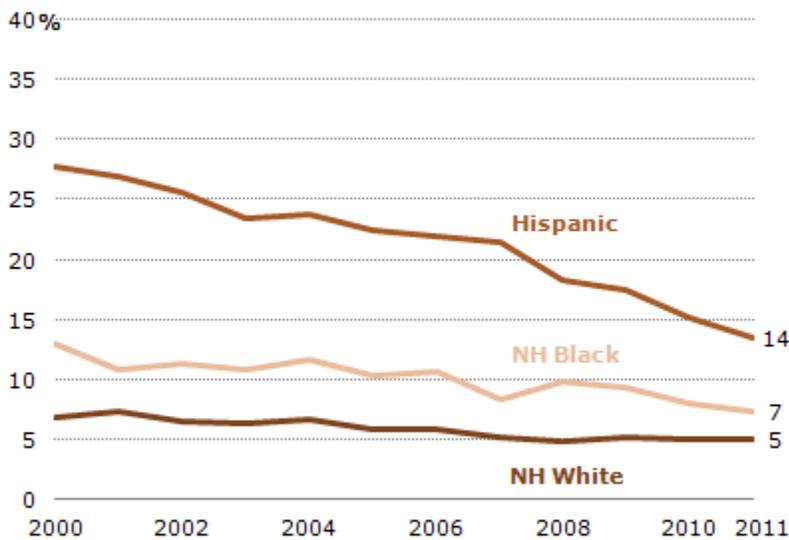
The GED test was officially created in 1942 which measured English language arts, social studies, mathematics, and science. There were three more versions of the GED exam, 1978, 1988, and 2002 series which kept the original content from the 1942 exam with increased levels of proficiency of the assessments (GED Testing

Service, 2018). These exams were available in English, Spanish and French. In 2014, the GED changed drastically and created many challenges for adult education. The GED2014 exam was completely redesigned from paper-based test to computer-based test which included a new scoring system and a higher level of content in English language arts, social studies, mathematics, and science (GED Testing Service, 2018). The GED2014 is only offered in English and Spanish currently.

In the late 1950s and early 1960s, it was a difficult time in education for the Latinx population because advancement was challenging for them (Arciniega, 2012). In the late 1960s, 1970s, and 1980s, changes were made in the acceptance of the education of the Latinx population which resulted in more Latinx people as students, teachers, and department heads and included more acceptance than the previous decade (Arciniega, 2012). Since 1971, GED attainment continually increased due to minorities and economically disadvantaged backgrounds enrolling into adult educational programs (Maralani, 2011). Since the 1990s, there has been an abundance of advocacy for Latinx education and career advancements (Arciniega, 2012). More attention has been focused on the education of the Latinx population due to the immigration of many to the United States. The Department of Education focuses on improving high school and college graduations with an increasing focus on the Latinx educational issues (Orchowski, 2010). The United States Department of Education awards federal grants to assist migrant students in obtaining their GED, enrolling in post-secondary education, and addressing specific needs of the Latinx population (U.S. Department, 2012). The Office of Migrant Education in the Department of Education oversees these grant funds and the programs awarded.

As depicted in the chart below, the Hispanic (Latinx) population has higher dropout rates from school than blacks and whites.

Figure 6
Status High School Dropout Rates, 2000-2011
(Share of 16-to 24-year-olds who are not enrolled in school and have not completed high school)



Notes: White and black exclude the Hispanic portion of those groups.

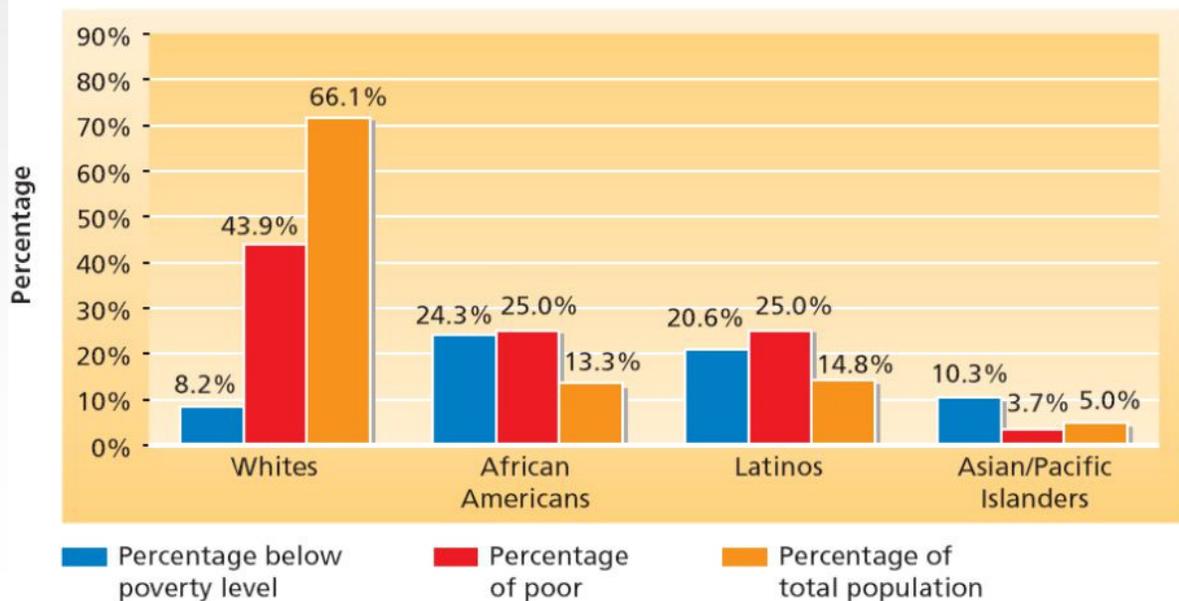
Source: National Center for Education Statistics *The Condition of Education 2012*, Table 116

PEW RESEARCH CENTER

The distribution chart below shows the levels of poverty in the United States by race. The Latinx (Latinos) are the second to highest percentages who are below poverty level. These poverty levels can be improved on by obtaining an education; however, these students typically need additional help to obtain their education and entering post-secondary educational programs.

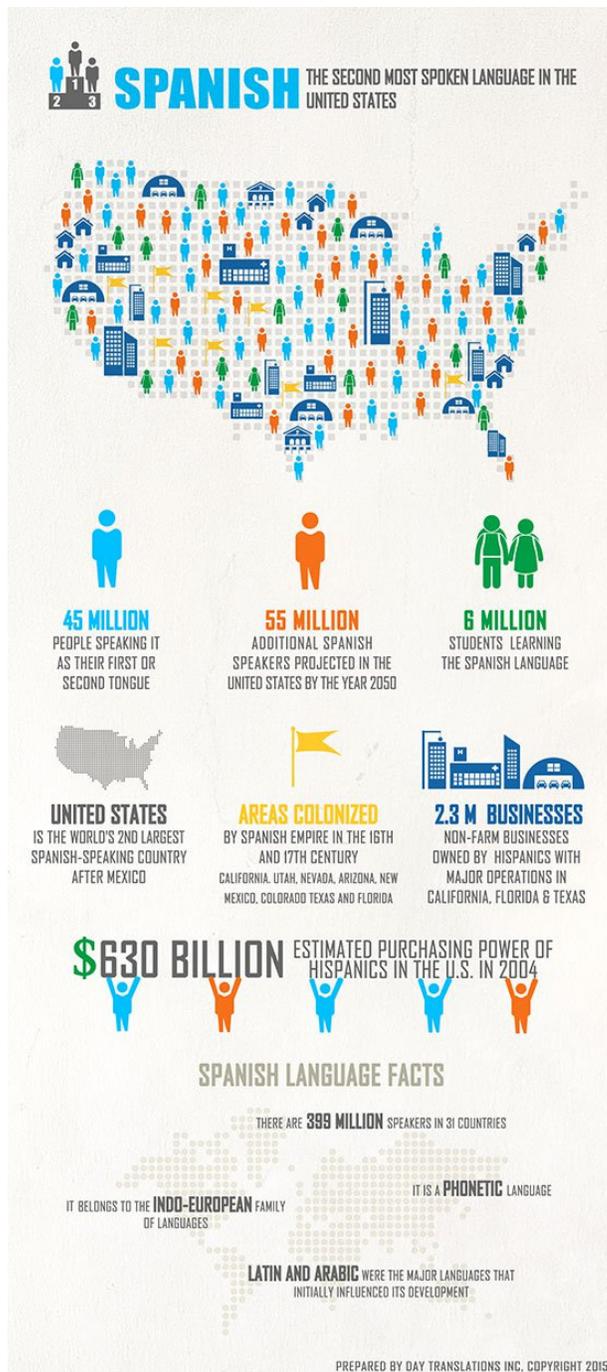
The Distribution of Poverty in the United States

What are the most important conclusions you would reach from this figure?



Need for Educational Technology in the HEP Classroom

While the need for bilingual (English and Spanish) GED educational technology is nationwide, this presentation is on the experiences of the HEP program at a community college in the Southeast. All of the HEP programs are funded through the Department of Education: Office of Migrant Education. The majority of the farm worker students in the United States that HEP serves, according to OME are of Hispanic (Latinx) backgrounds (Department of Education, 2017). The Office of Migrant Education encourages the HEP programs to continually search for ways to improve all aspects of the programs, especially instructionally. Since the change of the GED from paper-based to computer-based, the HEP program has searched for any resources to assist in the instruction and educational practices. Majority of the HEP students have low educational levels and little computer skills. By finding and utilizing educational technologies in the GED/HEP classrooms, students are able to become more comfortable with the computers and prepare for the GED exam. There have been several English GED programs created to help the students to prepare for the computer-based GED exam. The greatest need is for more Spanish GED computer-based programs to help prepare this population for the GED exam. There are a few computer-based programs available; however, not all of them have a good Spanish translation. These types of programs confuse the students as the Spanish translation is not perfect. Spanish is a need in the HEP programs as it is the second most spoken language in the United States as depicted in the statistics below.



In addition to the technology use in the classroom, the HEP programs are continually exploring new ways to address the barriers to education for the migrant/Latinx population. This population has many barriers to education. HEP helps the students to overcome these barriers to become successful in obtaining their education. This study explores the benefits of incorporating technology into the migrant adult education program to assist students in overcoming these barriers to education, which are cultural, language, health, socio-cultural, childcare, working long hours, poverty, basic needs, and low academic educational levels. The barriers and needs inhibit the migrant adult students from obtaining their GED if not addressed.

The HEP program provides academic assistance to the migrant adult education students. The migrant adult education students begin their educational journey by enrolling in an adult education program since most of them

were dropouts from the public school system (P-12). The HEP program serves the migrant and seasonal farmworkers. The program offers GED classes in English and Spanish. This assists the Latinx students in obtaining their GED in their native language. In addition, the migrant adult students need extra assistance when entering college. They need assistance in choosing a program they are eligible for (if the students are not United States Citizens, they cannot apply for state licensure, such as cosmetology or nursing). The Latinx students do not realize the power of education. They do not realize they can achieve their goals and desired careers.

The HEP programs assist in bridging the gaps between the barriers and the access to education for the migrant adult students. The HEP programs are continually searching for ways to assist the migrant adult students in being successful in obtaining their GED. J. Gonzalez a former migrant student, former HEP director, and current Chief Operating Officer for East Coast Migrant Head Start Project states HEP programs provide a needed service that addresses a critical need and is important in rural areas where access to resources for non-English speakers are limited (Personal Communication, November 5, 2017). HEP is able to assist with transportation and childcare, which are some of the greatest needs with migrant adult students. The migrant adult students need to have educators that understand their specific needs and are willing to assist them. The HEP programs work with their local migrant programs to assist the migrant adult students further. The migrant programs help the migrant family and focus on the children. By collaborating, the two programs are able to assist the migrant families in being successful by addressing the barriers to education.

OME focuses on improvements in the migrant adult education programs (HEP) to provide the Latinx population educational opportunities. The HEP programs focuses on the academic success of the Latinx students. The program's goal is to assist students in obtaining GED credentials and moving forward with their education and/or career. As addressed above, the HEP program is able to assist with the financial barriers by providing limited assistance. The program is searching for technologies to use to help address the barriers of education for the Latinx students.

Learning Theories and Motivation for Adult Learners

Andragogy educational philosophy was an educational approach created by Malcolm Knowles to be adult-centered since adult learners have different needs than children which was based on the humanistic learning theory (Elias & Merriam, 2005, p. 13). Knowles recognized the barriers to education for adults and the differences in learning as compared to children. Knowles identified five assumptions of adult learners in andragogy. These are self-concept, past learning experience, readiness to learn, practical reasons to learn, and driven by internal motivation (Elias & Merriam, 2005, pp. 133-134). Adult learners do have different learning needs than the traditional P-12 age groups. The Latinx adult learners require more attention in education due to the barriers of education and special needs as mentioned previously.

Technology in Education

Technology is the application of knowledge in a specific subject (Merriam-Webster, 2018). Technology in adult education can be used in various ways, such as online programs, YouTube videos, Google hangout, Internet, applications for tablets, applications for phones, laptops, and Chromebooks. Since the changes of the GED exam in 2014, there is a greater need for new methods of instruction and assistance for the students. The greatest challenge is the GED2014 changing to a computer-based exam. This results in students needing to be familiar with computers and online programs. Since the change of the GED to a computer-based format, there has been a decline in GED diploma attainments. According to the OME (2018), the GED diploma attainments were 74.5% in 2013, 2014 66.6%, and after the GED change it dropped to 48% in 2015. This was due to the test changing to a computer-based format with a slightly higher level of difficulty. This change of the GED in 2014 created a greater need for technology usage in the adult education classroom, including the HEP classrooms.

El Paso Community College is improving the access to education for Latinx students by creating educational classes with professors understanding the population, various learning options, and utilizing technology ("EPCC Serving," 2016). Technology has various usages and can assist in the instruction of the Latinx students. Online instruction in GED and ESL classes would be an option in incorporating technology into the HEP programs. The HEP program is sampling a variety of programs to assist the GED and ESL students who cannot attend class every day. The goal is to utilize available technology for the students to access study materials and lessons at home

when they are unable to attend class physically. Since this population works long hours on the farms, they are limited on the amount of time spent in the classroom. Finding online instructional programs for the adult educators to utilize would assist the migrant adult students in studying and completing homework at their home. This would be a great benefit for the students; however, there is a limited amount of Spanish online programs.

By using the tools available, the HEP programs are able to address the barriers of the students' access to education. An online instructional program would help to address the childcare issue. Students would be able to complete majority of their studies at home and not worry about finding someone to take care of their child while in class. Technology could be incorporated into the classroom to access online resources on cultural awareness and learning about society. Also, by finding online resources and programs for the students to use at home, they are able to address some of the financial issues, such as transportation. Students are able to research their rights on working on the farms and domestic violence/abuse. In addition, students could research about preventative healthcare and learn how to better care for themselves and their families. Most of all, students could research educational opportunities and future careers with the Internet to help them decide on what they want for their future.

Challenges Incorporating Technology

Technology usage is becoming a need in adult education. The adult educational programs need to implement technology into the classroom to prepare students for future careers using computer skills. The issue with the incorporation of technology into the adult education classroom is the need for technological support for the adult education educators and staff (Gopalakrishnan, 2006). While some educators and staff are reluctant to change, the majority are willing to learn new technology to assist their students. To be successful, they need technological support. In addition, the students must be taken into consideration during this process of change. The biggest challenges found with incorporating technology in the migrant adult education programs were access to computers and the Internet. Several studies determined only 60% of families own computers and have Internet access and those who are considered minority and in poverty do not own a computer (Stern, 2006)

Continuing Case Study of the HEP Programs

The case study is continual at the institution. The task is to find a bilingual computer-based program to use in the GED/HEP classroom. This is a difficult task because the programs are expensive. Typically, an institution has to purchase a large number of seats to access the computer-based program to be able to use in the classroom. Another challenge in finding a good computer-based program for the GED/HEP classroom is to find one containing a proper Spanish translation for the Spanish-speaking students. Some topics to discuss in this presentation are:

- What types of educational technology programs are available for GED programs?
- Which educational technology programs are available bilingually (English and Spanish)?
- How do you gain access to sample the educational technology programs?
- How much time do you need to invest in sampling to determine the accuracy and importance of the program for use in the GED/HEP classroom?
- How much time do you need to invest in sampling to determine if the Spanish translation is thorough for the HEP classroom?
- Is it feasible to create your own educational technology programs for use in the GED/HEP classroom?

Fellow Educational Technology leaders and instructors can use their expertise to give insights on the issue. Having a roundtable presentation can open up a discussion. All opinions and suggestions are welcome. In this presentation, the participants will be asked for any suggestions on improving the GED/HEP instruction, especially for the Spanish speakers. All input from the Educational Technology leaders will be helpful in finding a solution to improving the educational practices in the GED/HEP classroom. Input from other educational leaders will be valued. An intellectual discussion on the case study and looking for suggestions to find a solution to the problem is key.

Conclusion

The number one objective of this presentation is to help students succeed. The goal in this presentation is to find a computer-based program that is available bilingually (English and Spanish) for the HEP students to access when outside of the classroom. Normal instruction will take place during the classes. The computer-based program is to be for additional study and for homework. GED/HEP students need more help outside of the classroom because most of these students are limited on attending classes due to working full-time jobs. The plan is to utilize a computer-based program to deliver extra tutorials, additional classwork, additional educational practice, timed testing practice, and improving computer skills. Each of these areas will assist the GED/HEP students in being more prepared and ultimately more successful in passing the GED exam to obtain their High School Equivalency Diploma. This will also prepare the student for their future career.

Desired outcomes are to find solutions to the barriers to education for the migrant students. Technology offers assistance in addressing the educational barriers of the students. While there are issues to incorporating technology into the GED classroom, they are manageable. The main issues are access to computers, Internet, and Wi-Fi. Additionally, there has been little research conducted on the benefits of incorporating technology into the migrant adult education or HEP programs to address the needs and the barriers of education for the Latinx population. This study will focus on investigating improvements to migrant adult education (HEP programs). The desired improvements are student focused. The migrant adult education HEP programs want to see all of their students succeed in their academic endeavors. By finding solutions to the barriers of education, the students are able to be more successful. Technology has the potential to help to resolve many of the barriers to education.

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Creating a Microlearning Environment to Facilitate Retention of Information: A Three-Step Approach

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Descriptors: Microlearning, Instructional design

Introduction

Microlearning refers to a learning strategy designed using a series of short segments of learning content and short activities that makes a microlearning module. It is also called bite-sized learning because it utilizes small, well planned, bite-sized chunks of units or activities (Hug, 2005). It is designed to suit the limits of the human brain with respect to its attention span and avoid cognitive overload, and research shows how effective it can be on student learning (Aitchanov, Satabaldiyev, & Latuta, 2013; Liu, Wei, Gao, 2016; Wang, 2017; Zhamanov & Zhamapor, 2013). Although the concept of micro teaching existed for a long time, the term microlearning has not been used until a decade and a half ago (Hierdeis, 2007) and research that explores microlearning environments is still growing in the context of higher education.

Literature Review

According to Hug (2006), there are seven dimensions of microlearning: time, content, curriculum, form, process, meadiality, and learning type. They describe mainly the design aspect of microlearning. Although the design aspect is very important, but they lack the pedagogy and technology aspects, which are key elements to an effective microlearning design. Research conducted to investigate the opportunities of integrating technology to create microlearning environments is still at its infancy, and it focuses heavily on corporate training and adult learning. Research on higher education is very limited though. In higher education for example, a study by Liu, Z., Wei, L., Gao, X. (2016) found that 80% of college students took active part in teaching activities. They stated “it promotes multidimensional interaction and increases deep-levelled cooperation and understanding” (p.870). The researchers also found that microlearning environments inspired and improved the learning environment itself and students’ interest in learning. Zhamanov & Zhamapor (2013) started to implement microlearning technique in their university course and also received positive feedback from students. Students expresses higher level of interests to learn the subject matter, and the amount of materials learned has increased compared to previous years.

Results from a study by Bruck, P. A., Motiwalla, L., & Foerster, F. (2012) with a university level course and two governmental training courses showed that learners had good satisfaction levels and high usage levels for the course materials. Similar results by Aitchanov, et. al. (2013), who examined the use of Twitter, a social media technology, in a microlearning technique for educational purposes. They collected data from college students enrolled in Advanced Programming in C++ course, and found that the majority of them enjoyed learning the course materials when it was delivered in small chunks using Twitter. However, Students suggested that they would like the number of tweets to be increased, and to implement this technique to learn other spheres. Kovachev, Cao, Klamma, & Jarke, (2011) explored bilingual vocabulary learning, and they found “promising results in enhanced flexibility in personal learning content creation and increased efficiency in filling knowledge gaps” (p. 51). Similarly, Wang (2017), investigated the effect of delivering the Engineering Mechanic Experiment content in short sequenced videos. As a result, the author reported that “the engineering mechanics experiment grade of undergraduate has

improved significantly, the service efficiency of mechanical equipment and degree of familiarity has improved sharply” (p. 130). The design of those short videos, however, resulted to limited student-student and student-instructor interaction. Interaction with the digital content in this case is the highest.

In terms of evaluations, Giurgiu (2017) assessed whether students respond better to evaluation questions when they watch small segments of content followed by a number of evaluations, or when they watch large amounts of content with fewer evaluations. Findings suggest that smaller chunks of content helped students to better retain information and better perform in end-of-course test. Students who learned through microlearning technique took 28% less time to answer their evaluations and did 20% better, took three times less to cover the course materials compared to students who did not. This suggests that trying to learn large content at once result to little interaction with content.

Although research has shown its effectiveness, there is a lack of providing clear structure and theoretical framework for microlearning. This paper intends to fill the gap in research by providing a three step process of how to create a microlearning environment that help facilitate students’ retention of information.

Step 1: Break down the content

The first step in creating a microlearning environment is to break down content into smaller chunks. Microlearning is designed to suit the limits of the human brain with respect to its attention span and avoid cognitive overload, and it supports Hattie and Yates’s claim (2014) that learning new material/skills within several spaced short sessions is more effective than a single longer session. This does not mean that instructors cut down their class time but to cut down their class materials into mini ones. It is important at this stage to think about what are the must-to-know information and what are the ok-to-eliminate information when students interact with content.

The following questions can help instructors when thinking about the “must to know” information for their classes:

- What do I want my students to know and understand in order to move forward?
- What are the 3 or 4 most important things I want my students to learn?
- What are the most common mistakes students do that affect their learning and their grades?
- What topics do I think that can be broken down into small pieces?

These are just some example questions to ask for choosing appropriate content to break down. Once microlearning content is determined, it is essential to think about the pedagogical model to use and the design of the microlearning environment.

Step 2: Time the Activities

Another important elements to consider is the length of the learning activities when designing and creating an effective microlearning environment. Learning in small steps happens when activities are relatively short. The total amount to complete all segment of content in a microlearning module does not take more than 15 to 20 minutes for learners to complete. Within the microlearning module, micro activities are designed that takes learner 3 to 5 minutes to complete. This can include 5-minute mini lecture, followed by 5-minute think-pair-share, etc. The purpose of this step is to revisit information multiple times through a variety of activities to reinforce and retain information and help it move to the long term memory.

Step 3: Focus on a Single Learning Goal

A Microlearning module focuses on a single learning goal students need to achieve. What makes microlearning effective is not just because an activity takes 5 minutes to complete, but also provide specific and targeted information. The purpose of this step is to ensure that learners take one step at a time to learn and meet the goal, before they move forward.

When writing down the learning goal, it is important to first think about what is the one thing that students will learn by the end of the microlearning unit? Something they’ll be able to do, feel, or know as a result of interacting with

the microlearning content. For example, students will be able to compute basic statistical tests by the end of the unit. Once a learning goals for a lesson were determined, it is important to assign a single learning goal for each microlearning unit, and then think about its process to help students learn. Baumgartner (2013) discusses the theory behind microlearning and proposes a model of a competence spiral to scaffold students' learning. In the first phase called Learning I, students absorb knowledge; this knowledge is basic and has no meaning yet (relates to behaviorism), In the second phase called Learning II, students acquire knowledge. Students in this phase interact with artificial environments and make their own experiences. Learning here in active with meaningful feedback is provided by the instructor (relates to cognitivism). In the third phase called Learning III, knowledge is constructed where instructors and students work together to master the course materials (relates to constructivism). In Learning I+, students proceed to higher level with more advanced concepts. Based on the Baumgartner's model, Göschlberger (2016) proposed a social microlearning platform designed for all four phases. In Learning I, students create and share microlearning content. In Learning II, students evaluate, rate and improve the microlearning content. In Learning III, students are able to tag and collect content items. Learning I+, students interact with the microlearning content and solve low stakes quizzes, which they can take repeatedly to help them learn the materials.

The Role of Technology

Technology can play an important role in microlearning. It can be used to engage students with micro activities. The challenge with technology is that it is a fast-growing industry, sometimes it is hard for instructors to keep up, as they have teaching and non-teaching responsibilities. However, instructors often have knowledge about the content they are teaching, but not much how to integrate technology to help students learn. (Alqurashi, Gokbel, & Carbonara, 2016).

Many of the technologies used in the classroom nowadays are have mobile friendly applications. In addition, the number of students who own mobile devices continue to increase. For this reason, digital microlearning environments should use mobile friendly applications, to allow learners to complete learning activities on their devices. The integration of mobile devices to create microlearning environments was discussed by Hug (2010). He emphasized on the importance of mobile devices because many reasons: (1) content displayed on mobile devices is usually a microcontent, (2) attention span and time periods are relatively short when presented on mobile devices, (3) a screen size in a mobile device is smaller than other devices, (4) mobile devices allow the design of micro-steps in formal and informal learning environments, (5) mobile devices allow the microlearning environment to be mobile, physical and social, and (6) finally mobile devices are often associated with micro platforms.

Conclusion

The microlearning model helps to ensure that students retain information. It does help usually distracted individuals to learn in short focused micro content. Instructors must also focus on the learning experience in the big picture when implementing microlearning. The application and the construction of knowledge that occur in class after students complete their microlearning content outside of class. By including all elements of microlearning (i.e. content, pedagogy, and technology), it can increase student engagement, enhance student satisfaction, and positively impact the learning experience.

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An Introduction to the Cognitive Refraction Model for Instructional Design

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Descriptors: Instructional Design Model & Cognitive Load

The cognitive refraction model is a classification system for learning objectives that helps you understand the cognitive requirements necessary to achieve your learning goals. Learning objectives are grouped into conceptual bins based upon the work required to meet them, as estimated based on: the number of elements involved in the process, the choices that are to be made, and the concreteness of the information being presented. In the following presentation, I will address classifying learning objectives in the cognitive refraction model and using the classifications to guide instructional tool and techniques choices.

Introduction to the Cognitive Refraction Model

It is a complex endeavor to determine what instructional methods will make learning objectives accessible for learners. Great material is lost in droning lectures, ill-fitting reading assignments, and off-topic discussion questions. The design process is so difficult that some educators never undertake the challenge, instead accepting textbooks or premade curriculum that does not align with their learning goals. The cognitive refraction model supports the process of aligning instructional methods with instructor's desired learning objectives. It classifies cognitive tasks into groups based on intrinsic load, the cognitive work inherent in conducting the task (Chandler & Sweller, 1991). Once learning objectives have been classified, it is easy to determine the activities and tools associated with improving learning in that category of load.

The cognitive refraction model is an applied cognitive load organizing framework for instructional design. The basic premise of cognitive load theory is that learning is work and we have limited cognitive resources with which to perform it. When the cognitive load of a task is too great, learners' work quality suffers (Chandler & Sweller, 1991). This can lead to incomplete understanding, difficulty applying concepts, and inability to determine how to proceed in problem-solving. Luckily, instructional tools can help with these issues; they can ease the process of content acquisition, provide practice in the procedures and skills associated with a competency, and support the development of self-monitoring skills. To share this information, I will discuss classification rules for the model, the work associated with each category and how to support its learning, and tools that can be used to support learning in a task or simplify the processing of a category.

Intrinsic Load Based Classification

The cognitive refraction model classifies information in a cognitive load framework, looking at the intrinsic load of the task to be performed. The definition of intrinsic load used with this model is more complex than traditional definitions. Past models of intrinsic load measured load by examining the number of elements of interactivity in the task--the elements being held in the mind and used for interaction during task completion. The evidence that elements of interactivity influence intrinsic cognitive load is robust (Sweller & Chandler, 1994).

Elements of interactivity are a necessary measurement for intrinsic load because if the interacting elements are not processed together, the intended understandings will not develop (Sweller, 2010). For example, when considering possible factors affecting the velocity of a vehicle, attention needs to be paid to both the speed of the vehicle and the direction the vehicle is going. Looking at only one of those factors will not provide you with the velocity. Thus, velocity has at least three elements of interaction (speed, direction, and the interaction between the two).

The number of elements of interactivity in a task is not absolute. The number is affected by expertise in a subject matter: experts will group chunks of information together to be processed, thus reducing the number of elements and reducing the cognitive load (Kalyuga, Ayres, Chandler, & Sweller, 2003). Other than this effect of expertise, many researchers consider intrinsic load to be fixed for a given task. I argue that there are other elements

that we can establish as influencing intrinsic cognitive load. For example, tasks related to the same content and elements of interactivity might have very different intrinsic loads when using different learning objectives (Sweller, 2010). To refine the classic conceptualization of intrinsic load, I suggest two other factors that have been evidenced to have cognitive loads that relate intrinsically to the task. These are 1) choice/decision-making associated with the learning task and 2) loads of orienting information.

The first additional factor in the model is decision-making. The literature does evidence the importance of decision-making in intrinsic cognitive load. For example, your accuracy reduces when the extraneous load is increased with interruptions for complex decision-making, but not for simple decisions (Merriënboer, Kester, & Paas). This is evidence that the decision carries a load. This is easy to evidence experientially as well. Imagine the cognitive load associated with listening to a story. Your intended goal is to understand the story, but not to make a decision regarding the learning content. At the end of the story, you are asked to take a pop-quiz on the story's content. Now compare that with the load of listening to the same story after being told that you will be quizzed on it later. For each bit of information in the story, you must determine whether you need to put work into remembering it, and must invest your work where you decide it is useful for your score on the test. That second load is much greater. Even the same choice can carry a higher-cognitive load in different contextual situations: decisions that are "expensive", in terms of resource use or distribution, lead to higher associated cognitive loads, including affect-related cognitive loads (Whitney & Hinson, 2009).

The second additional load I suggest be incorporated is an orienting load. This load is associated with abstraction of conceptual information, mentally aligning concepts, and contextualization of information. Of these three load processes, abstraction is the most load inducing, so it provides the categorical rule for this load, even though, in actuality, all three orienting loads will influence an individual's learning. Conceptual abstractness influences cognitive load related to the learning task in both visual (Brady, Konkle, & Alvarez, 2011) and written information (Crutch & Warrington, 2005). This is another intrinsic load that is easy to experientially evidence and logically intuit. The load of decision-making about a problem related to concrete information, such as estimating the percentage of room a table takes in the overall room, is obviously going to be less than the load of decision-making about an abstract problem, such as estimating the amount of freedom in a nation. It is harder to identify what information is important in evaluating abstract concepts, and, similarly, it is difficult to estimate these factors' values. Thus, the cognitive refraction model categorizes concrete versus abstract cognitive processes in distinct categories of intrinsic load. Similarly, the load of mental alignment is an understood intrinsic load associated with the cognitive load involved in spatial rotation and map alignment (Tversky, 1993). If a map is oriented to the physical location of the map user, reading the map involves a lower cognitive load than if the user needs to mentally rotate the image to interpret it. Contextualization of information is also important, especially for experts (Grossman, 2017). Embedding learning in its contextual application can reduce the work of determining how to apply it. This can be interpreted as making the abstract more concrete by simplifying understanding its application.

The Cognitive Loads of the Learning Tasks

The cognitive refraction model is a tool to categorize intrinsic load of tasks based on these three factors: elements of interactivity, choice/decision-making, and conceptual abstractness. The categorization rules have been simplified for you in a decision tree in Figure 1, and will be explicated here, as well. To categorize learning objectives, you begin by determining if the learning objectives involve decision-making. If the answer is no, that information is categorized as structure processing. This is the processing associated with conceptual understanding. The cognitive load associated with it is the work of keeping track of information, activating the right information, and inhibiting incorrect information. This load can be small with very narrow, simple topics or heavy with interconnected and contradicting information.

If the answer is yes, there is some decision-making in the process, you must determine if the process requires only one decision or many decisions. If the processing requires only one decision, you next look at the outcome of the decision. Is this a concrete outcome, with a right or wrong answer, or is it a more abstract outcome, with multiple possible correct responses? If there is a right answer, this is categorized as action processing. The information from structure processing is still a cognitive load, but action processing adds the loads of identifying that a decision needs to be made and making the right decision. If the decision involves abstract information, the load is greater yet, with the additional loads of identifying important factors, estimating values of factors, and choosing a path. This is classified as heuristic processing.

If you need to make multiple decisions, those decisions must be connected into a procedure that organizes them. That imposes a cognitive load as well. That load is different if the steps involve reasoning about a more concrete product rather than a more abstract product. If the end product is concrete, such as a paper or other material object, then, as you organize, you can compare to a conceptualization of the concrete end product. This is design

processing. It involves all of the loads associated with the decision-making on different steps of the process, as well as the additional load of connecting the product being designed to some concrete, constraining principles. The ability to check each step for accuracy limits the load of this category to some degree.

The final category of processing is share processing. The work associated with share processing involves communicating information to other audiences. This work is sharing abstract information while comparing it to an abstract set of requirements, so the processing is very resource intensive.

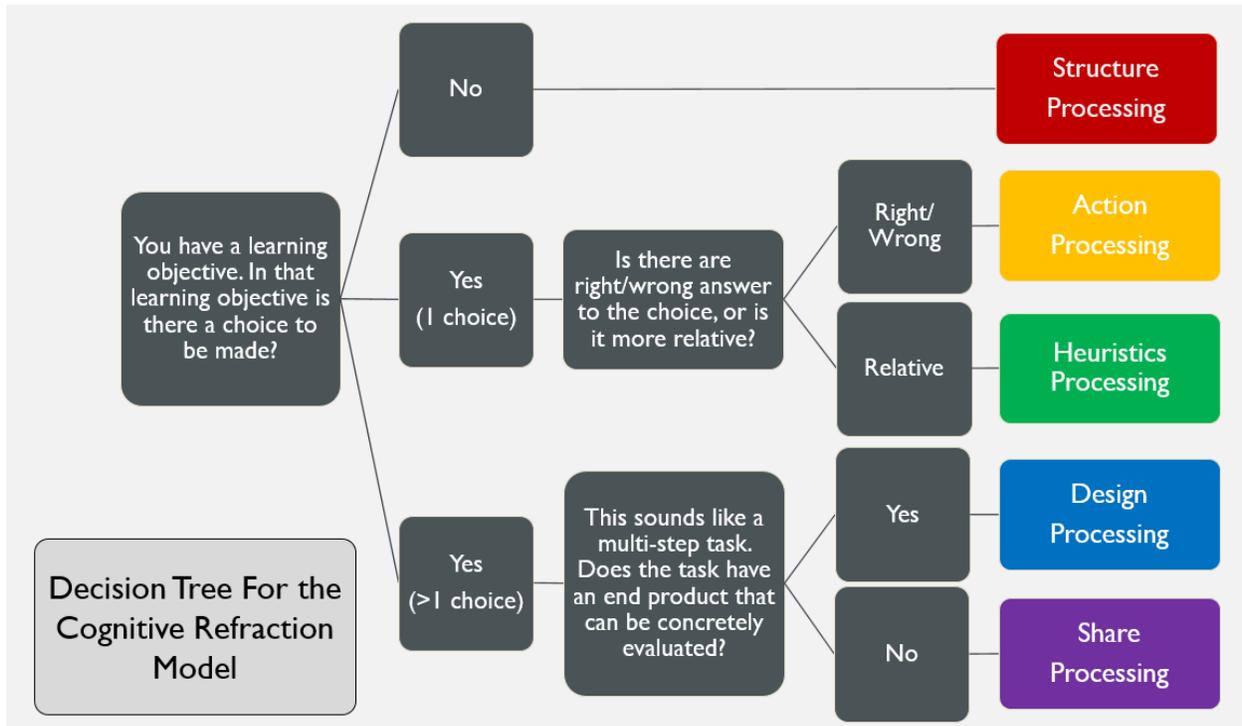


Figure 1. Decision tree for the categorization of the cognitive refraction model.

The Cognitive Refraction Model

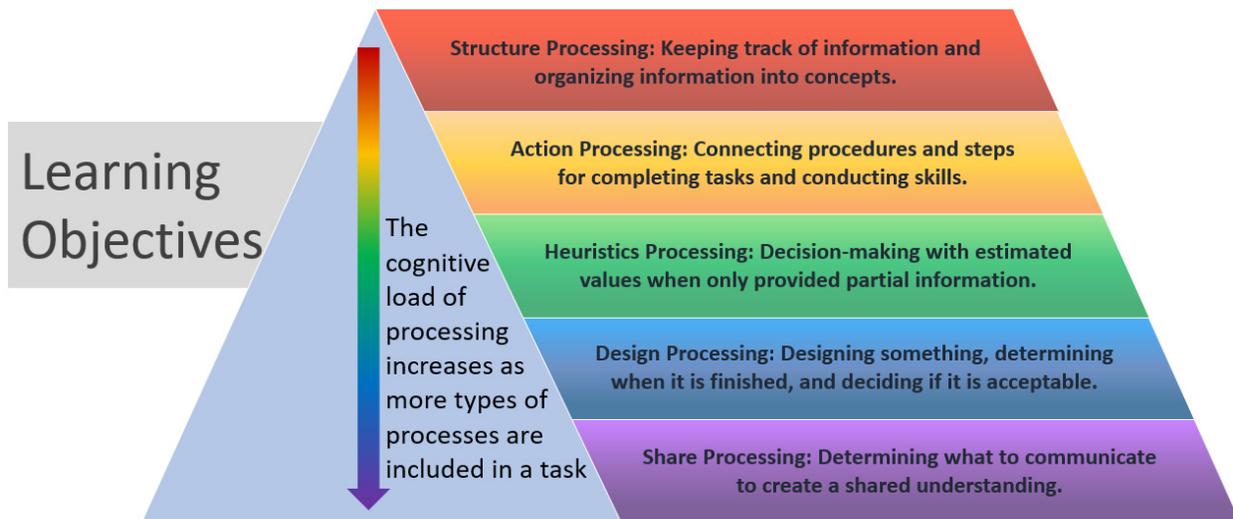


Figure 2. The cognitive refraction model and the work associated with process categorizations.

This categorization process is diagrammed in figure one. The model itself can be seen in figure 2. These categorizations might seem abstract. To make them more concrete for you, let me provide a light-hearted example of categorizations related to learning objectives about big cats.

- **Structure:** Knowing different types of big cats is an example of structure processing. Knowing characteristics of groups of big cats, like their coat patterns, is also structure processing.
- **Action:** Being told to choose the tiger from a set of big cat pictures of different species and being able to identify and select the right picture is an example of action processing.
- **Heuristics:** When shown a set of pictures of big cats with behavioral descriptions, choosing which big cat you would like to be stuck in a cage with for three hours is an example of heuristic processing.
- **Design:** Designing an approach to your confinement with the big cat as to give you the best chance of health and survival is an example of design processing.
- **Share:** Being told that your friend will be the one put in the cage with a big cat and that you need to share your design with your friend results in share processing. You have already come up with a great approach to staying alive; now you need to communicate this approach.

There is another load that an applied cognitive science framework incorporates that is not a load in the cognitive refraction model; this is the load of metacognition. Metacognition is thinking about the processing involved with one or more of the previously identified categories: structure, action, heuristics, design, and share. This load is associated with planning future actions, monitoring current actions, and evaluating past actions. These are all very abstract processes that look at two abstract concepts as they change over time. These processes are cyclic and constantly recurring. You can add a metacognitive load to any other process category. This will increase the overall cognitive load, but helps improve the quality of the final product if there are enough processing resources for the task.

Prescriptive Categorizations

Different types of processing are supported by different tools. If you need to understand a category, a list of what is in that category supports this learning well. However, if you need to choose the best option out of a number of possible choices, a list only helps you remember what the options are; it does not help you weigh those choices. A decision tree would support this learning more. Each category of processing has tools and techniques that specifically aid those processes; what those tools are, and how they aid learning, was derived from the cognitive science literature.

To align these tools with the model's categories, I reviewed the cognitive load literature about tools and techniques that improved learning and categorized them based on the types of tasks they influenced. Methods that simplified learning in a situation or improved the learner's accuracy were categorized by the learning tasks they could be applied to and then classified using the cognitive refraction model. From this work, I created a classification chart identifying the tools and techniques that can be used with that category of learning tasks. This allowed the model to be prescriptive: after categorizing the learning objectives, you can choose between the tools that support that category of learning. The logic behind the tool classification involved an analysis of the type of work each tool theoretically influenced and using its predicted influence for instructional design purposes. The following section goes through the explicating logic of tools and techniques associated with each category.

Structure Processing Tools and Techniques

Addressing contradictions: Addressing contradictions in material improves structure learning because overlooked contradictory information will lead to less accurate decision-making. Furthermore, if contradictory information is automated without being addressed, it can lead to ingrained decision-making biases and systematic misidentified or unidentified factors.

Categorization offloading tools: Categorizing offloading tools are tools that make the process of categorizing easier. Examples include guide books and data classification charts. They simplify the process of identifying what fits into a schema and how it gets incorporated.

Categorization practice: Practicing the process of categorization of information improves the automaticity of the schema information, helps identify areas of contradictions, and strengthens the chunking of schema information.

Coherent structure: Having a coherent structure makes learning a schema easier because it provides an example of a successful way to model the schema. The learner can see the model created with the instructional structure and map their structure onto a similar framework.

Concept maps: Concept maps improve structure learning by making the important information explicit. They also reduce the work of schema organization through the spatial offloading of learning information into a graphical form.

Contextual embedding: Having structure information embedded in the context the information will be used in simplifies the process of identifying interactions between the learning material and the context. This improves the usability of the material being learned.

Embedding in prior knowledge: Schema information that is incorporated into previously learned materials is easier to learn because previously learned information is already incorporated into mental structures, allowing the new information to be attached to prior understandings instead of constructed from scratch (which requires more work).

Reducing unnecessary information: Excluding unnecessary information from a presentation simplifies the process of schema creation. This is because the learner doesn't need to determine how to incorporate the unnecessary information into their understanding.

Rule identification instructions: Information is often classified by rules that guide what information is placed in which category. Providing the learner with copy of these rules to be reviewed whenever needed reduces the work associated with the task of classifying information.

Summaries: Summaries simplify the process of learning schemas because they share an expert's perspective on the important material to cover in the schema. This simplifies the process of determining what is meaningful. It also increases learners' accuracy in identifying important conceptual connections.

Action Processing Tools and Techniques

Checklists: Providing a checklist for action information simplifies the identification of needed steps and reduces the load of keeping track of the procedure being followed.

Flow charts: Flow charts are another way of simplifying the identification of needed steps and reducing the load of tracking the procedure being followed. It does this in a spatial organization, which can further off-load the information for some learners.

Just-in-time guidance: Providing just-in-time guidance during action learning improves learning by reducing the load of remembering the steps of the procedure and reduces the load of remembering the specific directions associated with the procedural learning.

Modeling: Modeling action information simplifies learning because it shows the learner how the task can be successfully carried out in a contextually-embedded format. This reduces the work of identifying what needs to be considered.

Role playing: Role-playing action information allows the learner practice the action in a lower-stakes setting and helps develops automaticity for aspects of the process.

Timely feedback: Providing timely feedback helps with the learning of action information because it strengthens the incorporation of correct action and it enables the identification of incorrect action or contradictory action information. This improves the accuracy of future action practice.

Video evaluations: By viewing a video recording of themselves performing an action, learners can self-evaluate their performance. This is particularly helpful when dealing with physical actions, where kinesthetic and spatial information guide the learning.

Heuristic Processing Tools and Techniques

Feedback: Providing feedback during heuristics processing allows the learner to recognize aspects of the process that they were doing well and to identify aspects that could use some improvement. It allows for the correction of errors and reduces the chance that errors will be regularly practiced and automated.

Graphic organizers: Graphic organizers improve heuristic learning by reducing the work of mentally maintaining representations of multiple factors and their interactions simultaneously. Off-loading the factors to a visual modality reduces the working memory load.

Guiding questions: Guiding questions direct the learner to the decisions and choices that must be made for heuristic processing. They guide the learner in identifying pertinent factors and interactions that influence the heuristic processing. This can simplify mental processing and make end products more accurate.

Mental models: Mental models simplify the process of heuristics learning because they offload the work of representing multiple elements at the same time. This allows the decision-making process to be guided by the model and improves the accuracy of factor identification.

Metacognitive skills training: Training learners in metacognitive skills (planning, monitoring, and evaluating processes) allows learners to strengthen their understanding of the decisions that need to be made and the

factors that need to be attended to. Metacognitive monitoring of heuristics can improve the accuracy of the decisions being made and allow for refining of the heuristic throughout the process.

Outline: An outline is helpful for heuristic processing because it allows the learner to self-check that they are following the problem logic well and have identified the important aspects of a problem. The outline can signal important information, guide behavior, and provide a way to self-monitor learning progress.

Partial practice: At times the cognitive load of a whole task is so large that learners quit instead of trying to surmount the work. In these situations, it can be helpful to break problems down into smaller parts and have learners practice part of the task before attempting the full task. This allows learners time to automate aspects of the task and chunk aspects of the schema. Partial practice allows the learners to simplify the learning task through experience before attempting the whole task.

Process guides: Process guides direct the learner by breaking down the learning situation into steps and identifying the different steps in the process being learned. This reduces the work of deciding what to do, and in what order.

Sharing rules of thumb: Rules of thumb are the guiding logic of decision-making that others rely on. By having experts share the considerations and estimations they use in heuristic processing, the learner is provided with expert guidance for making the same decision themselves. This reduces the work of deciding what to do and monitoring decision making.

Worked examples: Providing worked example problems reduces the work associated with heuristics learning because examples show the steps needed and the information to include in order to solve a particular problem. This reduces the work of maintaining this information in the mind while processing.

Design Processing Tools and Techniques

Contextualization of information: Contextualization of information reduces the work of design processing because in design processing context can be very important for final design. If the context of the design is provided, the learner does not need to imagine or create a representation of the proper context.

Feedback: Feedback reduces the work of design processing by identifying areas in the design or the design process where attention needs to be paid or errors have been made. It allows the designer confirmation that their internal representation of the process is similar to outside criteria.

Graphic organizers: Graphic organizers reduce the work of the design process because they can organize work into steps, off-loading the working memory load required to hold multiple elements in mind at the same time. They can also store important structure information, such as where items are located or how systems are interconnected, so that the designer doesn't need to be experts in those systems.

Rubrics: Rubrics reduce the work of design processing because they make it easier for the designer to recognize important design constraints and reduce the load associated with evaluating whether the created product meets the desired specifications.

Skill simplifying tools: Skill simplifying tools can reduce and improve the work of design work by making the quality of the design better, making the work easier, or both. For example, when designing a yearbook, having to cut physical pictures out is more work and harder work than using a digital design program (one you have the skills to use them). The caveat here is that the load of learning to use the tool needs to be low enough for the use of the tool to be possible. If learning to use the tool is too hard, then the tool will not be used, or its use will reduce the quality of the end product.

Time management offloading tools: Time management offloading tools help organize time in larger projects to reduce the load associated with figuring out what to do, when. Setting a calendar that notifies you of an upcoming meeting, setting incremental due dates for portions of projects, and having a project timeline are all examples of time management offloading tools for design processing.

Visual representations: Providing visual representations of the design product can reduce the work of design processing because it makes mentally representing the product in the mind easier. However, making the mental representation more concrete might also lead the learner to constrain their product and reduce creative or novel design processing.

Share Processing Tools and Techniques

Graphic organizers: Graphic organizers simplify and improve share processing by creating visual/spatial representations of share information. This does a number of things: 1) it gives the audience information in a different modality to reduce their load; 2) it supports the building of shared understanding through visual information organization; and 3) it creates a spatial representation of the information that can be referred to as a place holder for that information in information sharing.

Rubrics: Rubrics simplify share processing by explicitly providing evaluation criteria to evaluate the share processing. They highlight important information for the involved parties and simplify the process of determining what is necessary to share to create a shared understanding.

Self-assessment practice: Self-assessment practice improves share processing by improving skills in determining how successful a sharing process was and helping to automate parts of the self-assessment process.

Self-assessment guides: Including guides for self-assessment of the share processing can improve the work associated with sharing because it forces the learner to slow down and think about the process of information sharing. This improves the designing of future communications and helps the learner self-identify areas where work is needed.

Shared communication tools: Shared communication tools reduce the load associated with share processing by making the sharing more powerful through the use of technological tools. An example of this is a webinar that includes visual and auditory information to ease the work of creating a shared understanding.

Sharing guidelines: Sharing guidelines improve share processing by creating agreed-upon constraints on how collaboration and sharing are conducted. These guidelines allow the participants to simplify figuring out what to share and how to understand shared material. Guidelines might constrain what information is to be shared, the organization of the share processing, who is to be involved in the share process, or timelines associated with the sharing. Creating system constraints reduces the work of determining what to include.

Templates: Templates simplify share processing by guiding the learner in what information to share and when to share it. The template provides structure and organization information for the share processing so that the process of determining how to create a similar sharing is simplified.

Time management offloading tools: Time management offloading tools improve share processing by simplifying the work of having multiple parties share information, both synchronously and asynchronously.

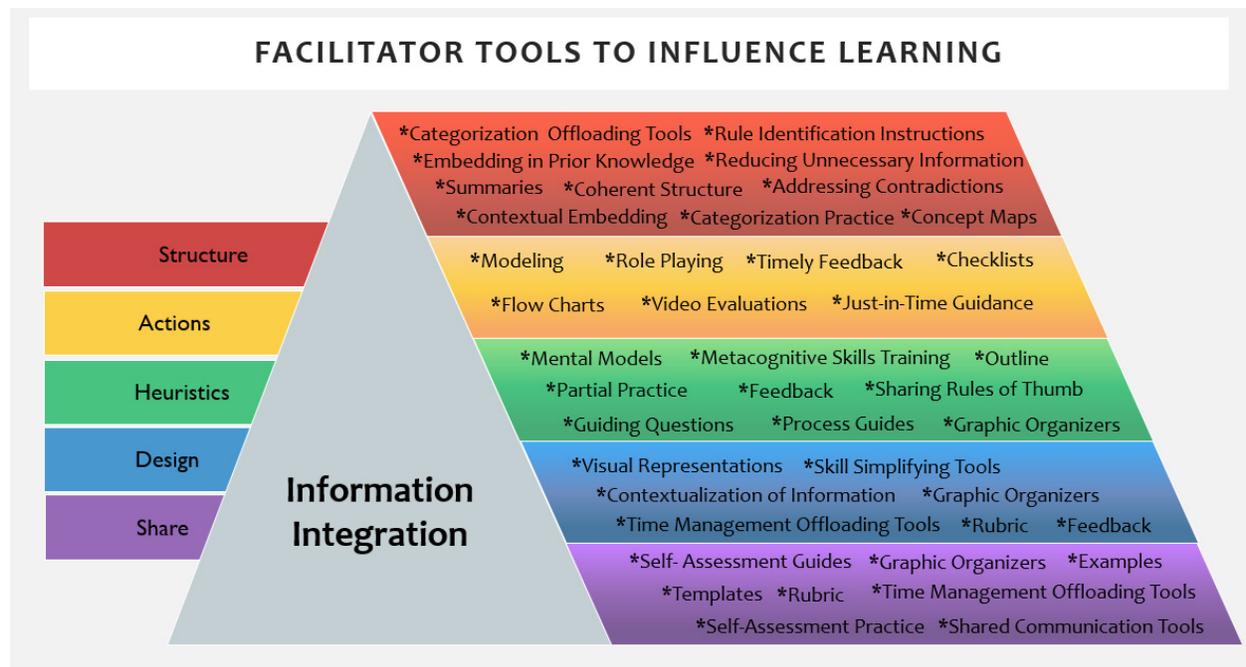


Figure 3. A classification chart of the tools and techniques associated with each process category.

Discussion

The cognitive refraction model was created to align child trauma curriculum with professional mental health competencies. The project initially attempted to use Bloom's taxonomy for the task (Krathwohl, 2002), but that proved to be not suitable for the work. Bloom's taxonomy made predictions that did not align with a cognitive load framework on learning, and its predictions were not as directive as desired for a flexible training curriculum facilitated by mental health experts instead of educators. The cognitive refraction model was constructed as a part of a larger cognitive load framework that I call the Cognitive Ecocultural Framework. This framework uses instructional design concepts from problem-based learning (Barrows, 1986) and experiential learning (Kolb, 2014)

to shape instruction and learner/facilitator interactions in this collaborative, ecoculturally-embedded approach. The framework allows instructional designers to align their instruction with the realities of the learning setting. The model is part of this framework, but can be applied alone to determine instructional tools to support curriculum or to recommend successful techniques to use with your planned instruction.

In this presentation I have provided the basics for getting started using the cognitive refraction model to categorize learning objectives and to select tools and techniques for instruction. The model can also be used to adapt existing curriculum for better learning or to determine appropriate assessment methods. While this instructional model was initially designed for mental health professionals around child traumatic stress, it is applicable across subject matters. Two of its most promising applications are to support trainings in other professional capacities and, as translated into classroom practice, to support next-generation science standards. There are many promising areas to explore and places to apply the model to improve learning.

To validate this model, we are using design-based research instead of an experimental approach. We want to show its validity its usability. I am also presenting about a curriculum improvement project (Grossman & Layne, 2018) and how we used heuristic graphic organizers to support complex problem-solving in a problem-based learning curriculum (Grossman & Layne, 2018). These studies both support the model's usability and utility.

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Conducting a Collaborative Curriculum Improvement Project

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Descriptors: Collaborative Instructional Design & Problem Based Learning

This presentation will discuss a collaborative project to improve a curriculum about child traumatic stress by integrating new instructional design principles with problem-based learning. This will include a discussion of the design process, how needs and constraints were included in the analysis, solutions to identified improvement goals, and the process used to create new curriculum tools. The objective of this presentation is to share experiences with other instructional designers conducting similar projects.

The Core Curriculum on Childhood Trauma

The Core Curriculum on Childhood Trauma (Core Curriculum) is a tool being developed by the National Child Traumatic Stress Network to educate professionals who work in different academic- and field-based child-serving systems to improve the national overall quality of trauma-informed care for children and families. Settings in which the curriculum is being implemented include community-based mental health clinics, teaching hospitals, academic institutions, juvenile justice systems, and child protective services. Curriculum trainees include practicing mental health professionals, such as social workers, psychiatrists, psychologists, and mental health counselors; mental health graduate students, interns, and post-doctoral fellows; and professionals who provide other services to trauma-exposed youth and families, including child welfare and juvenile justice system workers. The Curriculum uses Problem-Based Learning (PBL), a collaborative learning practice in which groups of learners are presented with complex problems resembling those encountered by practicing professionals. These problems contain multiple decision-making points that require learners to repeatedly sort through, integrate, and develop solutions for problems (Barrows, 1986). Our cases are segmented into pages focused on different aspects of a child's case. A facilitator supports the group as they collect and consolidate information; guiding them through the learning experience. In its basic form, the Core Curriculum guides learners through a four-step PBL process comprising (1) identifying important facts from the case description, (2) formulating hypotheses about the case, (3) determining important considerations and next steps to take, and (4) identifying learning issues that require further research.

The Core Curriculum instructional design team included a postdoctoral instructional designer, a clinical psychologist who serves as director of education in evidence-based practice at the Center, a child psychiatrist with expertise in childhood trauma and bereavement, a clinical care and implementation expert, and two social workers with expertise in childhood trauma and child service systems. The mental health professionals had all been working with the curriculum for a number of years, and were deeply invested in its success.

Design Process Overview

At the beginning of this project, the stakeholders did not have a clear idea of what the project might entail. They had a strong belief that instructional design principles would positively influence learning from the curriculum--so much so that they had worked with an instructional design consultant for several years until they finally obtained the resources needed to hire a full-time postdoctoral fellow to assist them in realizing their ambitions. However, they had only a vague awareness of the areas of the curriculum that needed improvement. To identify the improvements in the Core Curriculum that were most needed, and to develop a strategy to sequence and carry them out, we chose to conduct the project as a form of design-based research. This is an approach in which products are designed to solve a problem in a specific context through iterative improvement cycles. It frames solutions as goals constrained by the systems in which the problems are embedded (Sandoval, & Bell, 2004). This particular collaborative model used a critical analysis aspect in the design process. This allowed content knowledge to be guided by experts in trauma-informed care, while the improvement process itself was guided by an expert in instructional design.

The project began with an exploratory analysis of what should be included in the curriculum improvement plan. This was conducted as a critical needs and constraints assessment to determine what goals the current Core Curriculum was meeting and to identify the foundational aspects of the Core Curriculum that should be retained. After the assessment was concluded, its results were used to guide discussions of curriculum improvement goals. The primary aims identified were to support PBL facilitators, improve program implementation fidelity, create tools to improve critical reasoning and other learning objectives, and develop assessment materials for the curriculum. Many types of materials were needed to support these improvement goals. These included instructional guidance materials, case materials and resources, learning tools, and assessment tools. The existing curriculum materials were consolidated into these categories to determine which areas were well covered, as well as to identify gaps that still existed. Once we had identified a gap, we designed various tools and activities to address the learning needs. Once tools were created, they were distributed to our PBL facilitators for trial and feedback in an iterative process of refinement until the product was deemed adequate to fulfill the intended learning objectives. The design process we created to do this work is outlined in Table 1.

Table 1: Design Process Steps

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1. Clarify the research question- What is the overall goal of the design project?
 2. Perform a content needs and constraints analysis- What needs to be shared? What are the domains of information that need coverage?
 3. Summarize the content analysis results to aid in group communication.
 4. Collaboratively determine the smaller project goals and constraints that limit what can be done in the design process.
 5. Create a draft of design. In areas with uncertainty, leave unmapped areas for collaborative decision-making.
 6. Brainstorm possible design solutions to these areas, and use consensus decision-making to determine the courses of action.
 7. Create a completed rough draft of the product.
 8. Train collaborators and facilitators with the draft of the product, have them use it with learners.
 9. Collect feedback about the draft.
 10. Incorporate corrections and refinements derived from stakeholder feedback.
 11. Iteratively continue cycles of refinement until an acceptable draft has been created and formalized.
 12. Evaluate the final product's utility and applicability, and the fidelity with which it can be implemented.
-

Needs and Constraints Assessment

A conceptual content analysis was conducted on the Core Curriculum to identify the elements that made up the Core Curriculum, what stakeholders wished it to be, and what restrictions were necessary in the design process to retain foundational program features. Many materials were used in this needs and constraints assessment. The summary of these can be found in Table 2: Materials for Analysis.

Table 2: Materials Included in the Needs and Constraints Analysis.

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- 1) The process conducted to determine what the Core Curriculum was:
 - read through the curriculum materials
 - read articles about child trauma
 - reviewed past evaluation reports on the Core Curriculum
 - interviewed internal team members about their conceptual frameworks
 - interviewed facilitators about their facilitation practices
 - surveyed facilitators about how they applied the curriculum in their work

 - 2) The process used to determine what stakeholders wanted the Core Curriculum to be:
 - interviewed internal team members
 - surveyed facilitators regarding what they wanted the Core Curriculum to be
 - examined professional competencies about trauma-informed care
 - examined the contexts in which people wanted to use the Core Curriculum

 - 3) The process conducted to determine the constraints of the project:
 - interviewed stakeholder about the learning goals of the Core Curriculum
 - read through facilitator guides
 - surveyed facilitators about their constraints in trainings
 - reviewed past evaluation reports on the Core Curriculum
-

Once this information was collected and consolidated, these areas of interest were used to construct rough models of each factor (what it was, what we wanted it to be, and systematic constraints) and to identify the primary components of each factor (e.g., clinicians had very little time for training, so trainings were constrained to being able to be conducted in a short time). This information was used to identify the improvement goals for the Core Curriculum. These improvement goals can be seen in Table 3

Table 3: Identified Curriculum Improvement Goals

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1. Constraining all new additions to keep the rich, case-based approach of PBL. Everyone liked the existing cases. They wanted them retained, but with more materials to support their planning and use.
 2. Create short cases to introduce the core concepts within a more limited time frame, when needed.
 3. Create tools and systems to support PBL facilitation and fidelity of facilitation. Provide facilitators with guides for planning and instructing.
 4. Create tools to support critical reasoning, case conceptualization, and some of the more challenging foundational knowledge. The tool creation should be constrained to PBL formats to be used with Core Curriculum cases.
 5. Create ways to assess learning in the Core Curriculum, evaluate the Core Curriculum instruction, and improve program fidelity.
 6. Determine acceptable formats for Core Curriculum training to meet the learning goals. Planning was difficult for facilitators, which constrained the use of the curriculum.
-

Building Towards the Identified Improvement Goals

After we determined our improvement goals, we continued our design-based research approach to develop the curriculum materials to reach these goals. We created planning, learning, and assessment tools to supplement the existing Core Curriculum cases. One important factor in the Core Curriculum development was building in sufficient flexibility and support so that facilitators could adapt the Curriculum to provide trauma-informed education for different audiences across a variety of learning settings. For this to happen, we needed to identify general learning objectives for the entire Core Curriculum regardless of such considerations as the case used, the specific learning audience, or the setting. The general learning objectives were thus separated from the case-specific learning objectives that the curriculum had focused on previously. Those case-specific learning objectives focused on specific insights and principles covered by the case material and on idiosyncratic details of the case itself that do not generalize well beyond that situation. We needed general learning objectives that could cover the scope of what

we wanted the curriculum to cover, regardless of which specific cases were selected or which particular instructional tools and activities were used.

The process of developing general learning objectives started as a content analysis similar to the needs assessment as previously described; competencies from different fields were coded and divided into categories. Key stakeholders, including the design team and Center leadership, were interviewed about the ideal content of general learning objectives and historical uses of the curriculum. This analysis was used to outline a prototype set of learning objectives. This prototype was then submitted to the senior management of the Center for review and approval. Management edited and re-wrote the learning objectives to frame the information in ways that they wanted. The design team then needed to convert the language of the general learning objectives to align with the intended curriculum assessment materials. The re-written learning objectives were iteratively cycled between the design team and senior management until a draft acceptable to both parties was produced. The final learning objectives can be found in Table 4.

Table 4: General Learning Objectives of the Core Curriculum

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1. Apply the 12 Core Concepts as conceptual lenses to frame information and guide critical reasoning about a case study.
 2. Identify ecological factors hypothesized to influence children’s traumatic experiences and contribute to their post-traumatic adjustment.
 3. Incorporate relevant ecological factors into a case conceptualization, and use that framework to evaluate the hypothesized contributions of different case factors and guide case-related reasoning.
 4. Use critical reasoning to make judgments about the relative impact of various factors hypothesized to influence a child’s traumatic experience and post-traumatic adjustment.
 5. Clearly and accurately communicate appropriate trauma information to fellow professionals, clients, and family members within and across settings.
 6. Apply a trauma-informed conceptual lens to real-world aspects of professional practice, including assessment, case management, and treatment planning.
-

Collaborative Instructional Design Process

The instructional design process used to create curriculum materials was very similar to the design process of the overall project. It was a form of design-based research in which products were designed to solve specific problems in the curriculum. This tool design process can be seen in Figure 1 below. The design team created four categories of materials: 1) Instructional Guidance Materials, 2) Case Materials and Resources, 3) Learning Tools, and 4) Assessment Tools. Table 5 describes each category of materials.

Collaborative Product Design Process

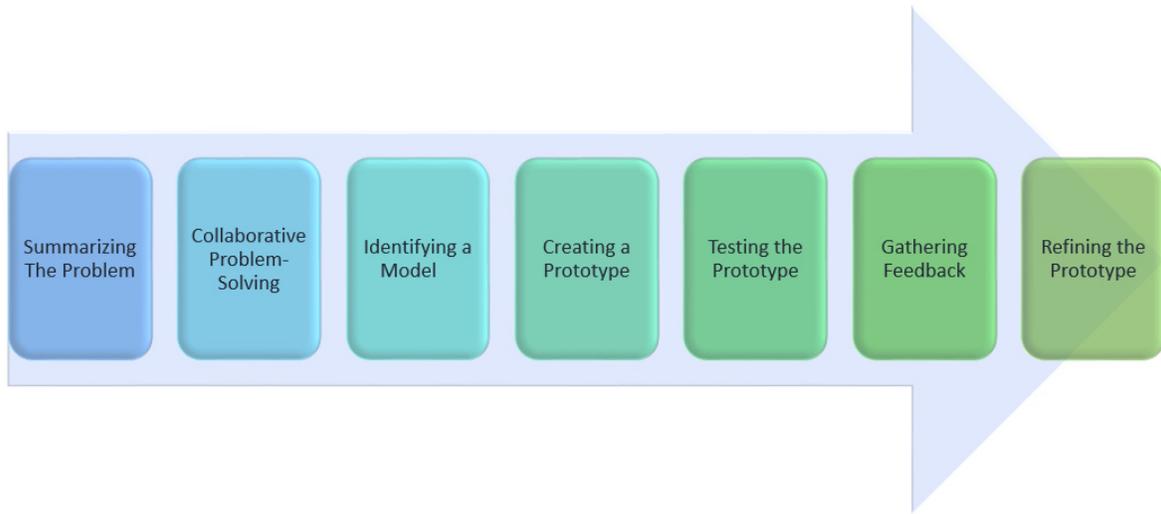


Figure 1. The collaborative product design process involved iterative cycles of prototype improvement.

Table 5 Categories of Materials Constructed for the Curriculum Improvement Project

Instructional Guidance	These materials guide facilitators in effectively using the Core Curriculum. This category includes materials to help learning facilitators plan their instruction, align their activities with their selected learning goals, incorporate appropriate materials that align with those objectives, and plan how to measure learning outcomes.
Case Materials and Resources	These case materials are used in the PBL process. They describe a child trauma case in sections so that group problem-solving can be conducted with the materials. Well-written case materials create rich, complex problem-based learning scenarios.
Learning Tools	Tools to support curriculum general learning objectives. They aid learners in communicating about the problem, consolidating information to create shared understandings. Also provide places to off-load information to simplify thinking about the problem-solving. Some learning tools also serve as assessment tools.
Assessment Tools	Tools to assess learning from trainings. There are both formative and summative assessment materials in multiple formats. Assessment methods are primarily performance assessment, to examine the complex thinking involved with case conceptualization and critical reasoning.

For instructional guidance materials, we developed structured planning guides, organizing templates, and worksheets that aligned with the PBL cases. The purposes of these materials were to improve facilitator support in planning and increase instructional fidelity to the curriculum. The learning tools we created were sets of heuristic graphic organizers to improve collaborative conversations and deepen thinking to support our general learning objectives. These tools were designed to reduce the work of consolidating information and simplify the creation of a shared understanding. They allowed for more complex interactions between factors and an enriched shared conceptualization.

The Instructional Approach

The instructional approach used in this collaboration was a model constructed specifically for this work. Embedded in cognitive science research, specifically related to cognitive load, the Cognitive Refraction Model guides the selection of tools and techniques to support a learning situation. Instructional design concepts of Problem-

Based Learning (Barrows, 1986) and Experiential Learning (Kolb, 2014) shape the facilitation of activities in this collaborative, learner-centered approach, while Backwards Lesson Design (Wiggins & McTighe, 1998) conceptually contributes a sequencing for the model's use. This cognitive load approach ensures that the materials created for instruction are scaffolded to the learners through facilitation techniques and instructional tools. The theoretical framework was constructed by reviewing and aligning applied cognitive load literature to derive a process-based categorization system organized by the work associated with the learning task. (Chandler & Sweller, 1991). This model is also being presented on at this conference (Grossman, 2018).

The Dissemination Process

The first round of tools was created and introduced at an advanced training of our existing facilitators. These stakeholders were knowledgeable about the curriculum and aware of the five rich PBL cases that had been a part of the curriculum for the previous five years. The new tools introduced at the college included two short cases, a packet of 6 learning tools and activities to support general learning objectives, an experimental extended case with a large suggested activity kit, and some rudimentary planning tools. In hindsight, we introduced too many new materials at this training, which proved to be detrimental in the short term to the adoption of the new materials.

After the initial training of the advanced facilitators, the project went into a lull. The majority of the design team attributed the lukewarm response to the materials to a deficit in the materials themselves. They deprioritized the project, and this led to bad communication and a slow feedback cycle. Furthermore, our initial collaborative approach had focused on development without an organized implementation plan. This lack of fore-thought developed into different understandings of the goals of the project and reduced the project's productivity.

Approximately a year into the project, this became a large enough issue that we took a step back and re-assessed the project and its forward progression. A report was created to summarize the work that had been done up until that point and to organize the project's future directions. This report was shared with the design team and other key stakeholders. The report being shared and discussed improved communication amongst the design team. It allowed for the creation of timelines and a strategic plan for future implementation. This included a larger discussion on material prioritization, an introduction of new pathways of information sharing within the team, and structured reporting formats. Materials needed for the new facilitators were prioritized before cycling back to the advanced facilitators. This report and the new approaches taken afterwards renewed the design team's dedication to the project.

Another factor that renewed interest in the project was that when our facilitators used the new tools, their learners liked them. The feedback was positive enough that the facilitators who did implement the new tools became the tools' champions. They used the tools, observed their role in their trainings, and came up with novel ways to implement them further. Since that time, many of these introduced tools have been refined based upon feedback from the advanced facilitators and redistributed in a more formal format.

The design team continued to create products to support the curriculum. As the project continues to progress, we are developing more assessment tools and cycling back to the advanced facilitator materials. These materials include planning tools for creating new case studies, an activity kit to explore more complex skills associated with the general learning objectives, and instructional guidance materials for tool use. This work continues to build on the identified action goals at the beginning of the project exploration.

To increase dissemination and usage of Core Curriculum material, we have formalized many of these products and posted them to a website accessible to our learning facilitators. Previously, facilitators had access to materials only at the training colleges or by requesting materials from the design team. By making the materials more accessible when our facilitators would like to use them, we hope that the materials will be used more, increasing program fidelity and learning. We have also been working to develop the public face of the curriculum through the National Center to increase awareness about the curriculum and further the dissemination of the work.

Evaluation Study

To better understand the learning associated with the instructional tools, we conducted an interview study about the tool use as observed by our advanced facilitators. These experts used the curriculum with the same cases both before and after the tools were introduced. We interviewed the facilitators about their tool use, the differences they observed in the curriculum's instruction, and the benefits and drawbacks of the tool inclusion. Overall, facilitators liked and valued the tools. They reported that the tools allowed for discussions that incorporated more factors together, better collaborative sharing, and a more holistic understanding of the situation. Furthermore, they

appreciated the greater flexibility the tools offered with training options and the increased ability to assess learners' current understanding. The tools increased engagement in the curriculum by breaking down the monotonous 4-step PBL cycle and allowed facilitators to tailor their lessons to achieve specific learning objectives, adjust to different audiences, or alter a training for the situation. The details of the study and the results of the interviews are being shared in another session in the conference, Heuristics to Improve Learning/Reasoning Skills (Grossman & Layne, 2018)

Collaborator's Perspective

This presentation about a collaborative process is being summarized and presented upon by an individual mind. This is theoretically misaligned with the collaborative approach. In order to buffer this limitation, this section includes the perspectives of the psychologist who served as the project's primary investigator and the director of education in evidence-based practice at the Center.

To date, the Core Curriculum has enjoyed good support across the Network. During past grant cycles, we focused largely on training new cohorts of PBL facilitators to assist in disseminating and implementing the Curriculum across the Network's many sites, while conducting two relatively modest evaluation studies. Always in the background, however, have been larger questions about how the Curriculum fits in with and helps to address calls for competency-oriented education and training in core professional competencies, including traumatic stress. Our decision to hire a full-time post-doctoral fellow in instructional design represented a significant commitment on the part of the UCLA National Center and the Network to apply (and in some aspects, create and innovate) instructional design principles to a curriculum that is already enjoying broad dissemination—in perhaps as many as 100 sites across the US thus far.

We believe that the curriculum carries the potential of much more widespread dissemination and impact. This includes both “upstream” impacts, by changing how the next generation of mental health professionals is trained in foundational trauma-related knowledge, skills, and values; as well as “downstream” impacts, by developing effective, efficient, and engaging ways to “retrofit” the existing professional mental health workforce by furnishing them with in-service training in foundational (and advanced, as appropriate) competencies. The large scale of this endeavor (the Network now consists of 100 actively funded sites, with many more affiliate sites), its social importance (receiving strong bipartisan support in Congress), and the aim and structure of the Network have created a very unusual instructional design laboratory where products can be quickly developed, field tested, refined, and then broadly disseminated. Notwithstanding the setbacks described herein, the rapidity with which these steps have been taken reveals a much more rapid evolution in the development and dissemination of the Core Curriculum relative to past grant cycles. The creation of general learning objectives, case-specific learning objectives, and an assessment toolkit will position us to undertake a more rigorous evaluation of the Curriculum than has been heretofore been done.

Discussion

The purpose of sharing so much of our process from our curriculum improvement project is to share perspectives and experiences with other instructional designers working on similar projects. To support this work, we offer some of what we saw as the strengths of our process, the challenges we had to overcome, and the big ideas we feel might be valuable for other practitioners who are seeking to apply instructional design principles to other professional settings.

Strengths of the Process. The biggest strength of the process was that our curriculum felt more complete and clearer as we made the improvements identified from our needs and constraints assessment. Our stakeholders said that they wanted specific changes to make the curriculum more powerful and more useable. The tools and materials that we created in our collaborative design process serve their intended purposes. Feedback from facilitators evidences the roles the materials are playing and the ways in which they are supporting learning. In this manner, we feel our collaborative design practice improved our accuracy in assessing the learning materials necessary and in designing the tools as well.

Another focal strength of the collaborative design process is that it allowed us to leverage the expertise of a number of professional contributors. Our design team consisted primarily of experts in different fields of mental health, and our facilitator collaborators were also experts in different fields of mental health. This made their feedback on content knowledge particularly impactful and relevant to the instructional design. The primary responsibility of the instructional designer was to weave this information together in ways that were accessible to the learners.

Difficulties with the Process. The first difficulty associated with this collaborative design project was that members of the design team had multiple demands on their time and were not equally invested. Feedback on prototypes was postponed as other projects were prioritized. Additionally, the process needed to work with people with very different schedules. We found that having set check-in topics and spots allowed people to re-align back to what we were working on, but that those also seemed to make the process take much longer. In this manner we would re-analyze and re-make the same decision multiple times. We never found a more successful way around this challenge, and it continued to be a bottle-neck in the collaborative process.

One of the strangest aspects of the Core Curriculum Improvement project was the translation across disciplines. The instructional design expert approached the curriculum design from a cognitive load perspective, focusing on improving collaborative load and scaffolding from facilitators to make learning materials more accessible to the audience. Materials were constructed with specific learning objectives in mind, and they influenced the end format of those materials. Evidence-based research was the foundation of the instructional approach, and each tool had a theoretical foundation for its construction. This intentionality proved difficult to communicate to the design team overall.

While the tools functioned as intended, many members of the design team were slow to adopt new aspects of the curriculum. They had not used the new materials with learners, so they only started to understand the tools' importance when their facilitator collaborators provided positive feedback. These collaborators became early adopters and championed the tool use integration. This created a cascading effect that slowly won over the more hesitant members of the design team. Nonetheless, the process of translating the cognitive science implications into easily accessible information for the design team was not as successful as it could have been, and that impacted the curriculum's dissemination efficiency.

Big Ideas

Even given the difficulties with the collaborative process, key stakeholders felt that this work was very successful and are invested in future collaboration. Overall, we would recommend this process to another group as a powerful approach to collaborative decision-making and project design/implementation. In recommending a similar process, we would also like to provide some guiding suggestions derived from our experiences.

1. Figure out your design and implementation process early on. When being invited to work on an interdisciplinary collaborative process, identify whether the people organizing the project have determined the methods they would like to implement to reach the project goals. If they do not have a process identified, as an instructional designer, you can improve your project by offering possible processes that might be reasonable. It is much easier to select from a few choices than to construct a process from an abstract theoretical framework. The model we created for this purpose was based in anthropology, ethnography, and qualitative research for problem exploration and iterative collaborative problem-solving for design purposes.
2. One of the most important aspects in our collaborative process was the work of summarizing collected information so that the design team could make meaningful decisions about the material. This information should be in a written format so that team members can analyze multiple aspects of the project as they align with each other. Having the information written allows the team member to refresh their problem representation in the moment of decision making. Ideally, this summary should be broken down into segments of identified decision-making points. To get consensus between group members can be difficult, especially when interactions are often asynchronous and across a distance. Separating and demarking different choices to be made makes it is easier for team members to orient together for problem-solving.
3. The instructional designer should identify ways of supporting team members in making valuable contributions. As the instructional designer, examine the processes your counterparts work well with and try to adapt your collaborative process to play on the strengths of your collaborators. For example, if a collaborator is much better at reviewing collected information than collecting the information, organize your collaborative process to have them incorporate their perspective later in the process. This allows people to contribute in ways that work for them and builds buy-in into the process.
4. Iterative processes are good for collaborative endeavors because they allow for continual product refinement and they allow for team members to flexibly contribute when they have the time.
5. In the creation of action goals, think of systematic constraints as well as the needs of a system. This makes it easier to prioritize what changes will give you the largest impacts for your time and effort.

6. Early adopters of tools and materials can field test and improve the curriculum. Moreover, their motivation can support generate interest and enthusiasm in program improvements. Identifying and supporting these individuals supports the project overall.
7. As you progress on your project, remember to monitor your progress and re-assess whether you are still in-line with your original goals. Look at the products you are making and see where your goals need support.

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Using Heuristics Tools to Improve Critical Thinking in a Problem Based Learning Curriculum

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Descriptors: Problem Based Learning & Cognitive Load

This presentation reviews the creation of instructional tools to aid learning in a problem-based learning (PBL) curriculum about child traumatic stress. The tool creation was a part of a larger curriculum improvement project using instructional design principles to improve the use and dissemination of the curriculum. In order to improve the support of complex-problem solving related to child trauma cases, we created a number of heuristic graphic organizers to incorporate into our PBL structure. This presentation will describe the curriculum, explain our steps in tool development, outline our theoretical approach, and discuss the results of the process as seen through the lenses of our PBL facilitators.

The Core Curriculum on Childhood Traumatic Stress

The Core Curriculum on Childhood Traumatic Stress is a national curriculum used to educate mental health practitioners in different academic and field-based environments about child traumatic stress. The curriculum is being developed by the UCLA/Duke University National Center for Child Traumatic Stress in collaboration with its partners in the National Child Traumatic Stress Network (NCTSN). The aim of the curriculum is to support the mission of the NCTSN to improve the quality of trauma-informed care for children and families by raising the standard of education and training for their care providers in foundational principles of childhood traumatic stress.

When the program improvement project began, the curriculum consisted of five detailed case studies written by a panel of experts in childhood traumatic stress. Each case focused on a fictionalized child and their family who had experienced a traumatic event or events. The cases were divided into sections, each ranging from one to two pages in length. Each section revealed new information about the child, the traumatic situation, and the context of the experience. These cases were conducted using traditional variations of a problem-based learning (PBL) model: Learners worked in groups of 6-12 students, reasoning section by section through the case. The cases were specifically designed to build complex problem-solving skills by intermixing both meaningful and less relevant information, thereby forcing learners to identify and piece together the relevant factors as they work their way through the case (Barrows, 1986; Hmelo-Silver, 2004). The curriculum used a medical variation of PBL, including a basic four-step PBL cycle. With each section, the participants work their way through the problem by (a) identifying facts, (b) creating hypotheses about the case, (c) determining next steps that align with the hypotheses, and (d) identifying learning issues where more information is necessary. This process is guided by an expert facilitator who helps to consolidate conceptual understandings and support the group process. (Layne et al., 2014).

At the beginning of our project, we conducted a qualitative analysis to determine the aspects of the curriculum that were serving their purposes and the aspects that could be improved. This work revealed that PBL was an essential aspect of the curriculum that needed to be retained. Not only was PBL known in the literature for building evidence-based reasoning and prioritization skills (Savery & Duffy, 1995), but a survey of our facilitators

showed that it was well liked and considered a strength of the program. However, the survey also revealed that facilitators felt that the PBL cycle did not easily support all of the learning objectives, especially objectives that centered on solving complex problems involving multiple interrelated factors.

Accordingly, one of the primary purposes of our program improvement project was to create ways to make this complex decision-making more accessible in the PBL framework. Our solution was to create graphic organizing tools that supported learners as they were working through these complex problems. The tool creation was guided by applied cognitive science, and the collaborative design process was guided by design-based research. After creating these tools, we invited the curriculum's current facilitators to field-test them. We then conducted an interview study to explore the tool use and how it influenced learning from the curriculum.

Design-Based Research Approach

The curriculum improvement project began with a critical needs and constraints analysis to determine which goals the current curriculum was meeting and to identify foundational aspects of the curriculum that should be retained. More about this analysis is being shared at this conference in a presentation about conducting a collaborative program improvement project (Grossman & Layne, 2018). After concluding the analysis, we reviewed the results to determine our improvement goals. Our primary aims were to improve support for PBL facilitators, improve program implementation fidelity, create tools that could be used to improve clinical reasoning and other learning objectives using the established PBL framework, and create ways to assess learning outcomes.

In order to create tools to support the identified goals of the curriculum, we needed to have a shared understanding of the curriculum's learning objectives. Our needs and constraints analysis provided some of the most basic constraints of what should be incorporated within the curriculum. The curriculum was created to share foundational principles about child traumatic stress; these needed to be incorporated. Additionally, the PBL process had been selected because skills that it helped develop, such as case conceptualization and critical reasoning skills, were seen as necessary for this work. These learning objectives were easy to identify. To identify other relevant learning objectives that were not as apparent, we reviewed trauma competencies from different professional literatures, such as social work, psychology, and psychiatry. These were used to identify overlapping goals and prioritize the skills seen as necessary for trauma-informed practice with professionals. This information was summarized and used to create a prototype of the general learning objectives. Once they had been negotiated on an organizational level, the design team went to work making sure there were tools to support those learning objectives. To build these tools we used a design-based research approach with iterative collaborative design and product development, followed by a comparative product analysis to determine utility (Sandoval & Bell, 2004). We identified the gaps in the curriculum through surveying learning facilitators, trauma experts, and learners. We then designed a tool to bridge those gaps in our learning contexts. These tools were prototyped and then evaluated by facilitators as compared to the curriculum without the tools.

Applied Cognitive Load and the Cognitive Refraction Model

Cognitive load theory approaches improving learning through balancing the cognitive work associated with a learning task. If the load is manageable, the material can be accessed by the learners. However, if the load too large (or not large enough), learning will be diminished (Chandler & Sweller, 1991). The instructional design used in this project was an applied cognitive load model specifically created to support this work. We used the model, which we call the cognitive refraction model, to identify tools that might aid learning during specific learning tasks. It organizes learning objectives into categories of similar types of work to prescribe what type of tools would support learners in the learning task. The model can be seen in Figure 1 and is also being presented at this conference in a separate paper (Grossman, 2018)

The Cognitive Refraction Model

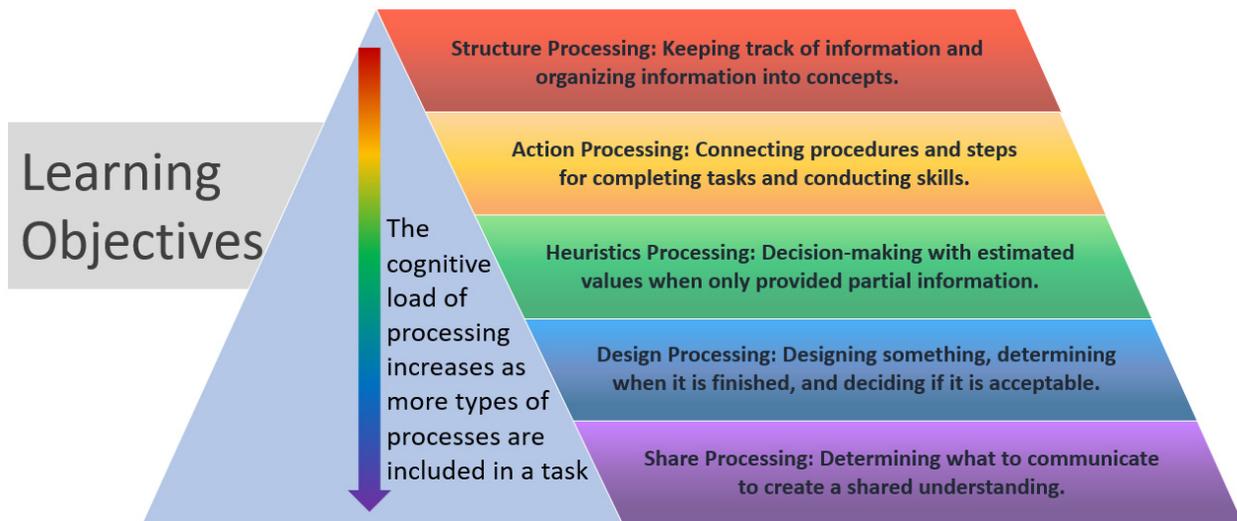


Figure 1. The cognitive refraction model categorizes learning objectives based upon the cognitive work associated with completing the task accurately (Grossman, 2018).

The model aligns these cognitive loads with tools that have been evidenced to support learning from the different tasks. We reviewed and categorized the cognitive load literature about tools and techniques that improved learning to align the tools with the model's categories. Further, we organized methods that simplified learning in a situation, or improved the learner's accuracy, according to the learning tasks where they could be applied. This allowed the model to be a prescriptive lesson planning tool: Specify your learning objectives, then use the model to categorize them and prescribe specific instructional tools to help learners achieve those objectives.

The cognitive refraction model classifies the complex problem-solving we wanted to support as heuristic processing. Table 1 provides some of the techniques for simplifying the work of heuristic processing and for improving the accuracy of heuristic processing.

Table 1: Examples of Techniques for Heuristic Processing

Simplifying the work of Heuristic Processing

- Providing guides to direct attention to important factors in the decision-making process
- Sharing an expert's guiding rules for decision-making before practicing the decision-making
- Providing tools that represent the information visually to reduce the work of multiple elements
- Practicing the decision-making to make the factor identification and weighing-out more automated thus requiring less attention

Improving Heuristic Processing

- Providing tools to allow more factors to be compared simultaneously
 - Teaching self-evaluating skills to improve accuracy in decision-making
 - Incorporating feedback about the accuracy of the decision-making methods during future decision-making
 - Increasing contextualization of information into larger systems and frameworks.
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The cognitive loads associated with heuristic processing include the work related to identifying relevant factors for decision-making, estimating the importance of these factors, determining interactions between factors, predicting what possible outcomes might be, and selecting the best outcome out of the options. To design the tools to support these processes, we needed to know which tools might help with each type of work. The cognitive

refraction model’s facilitator tools classification chart laid out our options for us in this practice (Grossman, 2018). We identified how we could support the skills specific to our learning objectives. We decided to create a classification chart to help learners identify important factors in a case. Other tools provided conceptual bins for classifying factual evidence to help learners integrate case information and form hypotheses about how various case factors interrelate.

Our heuristic processing was being conducted in a collaborative setting, and cognitive loads associated with collaboration would also influence learning from our PBL cases. The cognitive load literature most influential to this aspect of our work was the literature about collaborative load. Collaborative load is defined as the sum of the cognitive loads associated with collaboration on both the individual and the group level. Individual factors include the load of verbalizing thoughts and the load of maintaining an internal representation of the process. Group-level factors include both the load of creating a shared understanding, and the load of creating a representation of the group model of the problem-state (Kirschner, Paas, & Kirschner, 2009). We needed to keep these loads manageable for collaborative work to be successful. We decided to use graphic organizing tools to support these processes. Graphic organizers are helpful for collaborative heuristic processing in a number of ways:

- 1) For internal representations: Graphic organizers help keep multiple concepts in the mind concurrently. We can only hold a limited number of factors in our minds at one time (Cowan, 2010); when this work is offloaded into a visual-spatial format, this load is reduced.
- 2) For representations of the problem state: They organize information so that it can be processed more efficiently. By grouping information into meaningful conceptual bins, those categories can be processed together.
- 3) For reducing the load of verbalization and the load of creating a shared understanding: It concretizes definitions to create a shared understanding. As collaborative processes create agreed-upon definitions and categorizations, it becomes more clear when a shared understanding has been achieved.
- 4) For group representation of the problem-state: The visual representation supports the creation of a shared problem representation. Graphic tools can simplify defining and relating models in a collaborative process by predefining the factors in the model being applied.

The Tool Development Process

Our decision to guide learning with instructional tools was made after some tool construction had already taken place. One of the primary tools already existed (CHECKS/Double Checks Heuristic), and another had already been outlined (Seesaw Model). For the other tools, we used a collaborative design-based research approach to tool development, in which products were designed through iterative improvement cycles. This particular collaborative model included critical pedagogy, which allowed content knowledge to be guided by trauma-informed care experts while the overall improvement process was guided by an instructional design expert. The steps of the tool design process can be seen in Table 1.

Table 1: Steps of the Tool Design Process

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1. Define the goal of the end product.
 2. Determine necessary content and scope
 3. Engage in collaborative decision-making about content of prototype
 4. Create draft of prototype
 5. As a design team, continue to create iterative drafts of the prototype until an acceptable draft is created
 6. Field test prototype with expert facilitators
 7. Collect feedback about the draft
 8. Incorporate corrections and refinements derived from the feedback
 9. Formalize final product
 10. Evaluate the final product in relation to its use as a tool and its usability
 11. Effect wide dissemination of final product
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The Tools for the Core Curriculum

The needs and constraints assessment identified three of the curriculum's learning objectives as being particularly difficult to support: case factor identification, case conceptualization, and critical reasoning. These three learning tasks are all classified as heuristic processing in the cognitive refracton model. To support learning in these areas, we wanted graphic tools that could model the problem organization and simplify the work of creating shared understandings. We determined that we needed tools to serve three purposes: first, to help identify important ecological factors in a child's ecocultural context; second, to aid in conceptualizing about the case and how identified factors play a role in a child's traumatic experience and recovery; and third, to support critical reasoning around treatment prioritization and interventions related to a child's case. For these purposes, we created four graphic organizing tools to be incorporated into the PBL curriculum: (1) Ecological Dimensions Categorizing Chart, (2) Protective Shields Factor Map, (3) Seesaw Model, and (4) CHECKS/Double Checks Heuristic.

Ecological Dimensions Categorizing Chart (EDCC): The EDCC is our most basic tool. It helps novices learn to identify important case factors and classify them in meaningful conceptual bins. The tool presents learners with worked examples of ecological factors in a child trauma case. Learners are then asked to identify ecological factors in the problem case. Theoretically, it helps learners achieve a basic level of mastery in identifying and classifying case factors.

Protective Shields Factor Map (Protective Shields): The Protective Shields is a more advanced tool to aid in identifying case factors, as it requires a basic working knowledge of ecological theory. Using this tool, learners identify case factors and classify them into ecological dimensions based upon whether they are theorized to serve as causal risk factors or as supportive factors. In a cognitive load theoretical framework, the diagram reduces the work of holding case information in the mind, categorizing case factors, and communicating about the interactions between factors. We hypothesized that this tool will serve as a learning tool, communication aid, assessment tool, and supervisorial tool.

Seesaw Model: The Seesaw model takes a dichotomous (either-or) decision-making event and forces the learners to use evidence to support their decision-making. Using this tool, learners identify relevant case factors, weight each relevant factor according to its credibility, and then align the factors for versus against the decision. The seesaw model is hypothesized to be a good learning tool, communication aid, and assessment tool. Theoretically, this activity slows down thinking and requires explication of logic in a collaborative process.

CHECKS/Double Checks Heuristics: The CHECKS and the Double Checks Heuristics are tools to organize case information for case conceptualization. These tools organize the information based on the role each factor is hypothesized to play in influencing the child's experience and post-traumatic recovery. Using these tools, learners take identified relevant case factors and determine the role the factors play in the child's case and how they relate to the possible case outcomes. The CHECKS Heuristic invites learners to sort case factors into four conceptual bins consisting of: causal risk factor, protective factor, vulnerability factor, and negative outcomes. The Double Checks Heuristic is a more advanced version of the same tool that includes four additional conceptual bins: positive outcomes, promotive factors, inhibitory factors, and facilitative factors. The CHECKS and Double Checks are hypothesized to be learning tools, communication aids, assessment tools, and supervisorial tools. We theorize that these tools categorize information into meaningful chunks and help retain multiple factors simultaneously. We thus hypothesize that the CHECKS and Double Checks serve as learning tools, communication aids, assessment tools, and supervisorial tools.

Tool Evaluation Methodology

To examine how the tools were perceived to influence learning, we turned to our advanced facilitators for feedback. Our advanced facilitators (N = 26) were trained in the original curriculum between 1-3 years prior to the tools introduction. These advanced facilitators were professionals in fields of mental health, such as psychology, psychiatry, and social work. The group contained clinic directors, university instructors, and community center representatives. They held a great deal of expertise in child trauma, but were not professional educators. Since their original training, these facilitators had using the curriculum at their work sites and occasionally at affiliated sites. This gave them experience in conducting the curriculum without the new tools. In June 2017, these facilitators went to our advanced college, where they were introduced to the new learning tools.

In order to gain advanced certification, participants were required to train in a case using at least one new tool. Advanced facilitators who had used one of these learning tools in their training were then candidates for participation in the study. If a facilitator was willing to participate, an appointment was set up for a semi-structured telephone interview about their tool use and their perceptions of its utility. These participants were part of our program and invested in the project of program improvement. They were considered collaborators more than study participants.

Ten of these advanced facilitators agreed to contribute to evaluating their use of the tools. We interviewed them regarding the ways in which they were incorporating the new tools into PBL cases and the roles they might play in educating mental health professionals in foundational competencies. The interview included questions about their training particulars, the tools they used, details regarding how they incorporated the tools into their training, and how the tools were contributing to the quality of learning. We used this feedback for a number of purposes: to improve the tools themselves, to evaluate whether the tools were contributing to our learning goals, and to broaden the range of the tools potential applications.

Feedback from Facilitators

When we introduced the tools at the advanced facilitator training, the trainees appeared to be very circumspect, some even openly skeptical, in their reactions. We had groups of facilitators work through two of the new tools (the Protective Shields and Seesaw Model) in participatory exercises. We also introduced other two tools with the assurance that we would cover them later in a webinar. These instructional tools were only one part of a larger training, and the quantity of material they received during that two-day intensive training proved to be overwhelming for them. It was hard for the design team to tell if they considered the tools useful or enjoyable. Observing the training did inform us that we needed to clarify some of the tool instructions and to provide a terminology glossary for the language used in the tools. We analyzed and used this training feedback to refine the tools before formally distributing them. Whether or not they enjoyed the new tools, using at least one of the new tools was necessary for certification, so they were motivated to try.

The phone interviews with the 10 facilitators revealed a good deal about the tools' perceived utility. Everyone interviewed had used at least one tool in their training. Eight had co-facilitated the curriculum with another facilitator. This suggested that the early adopters were the ones who had the support of a partner. The tools were used in a variety of settings, including schools of social work, integrated health organizations, a special education collaborative, and for intern and clinical trainings. These trainings included shorter trainings (from 3-6 hours), extended classroom settings (a 7-day intensive and course-work broken between 20 hours across a semester), and regular clinical work incorporating aspects of the program (for example, attending 2, 3-hour blocks for all interns).

All five of our cases were used with the different tools, though more facilitators used the James case, a pre-teen case of domestic violence and child physical abuse, than any other case. All four of the tools were tried by at least one facilitator; EDDC, n=3; Protective Shields, n=7; Seesaw Model, n=3; CHECKS/Double Checks, n=4. The tools were appreciated by the facilitators who incorporated them. A primary appreciation of the tools was that facilitators valued how they changed the pace of the traditional PBL cycle, which could become repetitive. The tools were seen as giving facilitators more options in how they used their training time. Another common theme facilitator observed was the tools enriched group conversations about case factors, including deeper consideration about the specific roles each factor played, and the credibility of each piece of evidence. The tools also invited collaborative perspective sharing, leading to more contributed perspectives and pooled information. Many facilitators also remarked about the visual nature of the tools and how that was helpful for organizing information and comparing groups of information. The feedback about specific tools follow in Table 2.

Table 2: Summary of Feedback about Specific Tools

EDCC: Valued for giving novices structure to support conceptual understanding. It embedded the traumatic situation within the surrounding ecology in which it was happening. This tool was seen as very easy to incorporate.

Protective Shields: Valued as a tool for helping hold and organize multiple perspectives. Facilitators particularly liked how it helped learners communicate about factors and identify areas where they needed more information. Dividing information into risk versus supportive factors allowed learners to focus more on supporting the child than

they normally would. It was seen as an intuitive way of organizing the information. Two of the facilitators organized the fact collecting in PBL using this tool throughout the whole case.

Seesaw Model: Valued because it slowed down the learning process, forced learners to support their perspectives with evidence, and revealed personal biases. They particularly liked the conversations that came with trying to resolve differences of opinion related to case factors. This tool received some negative feedback, suggesting that time management was difficult with this too. Users reported that many professional decisions cannot be distilled down to dichotomous either/or options, and even seasoned professionals can reach very different conclusions about the same set of factors.

CHECKS/Double Checks: Valued as a framework for formulating a working clinical theory, this tool was used for organizing information and structuring learners' thinking about the roles factors play in traumatic situations. Facilitators who liked this tool applied it regularly and in multiple settings. It became a way of framing the reasoning around a case conceptualization and treatment planning. Users first used it as a communication aid and training tool, and then some expanded their application of the model itself by using it as a clinical supervision tool with their interns. The negative feedback about this tool was that the terminology of the tool needed pre-training, and that the Double Checks Heuristic (which contains 4 more factors) was too complex for beginning audiences.

Tool adoption, dissemination, and implementation

After facilitators had used the tools, they continued to use them. The tools were seen as engaging and especially valued for how they encouraged and facilitated perspective-sharing. They said they got more positive feedback from stakeholders as well. Each facilitator modified the tool use slightly to fit their situations; for example, some made hand-outs of the models for each learner, whereas others used the models with real-life case material in addition to Core Curriculum case studies. They became integrated into our facilitator's professional practice. These facilitators share aspects of their work with each other during our regularly held consultation calls, which is helping to slowly broaden tool use in the advanced facilitator cohort. Based on this feedback, we created a number of new tools to support reasoning in other learning objectives.

We also used facilitator feedback in another cycle of refining the curriculum. Because advanced facilitators judged the EDCC and the Protective Shields to be beneficial for all Core Curriculum learners, we chose to incorporate those two tools into the base curriculum and introduced them at our basic training for new facilitators. In this basic-level training, we were more intentional and direct in clarifying the flexibility that these new options created for facilitators. Introducing these tools at the basic training helped novice facilitators to conceptualize the tools as an integral and foundational part of the curriculum. Consequently, we observed that the novice facilitator cohort had an easier time incorporating the tools into their PBL facilitation than did the advanced facilitators.

The feedback also helped us identify that the Seesaw Model could not be classified as a tool. The Seesaw Model was seen as a useful activity to help learners slow down their thinking, identify biases, and find evidence for beliefs. However, it didn't flow well with the PBL cycle and wasn't something that would be regularly incorporated in a section-by-section case analysis. Instead, we recognized that the Seesaw model falls into a new category of instructional materials: Activities. We have thus started to develop a Core Curriculum activity kit to support our learning objectives. We will design the activities in this toolkit to deepen thinking about case factors outside of the regular 4-step PBL cycle, thereby allowing learners to practice the skill once or twice during the case (such as at critical decision-making junctures as the case unfolds) instead of incorporating the tool into regular section-by-section case processing. The Seesaw Model will become part of the activity kit once it is completed.

Discussion

At the beginning of our work, our needs and constraints analysis revealed a need for better support for learning objectives associated with factor identification, case conceptualization, and critical reasoning. We hypothesized that we could support this learning with heuristic tools to balance cognitive loads during the PBL cycle. The tools we designed would theoretically support this learning by aiding communication about the case, organizing information into conceptual bins, making the information easier to retain, and simplifying the creation of a shared understanding. The feedback from our facilitators supported these hypotheses. Facilitators spoke of

improvements in organization of information, sharing perspectives, and combining information. The tools functioned as hypothesized and in doing so, improved learning outcomes from the curriculum.

In the larger picture, this work supports using an applied cognitive load lens in instructional design. As anticipated, the practice of balancing the cognitive load of the learning task in PBL did improve learning from the curriculum. Facilitators spoke of holding deeper and richer conversations than they had previously had, and of building a deeper shared understanding of the material, than what was previously possible. We propose that mental health professionals require these diverse reasoning skills to handle the complex child trauma cases they encounter in their work. This curriculum invites them to practice that reasoning in a supported situation with low-risk decision making, given the obvious fact that making poor decisions with a fictional child carries far lower risks than making erroneous decisions in real-world cases. The use of the tools during learning aligns with and supports the classification skills and conceptual understandings that are necessary for performing this work in the field.

In terms of increasing the applications of PBL in complex learning, this study supported the methodology, showing that heuristic tools could be used to scaffold learning of complex-problems in a collaborative manner that allowed for perspective sharing and improved reasoning skills. This was engaging curriculum that learners felt was easily applicable to the everyday practices of their professional work.

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Optimizing Learner Experience with Intuitive Asynchronous Online Discussion Design

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Introduction

Social presence is an important metric for assessing learner performance in online learning environment. Asynchronous online discussions provide opportunities for learners to collaborate and socialize with their peers and instructors at their own pace. Brown, Collins, & Duguid (1989) asserted that people learn while interacting with each other through shared activities. But, Hewitt (2005) found that online learners consistently have limited discussion contributions in asynchronous discussions. Many researchers have examined the factors that caused low discussion participation and motivation (Deng & Tavares, 2013; Hew, Cheung, & Ng, 2010; Vonderwell & Zachariah, 2005). Besides learners' personality traits and instructors' pedagogical strategies, technical aspects have been identified as one factor affecting learner experience with asynchronous online discussions.

A good interface design can help learners overcome the technical barriers that may occur while using a system (Metros & Hedberg, 2002). More importantly, a good interface design can positively influence the quality and the quantity of the interactions in an online learning community (Swan, 2004). Discussion platforms are the vehicle for online instructors to represent and conduct learning activities. If the discussion tools that online course designers selected did not meet students' expectations, the activity might result in low participation rate and poor design. Compared to the limited participation in asynchronous online discussions, today's learners spend significant time on social media interactions in their everyday life. The different perceptions with discussions in online classes and social media platforms may due to learners' past experiences (Deng & Tavares, 2013).

Many online learners have learning curves in online learning environments. The anxiety of using new technologies has created unnecessary obstacles to learner performance. Many asynchronous online discussion platforms are based on text. This text-heavy interface design leads to information and cognitive overload to online learners (Vonderwell & Zachariah, 2005). In this research, we examined the Mayer's (2005) 12 principles of multimedia learning to provide design guidelines for online instructors. Therefore, instructors can search for the discussion platforms with the design features that can achieve their learning objectives. From learner perspective, the intuitive design of a user interface can help learners feel less intimidated and use the platform more. Thus, their learning performance can improve.

Given asynchronous discussion activities are the primary means for online learners to interact with each other, it is essential for course designers to understand the nature of the discussion activities that can accomplish the learning objectives. A small body of literature studied learner perceptions of online discussion platforms by using the Technology Acceptance Model (TAM). However, this model only provides general information about technology by users (Liu, Chen, Sun, Wible, & Kuo, 2010). We have studied the design features of three online discussion platforms: Discussion Board (DB) in the Blackboard learning management system (LMS), Piazza, and Yellowdig. By interviewing the online instructors and observing their online asynchronous discussion activities, we

have created an interactive design matrix to help online instructors determine the appropriate types of discussion platforms for their online classes.

The primary focus of this research is to identify the design patterns in designing effective asynchronous online discussions. Architect Christopher Alexander defined *design patterns* as reusable elements for solving recurring problems (Alexander, Ishikawa, & Silverstein, 1977). Design patterns are guidelines rather than prescriptions (Rohse & Anderson, 2006). In our research, the common and most useful design features in the online discussion platforms are identified as the design patterns for selecting asynchronous online discussion platforms. This interactive design matrix is built upon design principles and best practices to reveal the critical design features that fit online instructors' needs for their intended asynchronous discussion activities. These design features can also tell online instructors the grading schemas should be included in their online discussion rubrics.

Learning Experience and Intrinsic Motivation

In this research, we proposed a design model and instrument to help online instructors create intuitive asynchronous discussion activities for learners. Besides the 12 principles of multimedia learning, we also integrated the universal design for learning (UDL) framework to guide our design. UDL has proved its positive influence in students' academic gains and increased engagement (Rao & Meo, 2016). This framework focuses on the reduction of barriers in learning environment to create more inclusive classes for all learners (Al-Azawei, Serenelli, & Lundqvist, 2016). The traditional TAM mainly focuses on users' perceptions on the usability of systems, which is not suitable for online learning contexts, as online learning involves hedonic aspects of human-computer interactions. Beyond the perceived usefulness and ease of use, a hedonic-motivation system adoption model (HMSAM) added "cognitive absorption" (CA) as a new factor impacting users' behavioral intention to use the system (Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013). The sub-constructs in CA were built upon the flow theory and intrinsic motivation. The finalized HMSAM revealed that users' perceived use of ease affected their behavioral intentions to use a system through the mediation of perceived usefulness, curiosity, and joy (Lowry et al., 2013).

Similarly, Jordan (2000) categorized the evaluation of a product design into three levels (from low to high): 1- functionality, 2 – usability, and 3 – pleasure. This model suggests that beyond designing functional and effective products, the design of product should also bring pleasure to users. Pleasure refers to the satisfaction with the use of the product that users can emotionally relate to their real lives (Jordan, 2000). Some online discussion platforms have integrated the social and gaming mechanics in social network sites (SNSs), e.g., Facebook, Instagram, and Twitter, to their interface design (i.e., emoji, hashtag, leaderboard, likes, etc.), as many of online learners have used at least one SNS in their everyday life. Ryan and Deci (2000) asserted that intrinsic motivation leads to high-quality learning. Given that intrinsic motivation lies in people's innate needs for competence, autonomy, and relatedness (Ryan & Deci, 2000), the similarities of the interface design between the technology tools used in online courses and learners' daily life can trigger online learners' intrinsic motivation. Hence, authentic asynchronous online discussions can effectively engage online learners.

In the design and development process of asynchronous online discussions, instructors are also the stakeholders. By understanding the importance of pleasure in learning and self-determination theory (SDT), online instructors can create meaningful and engaging learning activities for learners. Moreover, online instructors need to monitor learner performance in discussion platforms to steer class discussions in the right direction. The discussion platforms they select must align with the HMSAM, which means that online instructors implement the platform with high intrinsic motivation. Compared to face-to-face classes, online instructors lack means for building connections with their students and understand their learners' needs in a timely manner. If the selected online discussion platforms have built-in learning analytical mechanics, they will bring pleasure to online instructors. Therefore, online instructors can provide efficient feedback with their learners. The selection of an appropriate asynchronous online discussion platform should take the needs from both learners and instructors into consideration.

Asynchronous Online Discussion Platforms and Themes

Online instructors constantly face guideline dilemma in asynchronous online discussions, i.e., use of grades, use of number of posting guidelines, and instructor-facilitation (Hew et al., 2010). Our university has integrated three asynchronous discussion platforms in the Blackboard LMS. We have collaborated with university faculty members to design online and blended courses. Each of the discussion platforms can represent a distinctive need for asynchronous online discussions. From the conversations with the instructors and the observations of their online discussion activities, we have found different discussion themes as needed by the instructors on the three online discussion platforms.

1. LMS Built-in Discussion Platform

Blackboard Discussion Board (DB) allows instructors to create independent discussion forums (see Figure 1). Instructor can differentiate the activity requirements and grading schemas based on independent discussion forums. The interface design for learner interactions on DB is not quite intuitive, as it requires multiple steps for instructors and learners to view each student's post. Instructors can only view the overall number of students' posts in each discussion forum, while manually track conversation flows and the quality of their students' posts. Instructors prefer to use this platform when they focus on content assessment, as well as need flexibility in grading different discussion forums.

The screenshot displays the Blackboard Discussion Board interface. At the top, there is a table listing discussion forums with columns for Forum, Description, Total Posts, Unread Posts, Replies To Me, and Total Participants. Below this, a detailed view of a forum titled "Forum: Week 2 Discussion Forum" is shown. This view includes a "Discussion prompts" section with numbered tasks and a "Forum view" section showing a list of student posts with columns for Date, Thread, Author, Status, Unread Posts, Replies To Me, and Total Posts. Red circles and arrows highlight specific elements: "Discussion forums" points to the forum list, "Discussion prompts" points to the task list, "Forum: Week 2 Discussion Forum" points to the forum title, and "Student Posts" points to the list of posts.

Figure 1. An example of Discussion Board in the Blackboard LMS for asynchronous online discussions

This discussion platform is suitable for end-of-chapter questions, as the purpose of this type of discussions is to assess each individual student's understanding of the assigned topics. The focus is not on student interaction but on content comprehension. Rather than providing students' opportunities for submitting individual reflections, a class discussion forum can help learners compare themselves with peers to check their understandings of the content.

This type of discussion activity can enhance active learning, as each student can share coaching and scaffolding information with peers. Learners can improve their communication skills and deep thinking skills through active learning (Prince, 2004). Moreover, knowledge acquisition shifts from instructor-to-student to student-to-student delivery. We recommend online instructors to use these self-checking discussion forums as low-stake activities, as each online learner needs a process to disclose and polish their thoughts. Online instructors can turn on "participate before seeing others' posts" function to give every student an opportunity to process and digest the learning content before seeing others' opinions.

2. Collaborative Learning Community

Piazza is a wiki-style Q&A collaborative platform. Instructors can create discussion forums as separate folders in Piazza (see Figure 2). Learners can view most recent class interactions on the main dashboard without going into the specific forum. Unread posts, peers' feedback, and instructor's posts have different colored icons. The average answering time for a question and the class contribution leaderboards are available to the instructor and the learners. Many STEM instructors use Piazza to promote student collaboration, as students form a learning community when the instructor clearly sets up the discussion rubric beforehand.

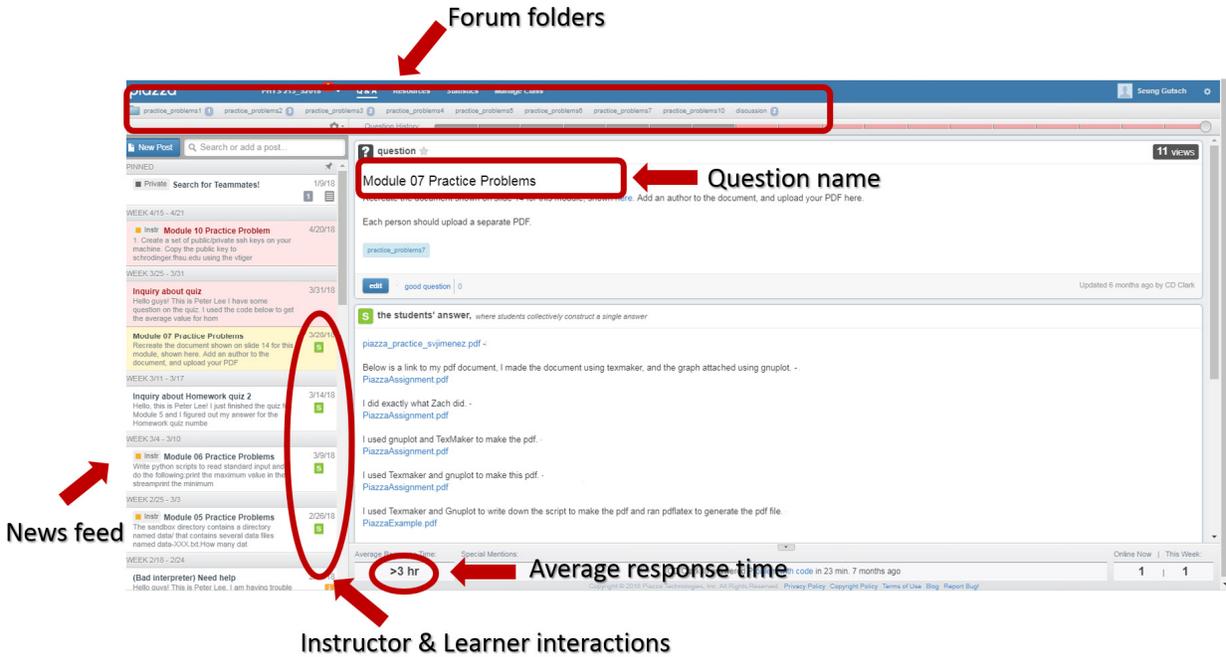


Figure 2. An example of Piazza for asynchronous online discussions

This type of discussion platform is suitable for learners to contribute answers and solutions to their peers' questions. This type of discussion activities should be problem-solving oriented, as well as student autonomous discussions. The discussion purpose should not focus on the quality of each question but the quantity of contributions to peers' confusions. We recommend instructors to use this type of discussion platform for extra points or no points for learners, as students should not be penalized if they do not have questions or not have time to answer peers' questions.

This discussion platform can help instructors identify the students who constantly struggle with the course content, as well as the proactive learners. Additionally, instructors can also find the concepts or homework that many students have issues. According to the UDL principles, instructors need to provide multiple means of representation for learners (CAST, 2018). Instructors can clarify the language and/or equations to scaffold online learners more effectively.

3. Social Learning Platform

Yellowdig is an online social learning platform with an interface like the SNSs. Learners can earn experience points (XPs) by posting, commenting, and like their peers' posts. Each student can monitor their individual performance such as the quality of posts, class influence, and class popularity on the discussion platform dashboard. Yellowdig also has a built-in grading rubric assigning XPs by using the minimum word numbers of students' posts and comments, which saves online instructors efforts in grading students' works. The instructors we have interviewed indicated the quality and quantity of students' posts in Yellowdig increased more than 50% compared to other online discussion platforms. Some instructors suggested Yellowdig was more suitable for augmenting in-class participations as in face-to-face classrooms rather than presenting "APA-styled formal reflections." We found most instructors had a learning curve when they were firstly introduced to Yellowdig. However, many instructors felt their efforts were paid off after seeing student interactions significantly improve in their online classes.

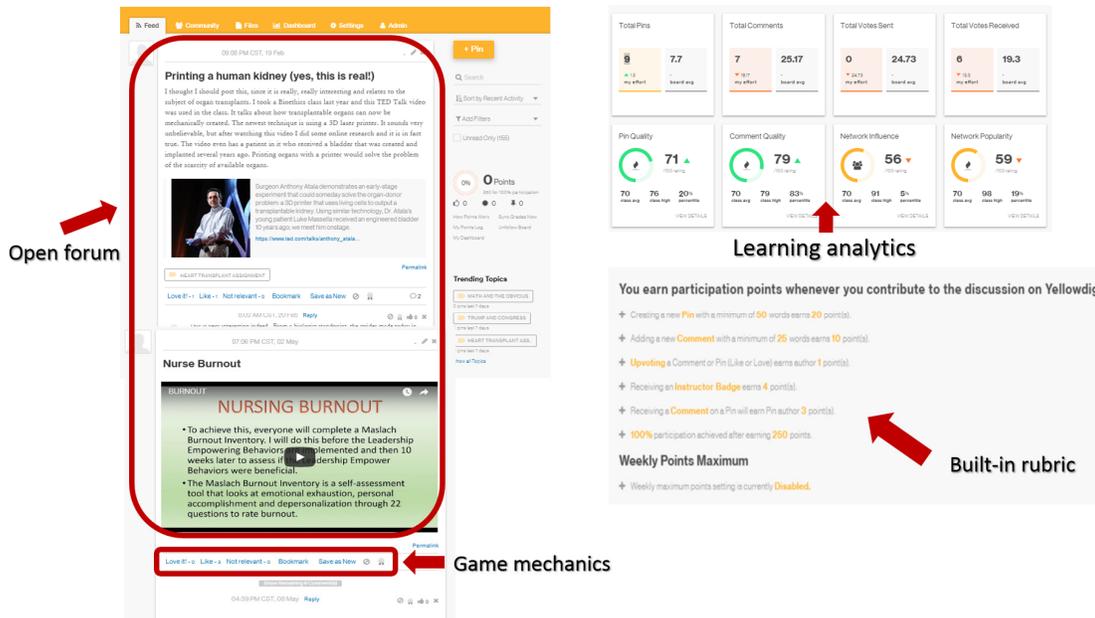


Figure 3. An example of Yellowdig for asynchronous online discussions

In the 2017 research report of ECAR study of undergraduate students and information technology, 42% undergraduate students rated social media as one of the tools that “wish instructors used LESS” in classes (Brooks & Pomerantz, 2017). Despite the popularity of social media tools being used in students’ everyday life, they do not feel comfortable to use personal social media accounts for academic works. This resistance of using social media tools in academic contexts provides opportunities for Yellowdig this type of discussion platforms, as they use the mechanics in social media platforms but adapt them into educational contexts. With the seamless integration into the LMS, learners do not need to register new user accounts with these platforms or worry if their personal life could be exposed to academic settings.

This type of discussion platforms is suitable for class participation, which allows students to share outside classroom resources with peers. The layout of the discussion platform can promote learners to create a knowledge base for the entire class and utilize the shared resources in their future studies. Online students are encouraged to view and comment on peers’ posts, which can record participation points for students. However, the participation points that students accumulate in a social discussion platform should not be regarded as grades. Every student wants to earn 100% in a grade, but their final grades can be affected by their deficiencies in certain rubric criteria. On the other hand, every student can earn 100% class participation points in a social discussion platform as the 100% participation is a baseline for learners to achieve, as long as they fulfill the minimum requirements, every student can be an “A” student in an online social discussion platform. The participation points also encourage students to contribute more to classes, as well as reduce online instructors’ workload in monitoring and grading student discussions.

4. Design Patterns in the Discussion Platforms

Besides the discussion themes we observed on the three types of asynchronous online discussion platforms, we compared the design features that the discussion platforms have, along with the built-in learning analytical mechanics they have. The design patterns used in the discussion platforms help us generate the design guidelines that online instructors can follow when they create discussion activities (See Table 1).

Table 1. Comparisons of Design Features in the Discussion Platforms

Platform	Comments	Forums	Hashtag	Badge	Leader-board	Posts	Subscription	Upvotes*
DB in Blackboard	X	X				X	X	X
Piazza	X	X		X	X	X	X	X
Yellowdig	X		X	X	X	X	X	X

Note. *For example, likes, endorsements, and ratings.

Although some design features are common, their uses are varied. For example, students can subscribe to the discussion forums and posts in DB, but online instructors need to turn on and/or off that functionality in advance. Students have no options to make decisions. In contrast, both Piazza and Yellowdig can send push notifications to online learners unless learners unsubscribe the class discussion forums. Another example is the “upvotes” feature in the three platforms. In Blackboard, only instructors can decide whether to use this feature, whereas in Piazza and Yellowdig, the setting of this design feature is by default. Students can opt to not like or endorse others’ posts, but they will see the availability of this design feature. Additionally, instructors can change the points associated with “upvotes” in Yellowdig.

We also examined the learning analytical mechanics in the three discussion platforms (See Table 2). Yellowdig has implemented all analytical mechanics and operate them automatically. In its dashboard, online instructors can view a summary of each learner’s behaviors. From learner perspective, they can view the total points they have accumulated in Yellowdig. Yellowdig automatically assigns participation points to learners once they reach the minimum words of posts and comments. The author of a post and a comment will also earn points if other students upvoted their inputs. Moreover, online instructors can assign instructor badges or revoke points from online learners.

Table 2. *Built-in Analytical Tools in the Discussion Platforms*

Discussion Platform	Counts of Comments	Counts of Posts	Counts of Visits	Points	Rubric	Time Investment
DB in Blackboard		X	X	X	X	X
Piazza	X	X	X			X
Yellowdig	X	X	X	X	X	X

DB in Blackboard has the second most analytical mechanics. However, it does not have an “all-in-one” dashboard to view student performance. Instructors can download class reporting to track student performance, such as numbers of views in each discussion forum, total counts of posts and comments in each discussion forum. Besides, online instructors need to go to grading center to manually assign grades to each student posts and comments. If instructors decide to use rubrics to grade student performance, they need to manually create criteria and level of achievements to embed rubrics into each discussion forum. This process usually costs a considerably large amount of workload for online instructors. This process also reinforces instructors to focus on the instructor-to-student delivery mode rather than a student-centric learning approach.

Piazza does not implement every analytical mechanic to its platform due to the purpose of the use of this asynchronous discussion platform. Piazza is designated for class discussions of problem solutions, so the platform only records the number counts of online students’ questions and contributions. The grade book in Piazza is not integrated to LMS. Instructors can manually export the class report and insert them to the grade book in LMS.

Design Frameworks

Through the discussion themes and the use of design patterns in these asynchronous online discussion platforms, we aim to help online instructors identify the most suitable platform type for their discussion activities. We tie the principles and guidelines for discussion activity design with the specific design patterns that online instructors can implement into the discussion activities and learner assessment. We also identify the challenges that we could face in the design process. Although the advancement in technology has significantly influenced industries, its impacts in higher education are moderate, as many stakeholders have taken part in the process of new technology integration. If not being mandated by the institution, instructors create learning activities based on their teaching preferences. Specifically, they might choose different online discussion platforms for similar discussion activities due to their different comfort levels with technologies. However, each online discussion platform has its pros and cons; it is online instructors’ selected activity type and organization that affect learning effectiveness.

Herrington (2006) posited that as many universities use LMSs to deliver online courses, instructors tend to focus more on information delivery through the use of a LMS than create meaningful activities for substantive learning. In this research, we created an interactive matrix to help online instructors identify the discussion platforms that most suitable for their desired learning activities and desired learning outcomes. We used the 12 principles of multimedia learning by Richard Mayer (2005) and the UDL framework by CAST (2018) to guide the design patterns that should be included in discussion activity design. We distinguished these two theories by emphasizing them on different aspects of creating asynchronous online discussion experience for learners. Multimedia learning

principles focus on the use of multimedia in discussion activities, whereas UDL principles focus on the narrative of discussion instructions. We examined the aspects that multimedia learning and UDL principles cover and overlap as shown in Table 3. We mapped these design guidelines with each discussion platform, which display in the interactive design matrix we developed in this research as a result for instructors' intended discussion activities (See Appendix 1).

Table 3. *Comparisons between Multimedia Learning Principles and UDL Guidelines*

Design Theory	Content	Organization	Representation
12 Multimedia Learning Principles	Conversational than formal (10)	Highlighted cues (2); User-paced segments (6); Clarify and decode symbols and text (7)	Graphic and narration (3, 5, 8, 9); Corresponding words and pictures are presented near (4); No extraneous words, pictures, and sounds (1)
9 UDL Guidelines	Alternatives for auditory or visual information (1); Background Knowledge (3.1)	Highlighted cues (3.2); Clarify and decode symbols and text (2)	Graphic and narration (1.1, 5.1)

Note. The numbers in this table are the principles or guideline numbers in the respective learning theory.

Additionally, we followed 4 Maximums of Grice's Cooperative Principles (1975): *quantity*, *quality*, *relevance*, and *manner* to group the essential discussion metrics that instructors can emphasize in evaluating their online discussion activities. After observing the analytical mechanics in the discussion platforms and instructors' feedback, we added a new discussion metric *time investment* to the analytical mechanics can be used in online discussions (See Table 4). Many studies have shown that the amount of time students actively spent on tasks can affect their success in learning (Carroll, 1963; Lee, 2018; Wellman & Marcinkiewicz, 2004). The LMS and the asynchronous online discussion platforms have log files for time-on-task of students. Online instructors can visualize students' frequencies of time-on-tasks in Piazza and Yellowdig; whereas they can export a class report from the LMS to analyze students' frequency logs in DB. Adding time investment to the grading schemas for a discussion rubric can provide more information and perspective for online instructors to evaluate their student performance. The interactive design matrix we developed in this research displays key grading schemas for online instructors' selected discussion activities (See Appendix 2).

Table 4. *Essential Discussion Metrics in Online Asynchronous Discussions*

Design Guidelines	Content	Expression	Engagement
4 Maxims of Communication	Provable by adequate evidence; Relevant to the discussion topic	Informative as required, no more or less; Direct without ambiguity	
Time Investment			Time spent in the learning community
UDL Guidelines			Multiple media for communication (5.1); Multiple tools for construction and composition (5.2)

Interactive Design Matrix for Online Discussion Activities

This section introduces the development process of the interactive design matrix. We used PHP and JavaScript to create an online self-report survey for instructors to complete (See Appendix 1). Upon completion, this online survey generates a list of design guidelines and the suitable discussion platforms for instructors' target students and discussion activities. Figure 4 shows the design model of our project. In our online instrument,

instructors will provide information on their target *students' characteristics, types of discussion activities, instructor's technology skills, and needs for learner's real-time data*. Instructors will select answers in the format of multiple choices and Likert Scale questions. Based upon the responses to the survey questions, instructors will see a list of design guidelines that they can follow to build discussion activities, as well as a sample discussion rubric that can measure their desired learning objectives of discussion activities. We have included the design rationale for each survey question in the following section.

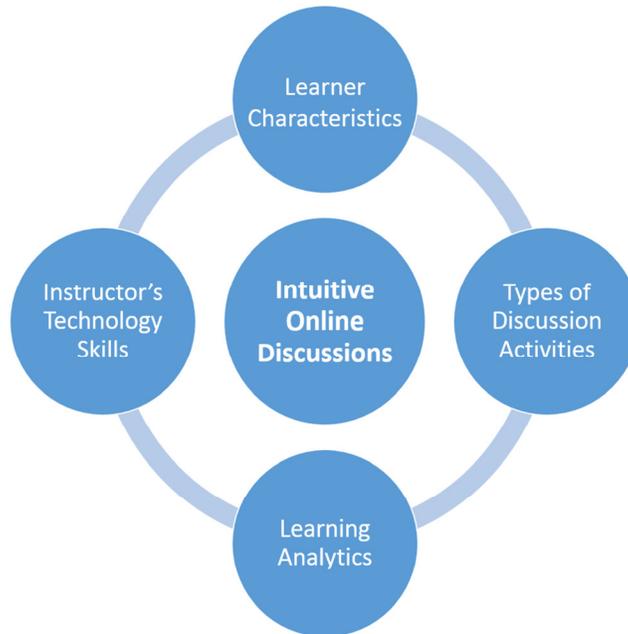


Figure 4. The design model of creating intuitive online discussions

1. Target student population

Among the three types of discussion platforms, social learning platform is the most advanced platform for instructors to adopt. Depending on the student characteristics, traditional undergraduate students do not have limitations to any discussion platform if the discussion activities are meaningful. Graduate students tend to have higher motivation and needs for collaboration and in-depth discussions. Therefore, social learning platform is most suitable for them. For a mixed student population or non-traditional students, we recommend online instructors to use the LMS built-in discussion platform to conduct discussion activities, as these students tend to have longer learning curves.

2. Motivations for Conducting Discussions

We categorized instructors' motivation for conducting asynchronous online discussions into three types. If the instructor plans to assess student understandings of the class concepts, they can conduct asynchronous discussions on any platform. If they plan to create a learning community to promote knowledge building, an open collaborative platform will suit their needs. If the instructor plans to provide opportunities for students to interact with each other, such as self-introduction prior to small group projects, a social learning platform will be an ideal interface for students to conduct this type of discussions. In addition, we have encountered some instructors implemented asynchronous discussions to their online courses only because it is a mandatory requirement from their departments or colleges. If this is the case, then a LMS built-in discussion platform can be an easy solution.

This survey question also affects the grading schemas in discussion rubrics. If the instructor focuses on the content and institutional requirements, then *quality* and *relation* are the two major grading schemas should be included in the rubric. If the instructor emphasizes the development of a learning community or student interactions, then *quantity* and *time investment* would be the two grading schemas in the rubric. Besides, in a learning community, the *relation* of discussion posts also matters; while in student interactions, *manner* should be taken into consideration.

3. Current Problems in Online Discussions

Instructors will indicate their primary concerns for their current asynchronous discussion activities. The aspects could be lack of interactions, lack of engagement, and lack of collaborations. Instructors can select all problems relevant to their current online discussions. If the instructor indicated that students lack interactions in current online classes, a social learning platform can help solve this problem. If the instructor considered student lack collaborations in the current online classes, an open collaborative discussion platform will be a good solution for this scenario. If the instructor indicated that the students lack engagement in online discussions, no specific discussion platform would significantly reverse this problem. But, instructors can follow the design guidelines we provide to refine their discussion instructions and activities.

4. Types of Discussion Activities

We identified five types of asynchronous online discussions. If the instructor decides to have students respond to a set of end-of-chapter questions, they can use the LMS built-in discussion platform. If the instructor wants online students to discuss homework or promote higher-order thinking skills, i.e., debating and critiquing, they can use open collaborative discussion platform. If the instructor wants students to share out-of-class resources and contribute to open-ended questions, they can use a social learning platform to achieve their discussion goals. Or if the instructor wants to provide a platform for online learners to share group projects, they can use any of the three discussion platforms to conduct this type of discussion activity.

The types of discussion activities influence the grading schemas in the rubric. For end-of-chapter reading discussions and group assignment sharing, *quality* and *relation* are the main foci in the rubric. For homework Q&A and higher-order thinking skills, *quantity* and *time investment* are the primary schemas in grading rubrics. If assessing student contributions to class participations, *quantity*, *manner*, and *time investment* are the suggested grading schemas in a rubric.

5. Grading Schemas

We also asked respondents for the grading schemas that they value the most. Respondents can choose from “quality of content”, “quality of interaction”, “numbers of contributions”, and “time investment” to reinforce the aspects that they want to assess learners. Each choice is mapped with one or more design metrics in learner evaluation. For example, if the instructor valued “quality of interaction” the most, then *quality*, *manner*, and *relation* will add more weights in the discussion rubric generated for the instructor once they complete the survey.

6. Technology Integration Skills

This Likert Scale survey question has a list of statements investigating instructors’ attitudes towards technology integration in teaching. Instructors will rate from 5-agree to 1-disagree for each statement to indicate their openness to technology integration. These technology integration questions are adapted from a free technology survey template in QuestionPro (<https://labs.questionpro.com/a/q/questionpro--technology-survey-5543460>). Respondents’ attitude towards each statement will add or subtract points they can earn for the openness to technology. The total points they have earned in this question are the indicators to low, intermediate, and high technology skills. LMS built-in discussion platforms requires low technology skills; open collaborative discussion platform needs intermediate technology skills; social learning platforms require instructors to have high technology skills and strong motivations. Additionally, if the instructor has equal scores for two and more discussion platforms, their points earned for this survey question will overrule the result. Since instructors will be the one that operate and manage online discussions, they need to feel comfortable about the platforms that discussions take place.

7. “Must-Have” Features in Online Discussion Platforms

This Likert Scale survey question is to investigate instructors’ needs for the features that they would like to see in online discussion platforms. This question consists of 5 statements, which are summarized upon the interviews we had with the instructors. Depending on the agreement levels (Agree, Somewhat Agree, Neutral, Somewhat Disagree, Disagree) the instructors rated, these statements indicate instructors’ preferences for different types of discussion platforms. Meanwhile, some statements also indicate the grading schemas that instructors want to use in the discussion rubric.

Figure 5 is a screenshot of a sample discussion platform and design guidelines that the online survey generates upon instructor completion. The bullet points are the key design guidelines that instructors can follow when they create the discussion activities on the suggested discussion platform. In addition, participating instructors also receives a sample rubric with weighted grading schemas that are related to their discussion activities. The instructors' choices for each survey question as shown in Appendix 3 add scores to a specific type of discussion platform and/or grading schemas to their discussion activities.

1. Which one is the best description of your students?

- Traditional undergraduate students
- Graduate students
- Non-traditional college students
- Mix of student population

2. Why do you want to have discussion activities in this online class?

- Assess student understandings of the class concepts
- Create a learning community to promote knowledge building
- Provide opportunities for students to interact with each other
- My institute's requirements

3. What are the problems in your current online class? (Please select all that apply)

- Lack of student interactions
- Lack of student engagement
- Lack of collaboration

7.	Question	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
a	It is important for me to know how long students spend on their discussion activities.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b	My online students should have multiple means to provide feedback to their peers. [Ex. Text comments, upvoting, voice comment, etc.]	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
c	It is important for my online students to view their peers' level of engagement. [Ex: numbers of posts and comments, time spent in total, offline or online status]	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d	It is important for my online students to have mobile apps.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
e	I like being able to intervene student participation in discussions.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

✔ Submit
🔄 Reset

Recommended Discussion Platform

- You might consider using the **built-in discussion board tool** within the learning management system for this online class.
- When you write the discussion prompt for each discussion topic, please consider using **words and pictures**. If you decide to include any video clip to the discussion prompt, please make sure that the video clip is closed captioned.
- Please keep your discussion prompt conversational than formal. Your students will learn better from **graphics and narrations** than from animation and on-screen text.
- If your discussion prompt is longer than 3 sentences and including multiple tasks, please **segment the information** with bullet points or highlighted cues.

Figure 5. A screenshot of the interactive design matrix for online discussion activities

Future Steps

We have demonstrated this tool to a small group of audience at our university. We will integrate this instrument to the online course development process in our department. Therefore, we can 1) better assist the faculty members to select and create intuitive asynchronous discussion activities; 2) evaluate the effectiveness of this instrument. We will add more background information questions to the instrument for us to collect data such as different academic disciplines and instructor demographic background.

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Appendix 1: Design Guidelines for Each Type of Asynchronous Online Discussion Platform

Recommended Discussion Platform	Discussion Prompt Guidelines
LMS built-in discussion tool	When you write the discussion prompt for each discussion topic, please consider using words and pictures . If you decide to include any video clip to the discussion prompt, please make sure that the video clip is closed captioned.
Open collaborative discussion platform (e.g., Google Community, PBWorks, and Piazza)	Please keep your discussion prompt conversational than formal. Your students will learn better from graphics and narrations than from animation and on-screen text. If your discussion prompt is longer than 3 sentences and including multiple tasks, please segment the information with bullet points or highlighted cues.
Social learning discussion platform (e.g., Facebook, Twitter, and Yellowdig)	If you include online resources (web links, pictures, audio files, etc.) in the discussion prompt, please write a short blurb to clarify the resources .

Appendix 2: A Complete Rubric for Assessing Asynchronous Online Discussions

Criteria	Wow (4 points)	Good (3 points)	Average (2 points)	Poor (1 point)
Quality of Post (20%)	Provide adequate evidence; Very informative as required	Provide superficial evidence; Somewhat informative	Provide inadequate evidence; Missing information	Show minimum effort to write a post
Relevance of Post (20%)	Relevant to the discussion topic; Integrating outside resources and cite appropriately	Somewhat relevant to the discussion topic; Provide some supportive documents	Somewhat relevant to the discussion topic; No supportive document	Post topics do not relate to the discussion content
Contribution to the Learning Community (20%)	Prompt responses to peer posts; Focused argument with supportive information; Developing further discussion by building on peer posts	Prompt responses to peer posts; Somewhat focused argument; Frequently contribute to ongoing conversations	Frequently not responding to peer posts; Sometimes contribute to ongoing conversations	Show minimum effort to write a response (e.g., “I agree with John”, “thank you for sharing”)
Etiquette (20%)	Discussion interactions are polite and to the point; Show respect and sensitivity to peers’ backgrounds	Discussion interactions sometimes are excessively long and show no sensitivity to others’ perspectives; Show respect and sensitivity to peers’ backgrounds	Discussion interactions are ambiguous; Show little respect or sensitivity to peers’ backgrounds	Show no respect or sensitivity to peers’ backgrounds
Engagement (20%)	Frequently view peers’ posts; Respond to diverse peers’ posts; Present creative approaches to the topic	Read most peers’ posts; Attempt to respond to different peers’ posts; Present traditional approach to the topic	Do not read peer posts; Respond to few peers’ posts; Do not spend time in providing high quality contribution in discussion	Show minimum effort to participate in discussions

Appendix 3: Interactive Design Matrix for Asynchronous Online Discussions

1. Which one is the best description of your students?
 - Traditional undergraduate students
 - Graduate students
 - Non-traditional college students
 - Mix of student population

2. Why do you want to have discussion activities in this online class?
 - Assess student understandings of the class concepts
 - Create a learning community to promote knowledge building
 - Provide opportunities for students to interact with each other
 - My institute's requirements

3. What are the problems in your current online class? (Please select all that apply)
 - Lack of student interactions
 - Lack of student engagement
 - Lack of collaboration
 - Not applicable

4. What type of discussion activities do you plan to use for this online class? (Please select all that apply)
 - End of chapter reading discussion
 - Class participation (e.g., open-ended questions, sharing resources)
 - Homework Q&A
 - Group assignment/project sharing and commenting
 - Promote higher-order thinking skills (e.g., debate, critique and analyze topics)

5. Which grading scheme do you value the most when evaluating students' discussions in this class?
 - Quality of content
 - Quality of interaction
 - Numbers of contribution (e.g., posting and commenting)
 - The time that students spend on the discussion platform (including reading posts and writing comments)

6. Please select the answer that most accurately describes your feelings about using technology (5-agree, 4-somewhat agree, 3-neutral, 2-somewhat disagree, 1-disagree)
 - I feel confident in my ability to integrate multiple technologies into my instruction.
 - I have a good variety of ideas and lessons for integrating technology into my teaching.
 - The amount of time needed to prepare technology-based lessons deters me from creating them.
 - I believe that integrating technology into my curriculum is important for student success.
 - I am aware of the resources available by my institution that can help me learn how to integrate technology.
 - I do not have the technology skills to support the students when they use technology for a project.

7. Please select the answer that most accurately describes your feelings about using a discussion platform (5-agree, 4-somewhat agree, 3-neutral, 2-somewhat disagree, 1-disagree)
 - It is important for me to know how long students spend on their discussion activities
 - My online students should have multiple means to provide feedback to their peers [Ex. Text comments, upvoting, voice comment, etc.]
 - It is important for my online students to view their peers' level of engagement [Ex: numbers of posts and comments, time spent in total, offline or online status]
 - It is important for my online students to have mobile apps
 - I like being able to intervene student participation in discussions

Developing Preservice Teachers' Technology-Integrated Design: Comparing a Problem-Centered Approach in Face-to-Face and Flipped Courses

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Abstract

Researchers have noted the critical need for developing teachers as designers, especially as it relates to designing purposeful instruction with technology. This study applied a problem-centered approach based on the First Principles of Instruction. The course's goal was to develop preservice teachers' application of TPACK when designing technology-integrated lessons. Using an embedded, quasi-experimental design to compare TPACK-application outcomes between face-to-face and flipped course implementations, preservice teachers' growth was shown to be statistically significant in both the face-to-face and flipped course sections but not statistically different between sections. Additionally, a descriptive phenomenological analyses of preservice teachers' experiences with the problem-centered principle provided additional explanations of these quantitative outcomes and offered insights for future problem-centered design.

Introduction

The terms instruction and teaching have been defined similarly by leaders in teacher education (TED) and instructional design and technology (IDT) (Elen, 2013). IDT leaders have defined instruction as "anything that is done purposefully to facilitate learning (Reigeluth & Carr-Chellman, 2009, p. 6)" while TED leaders have defined teaching as "the deliberate activity of increasing the probability that students will develop robust skill in and knowledge of the subject under study and coordinated within larger education aims (Ball & Forzani, 2009, p. 503)." Given the similar intents of these terms in their respective disciplines (i.e. facilitating learning and increasing students' skill and knowledge) and their comparable methods (anything purposeful and deliberate activity), there has been great interest in developing teachers design thinking (Harris & Hofer, 2009; Koehler & Mishra, 2005). More recent research projects further exemplify the synergy as researchers have been interested in improving technology enhanced learning environments by engaging teachers' in participatory design (Cober, Tan, Slotta, So, & Könings, 2015) and have also been examining how teachers can enhance their teaching by using instructional design processes for planning, designing activities, and selecting media (Carr-Chellman, 2016).

Countering the development for teachers as designers are questions of necessity and purpose. Should and why do teachers need to be designers? One may argue that given most teachers' time constraints, potentially limited expertise in instructional design, and likely few incentives for designing, engaging in design is not an advantageous endeavor (Kirschner, 2015). This argument is built upon the costs outweighing the benefits; the cost of teachers doing the work, the cost of developing their design thinking, and the cost of incentivizing these efforts. However, these concerns may be countered simply by the fact that teachers already are acting as designers (McKenney, Kali, Markauskaite, & Voogt, 2015). They are designers due to necessity and expectation. Institutional structures often need teachers to design and expect them to customize cookie cutter resources to meet the needs of their learners, their objectives, and their environment. Teachers also create and modify digital resources as an epiphenomenon of emergent technology adoptions by school districts. Especially for commercial digital tools not specifically developed for educational environments, teachers need to design for purposeful integration of the technology (Laurillard, 2012; Svihla, Reeve, Sagy, & Kali, 2015). Additionally, the push for deeper student learning has cast a fresh vision for the role of teachers; a vision that expects them to design powerful learning experiences (Martinez, McGrath, & Foster, 2016). The need and expectations for teachers to act as designers, however, does not negate the costs Kirschner listed (2015), but developing teachers' design practices and thinking may increase the benefits, potentially decrease the cost, and thereby constitute a valuable area of research.

Purpose

This study seeks to examine a problem-centered approach to developing preservice teachers' design of technology-integrated lessons and resources. Further, this study will compare the impacts of the problem-centered approach when used in comparable face-to-face (F2F) and flipped course sections. Both course sections were designed according to the First Principles of Instruction (FPI), and both course's learning outcomes were based upon the technological, pedagogical, content, knowledge (TPACK) framework (Koehler & Mishra, 2009; Merrill, 2002). While the broader mixed methods study also examined preservice teachers' perceptions of their TPACK and learning experiences related to the entire FPI model, the next sections focus on explaining how participants interacted with the problem-centered principle of instruction as a means of informing the TPACK application outcomes. The research questions are the following:

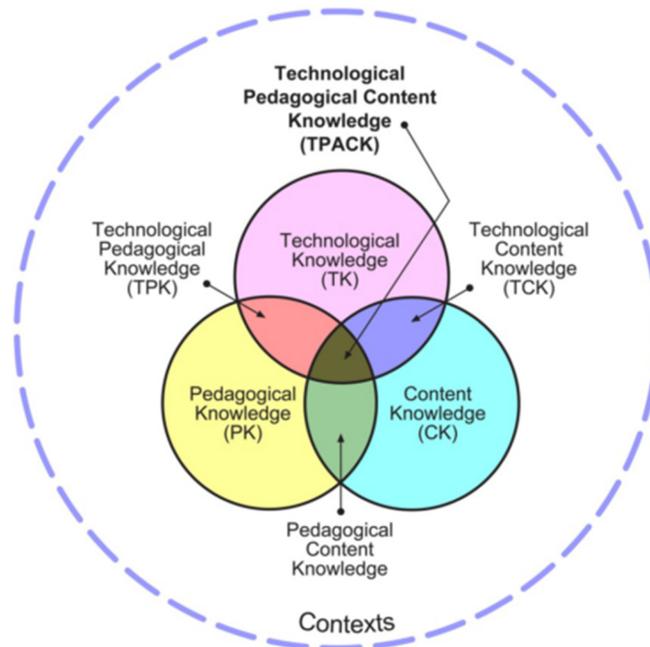
- How do preservice teachers' application of TPACK to technology-integrated lessons compare between flipped and F2F sections of a course designed according to the FPI?
- How do the preservice experiences with FPI's problem-centered principle explain their application of TPACK?

Perspectives

TPACK

The technological, pedagogical, content knowledge (TPACK) framework has significantly impacted technology-integrated design and preservice teacher development. As of 2014, over six hundred articles had been published based on TPACK, and over one hundred forty instruments had been devised to measure its constructs (Koehler, Mishra, Kereluik, Shin, & Graham, 2014). Scholars have applied the TPACK framework to reimagining practice in K-12 and higher education (Chai, Koh, & Tsai, 2013) and to reforming methods for developing preservice teachers (Lee & Kim, 2014). Prior to TPACK, similar frameworks for technology integration knowledge had been discussed (Angeli, Valanides, & Christodoulou, 2016). First introduced as TPCK, Mishra and Koehler (2008) changed TPCK to TPACK to emphasize the Total PACKage of knowledge needed for teachers to effectively design curriculum and instruction with technology.

Figure 1
TPACK Framework



Note. Reprinted from "What is Technological Pedagogical Content Knowledge", by Koehler, M., & Mishra, P., 2009, *Contemporary Issues in Technology and Teacher Education*, 9(1), p. 63.

Extending Shulman's PCK framework from three to seven domains of knowledge, TPACK is composed of three overlapping circles that represent three distinct domains (TK, PK, and CK). As illustrated by Figure 1, four hybrid domains (TPK, TCK, PCK, and TPACK) are formed from the overlapping circles. Technological knowledge (TK) refers to the knowledge of how to use software, hardware, and associated technologies. Pedagogical knowledge (PK) encompasses the knowledge of learning theories, instructional methods, and assessment (Chai et al., 2013). Content knowledge (CK) is the knowledge one has of a subject matter. The hybrid domains, consequently, transform isolated knowledge areas to create new forms of knowledge. As one example, technological content knowledge (TCK), is the knowledge of how to leverage technologies to research and create content within a subject area but does not consider knowledge for teaching. TPACK application, the course's goal in this study, is the ability to select and integrate various technologies that facilitate instructional methods within a specific content area.

First Principles of Instruction

A problem-centered approach, based on the First Principles of Instruction (FPI), framed the design and implementation of this course. Merrill (2002) contends that applying FPI's problem-centered principles of activation, demonstration, application, and integration will improve instruction's efficiency, effectiveness, and engagement. The assumptions are that learning will be promoted when learner's prior knowledge is activated, or they are given opportunities to build this knowledge with new experiences. Learning will be promoted when new knowledge is demonstrated to the learners, and when learners apply this knowledge to varied problems and integrate it within their everyday experiences. All these phases are more effective when situated and connected within authentic and complex problems. Although the course in this study applied all components of the FPI, this paper focuses on the problem-centered principle, its corollaries, and learners' related experiences and learning outcomes.

In this study, the problem-centered principle engaged preservice teachers in solving an authentic and relevant problem through the iterative design of increasingly complex, technology-integrated, lesson plans and digital artifacts. The design problem, a technology-integrated lesson with supporting digital resources, was divided into five distinct phases. The number of phases was based partly on contextual factors such as the number of class meetings, but it was also related to components of a conventional lesson in childhood and early childhood education. The design phases were (1) analyzing the context, (2) selecting and aligning content and technology standards, (3) crafting learning objectives, (4) designing learning activities, and (5) creating assessments.

Per the FPI's *show task* and *problem progression* corollaries, each instructional module focused on a technology tool and a specific phase or component skill of the whole problem. The show task corollary posits that learners should be shown what problem or task they will be able to complete as a result of the instruction. Therefore, following instruction on the module's new component skill, an entire problem or instructional scenario was presented to the students. For the problem progression corollary, the design problem shifted to a different context in each module, and its complexity increased as preservice teachers applied additional component skills. The increased complexity of subsequent problems and the provision of multiple problems intended to progressively improve learners' skills. Although they began with fewer and simpler tasks within the problem, they gradually engaged more components of the design problem until they were assigned the entire problem.

Since the initial component skill taught was assessment, students were only required to plan an assessment for the first design problem; all other components were provided. Learners then designed an assessment for each subsequent design problem. The second component skill, writing effective learning objectives, was provided in the initial design problem but required of students for the second design problem and beyond. This implementation of the problem progression corollary intended for students to develop mastery of isolated component skills situated within varied and authentic design problems. This proposed to scaffold them for their final design problem, when they would be expected to design a technology-integrated lesson and supporting digital resources for their field placement.

Methods

This study compared the impact of two FPI-based courses on preservice teachers' application of TPACK when designing technology-integrated lessons within a problem-centered environment. To examine this impact, the quantitative data analysis focused on comparing the two conditions (F2F and flipped) on the TPACK outcome variables. Further, the study also explored preservice teacher learning experiences. The qualitative analysis of their reflection journals and the interview transcripts sought to better understand how they interacted with the content in each course version and how they perceived the FPI elements impacted their learning experiences.

During the spring 2017 and fall 2017 semesters, participants were recruited from four sections of a required technology integration course in their teacher preparation program. All participants were either elementary or early childhood majors with a focus on inclusive and special education. There were 32 participants total. Twenty participants completed the F2F course in the spring, and 12 completed the flipped course in the fall.

Participants completed pre- and post- technology-integrated lesson designs using a specified template. Two raters individually applied the TPACK-based technology integration assessment rubric to each lesson (TIAR; Harris, Grandgenett, & Hofer, 2010). The TIAR consists of four domains, and scores can range from four to sixteen. Researchers met weekly to discuss scoring and reached consensus on lesson scores that differed by greater than two points. Finally, the primary researcher calculated gain scores from the differences between the pre- and post- scores and computed an ANOVA of gain scores following an exploratory analysis.

As for the qualitative data, eight course assignments for each participant were analyzed, resulting in approximately 240 written artifacts. The researcher also interviewed four participants, three from the F2F course (Andrew, Aadan and Angie) and one from the flipped course (Brooke). Interviews ranged from 27 to 42 minutes. All interviews were recorded, imported into MAXQDA alongside participants' reflections, and transcribed verbatim. A descriptive phenomenological approach to qualitative data was then applied to this analysis (Cilesiz, 2011).

Phenomenological research attempts to represent the general nature of the phenomena by exploring it from the various perspectives of those who have experienced the phenomena (Matua & Van Der Wal, 2015). Thus, this study sought to represent the phenomena of experiencing a technology integration course intended for preservice teachers that has been designed according to the problem-centered principle of the FPI. The descriptive phenomenological method was selected for its alignment with the research questions focused on exploring participants' experiences with course elements in both the F2F and flipped course versions. Further, a phenomenological approach has been applied to similar studies in educational technology to explore preservice and in-service teachers learning experiences and their TPACK development (Clark & Boyer, 2015, 2016; Lin, Groom, & Lin, 2013).

In phenomenology, general themes or the essence of an experience are represented as a textural-structural synthesis. The essence represented by this study does not intend to be a universal truth for experiences in technology-integrated courses or experiences with a problem-centered principle. Rather, as Moustakas wrote, "The fundamental textural-structural synthesis represents the essences at a particular time and place from the vantage point of an individual researcher following an exhaustive imaginative and reflective study of the phenomenon (Moustakas, 1994, pp. 101–102)." As a researcher continues to study a phenomenon, an infinite number of experiences may be discovered (Husserl, 1931). The goal of the phenomenological analysis reported in the following sections was to best describe the general lived experiences of the participants in these problem-centered technology integration courses and the essential aspects of the experiences that related to their TPACK application.

Results

FPI's Impact on TPACK Application

While the ANOVA results showed no practical or significant differences between groups, an examination of the confidence intervals offered information about the potential statistical significance of each treatment group's mean gain score. The 95% confidence intervals for this analysis did not include zero for either group. The intervals for each group ranged as follows: F2F group ranged from 2.61 to 5.59 and flipped group ranged from 2.30 to 6.70. These data show that while the two groups' gains were not significantly different, both groups exhibited a significant increase in their application of TPACK to technology integration lessons as the mean gain score is statistically different from zero.

To explore the statistically significant gains in TPACK application further, participants' gains on the TIAR subscales were analyzed. As the TIAR subscales' data did not meet the assumptions of normality for parametric tests, a Wilcoxon Signed Ranks test was applied. Table 1 displays the resulting pre- and post- medians, effect size, and degree of significance. All four domains of TPACK application as measured by the TIAR were statistically significant for both groups. These data indicate support for FPI's potential to promote learning and indicate that the FPI may promote learning equally well in F2F and blended environments. Next, the descriptive phenomenological analyses of participants' experiences with the problem-centered principle will be discussed and related to these quantitative outcomes.

Experiences with the FPI as Explanations for Growth in TPACK Application

As displayed in Table 1, preservice teachers exhibited statistically significant growth in the application of TPACK to technology integrated lesson designs. Many shared that experiences with elements of the problem-centered principle positively influenced their learning, helped them apply knowledge in the course and provided an authentic context for their learning. Brenda clearly connected her problem-centered course experiences with learning how to integrate technology when she wrote, “Each week I feel I am becoming more and more comfortable with creating lessons with my design team, while incorporating the new types of technology we are learning each week and the ISTE standards. I feel that when the time comes around and I have to plan a lesson for my second grade students this semester, I will have so many new technology options that I can incorporate into my lesson.”

Brenda identified the repeated opportunities for practice, her increased comfort with design and knowledge of technologies, and her confidence that these knowledge and skills would be useful. In terms of TPACK-application, Brenda’s statement aligned closely with elements of the TIAR. Preservice teachers exhibited consistent growth across all TIAR criteria with medians increasing one point. Preservice teachers’ experiences with the

Table 1
Wilcoxon Signed Ranks Tests of Pre- and Post-TIAR Scores

<i>Criteria</i>	<i>Group</i>	<i>n</i>	<i>Mdn (Pre)</i>	<i>Mdn (Post)</i>	<i>Z</i>	<i>Sig. (2-tailed)</i>	<i>Effect Size r</i>
<i>Curriculum Goals and Technologies</i>	F2F	20	2.00	3.00	2.86	.004	0.64
	Flipped	12	2.50	3.50	1.79	.074	0.52
	Flipped ^a	11	2.50	3.50	2.41	.016	0.73
<i>Instructional Strategies and Technologies</i>	F2F	20	2.00	3.25	3.47	.001	0.78
	Flipped	12	2.00	4.00	2.97	.003	0.86
	Flipped ^a	11	2.00	4.00	2.97	.003	0.90
<i>Technology Selection(s)</i>	F2F	20	2.00	3.00	3.03	.002	0.68
	Flipped	12	2.00	3.00	2.03	.043	0.59
	Flipped ^a	11	2.00	3.00	2.68	.007	0.81
<i>"Fit"</i>	F2F	20	2.00	3.00	3.43	.001	0.77
	Flipped	12	2.00	3.00	2.56	.010	0.74
	Flipped ^a	11	2.00	3.00	2.95	.003	0.89

^aOutlier removed from this group based on a sensitivity analysis results.

FPI-elements in the courses may offer explanations for the growth in these criteria and lay the groundwork for considering future design implications. The integrated findings discussed next will focus on relating participants’ experiences with two criteria from the TIAR, (1) Curriculum Goals and Technologies and (2) Technology Selection(s).

Curriculum Goals and Technologies

Emphasizing the alignment between technology selection and curricular goals, this area of TPACK application was noted as an area of concern during activation phase of instruction and early application phases. During an interview with Aadan, he reflected on his experiences with a one-to-one chromebook initiative, “Um I think technology can be a fantastic tool depending on how it's used.” He continued to describe how he often did not sense there was an alignment between technology and curricular goals when he was a student and found the tools distracting. Avery also noted times when technology seemed to be used for the sake of technology and not in service of content and learning when she wrote, “I would’ve rather done things my own way, but usually when technology was involved we were required to do things so specifically and include so many components (follow so many steps). Furthermore, the types of technology I used were very confusing to me at times and I feel that they were not helpful to my learning. I would’ve been better off without the technology and just doing things the old school way.” While some preservice teachers recalled learning important skills with technology, its’ integration in their K-12 education was frequently seen as superfluous to curricular goals.

In spite of these critical perspectives, preservice teachers at the beginning of the course still remained open to the possibilities as Bridget wrote, “The more technology a teacher can incorporate into the lesson the better. This will make [it] feel like a normal part of everyday life.” Bridget’s rationale for incorporating technology and her peers’ observations of technology integration attempts in their K-12 classrooms offer possible factors for the limited alignment between curriculum goals and technologies on the pre-course lesson designs. In preservice teachers’ prior technological experiences, content was often relegated, ignored, or misaligned with the digital tools’ affordances. As Bridget argues for more technology in the classroom, she does not support her position by relating it to learning and instruction. Her premise assumes that teachers should be concerned with technology becoming normative and that resulting instruction will improve. This perception of technology’s role does not account for content nor consider the role of pedagogy as technology becomes the end goal.

Preservice teachers’ iterative lesson designs during the application phase of instruction may also explain the positive shift in their attention to the alignment of technology with content goals. As Arianna noted, “I would definitely say the repeated practices we complete in this class are productive to us as future educators. As it may be redundant and tedious for some, it still is eliciting great and continuous practice of effective ways to consider and implement technology into the classroom.” She and Angie both highlighted the benefits of this continuous practice. Participants’ experiences with the problem progression corollary were described as benefitting their ability to isolate and focus on key design elements. They were able to break down problems and build up their confidence.

One of these key design elements, or what Merrill (2012) referred to as a subtask, was referenced in Bridget’s reflection on her group’s technology integrated lesson design near the end of the semester. Bridget wrote, “I think that it would be important to make sure that our objectives are closely aligned with the technology that we incorporated. I want the technology included to extend and build on the lesson, not be completely irrelevant or come across as busy work. I hope that as we finalize our lesson, we can nail down forms of technology that fit our objectives.” The continuous practice elicited by the problem progression corollary during the application phase of instruction provided a space to reconsider technology’s relationship to curricular goals within a lesson design. Bridget shifts from “the more technology...the better” to writing of the importance of alignment and fit between learning objectives and technology. Whereas considerations of learning and content were absent from her earliest reflections, she now wants the technology to “extend” and “build” and to be relevant.

Further connecting the increase on this TIAR criterion with participants’ opportunities for practice and problem progression is yet another of Bridget’s reflections. She wrote, “I think that starting with most of the information filled in made me feel more successful in my abilities to plan a lesson that met both Common Core State Standards and ISTE standards.” In this statement she identifies technology and content standards, recognizes the need for lessons to address them, and relates the problem progression corollary to her sense of success and confidence. Brooke’s experiences also support this connection as she wrote, “By using this process I believe that it has benefited our groups understanding of what the most important components that go into a lesson are.” While she believed technology to be an important element to consider from the beginning, she wrote that should be considered alongside learning objectives and assessments. This iterative design process informed by the problem-centered principle and its corollaries was regarded as beneficial by the preservice teachers and may have contributed to their statistically significant increase in alignment of curricular goals and technologies.

Technology Selection(s)

The Technology Selection(s) criterion focused on the compatibility of selected technologies in the preservice teachers’ lesson design given their instructional strategies and curriculum goals. The previously discussed criterion evaluated alignment, but Technology Selection(s) evaluated the appropriateness of the selected technologies. While the median of participants’ technology selections in the pre-lesson designs corresponded with marginally appropriate technology selections, the median for their post-lesson technology selections was at the appropriate but not yet exemplary level. While they did not achieve the highest possible level of technology selection measured by the TIAR, both groups’ growth was statistically significant.

When preservice teachers discussed learning about different forms of technology in this problem-centered environment, they described their experiences learning various digital technologies as a process: introduction to a technological tool (Activation and Demonstration), practice using the tool (Application), and evaluating its potential for a future lesson implementation (Integration). The activation phase introduced preservice teachers to new digital tools and structured experiences for them to build new knowledge about and with these tools. In an early reflection, Andrew acknowledged that prior to the course, he considered himself “tech savvy”. He then listed the many technologies he had already learned in the semester. Similarly, Aadan observed that course experiences exposed him to a range of technologies. Audrey and Alyssa tied these introductory experiences to preservice teachers’ capacity

for appropriate technology selections when they wrote that technology integration seemed more achievable after learning about new digital tools. An expanded repertoire of tools, Audrey also wrote, made technology selections more complicated. “It [is] difficult picking and choosing what technology to use (and potentially how to get the best use out of it) for a specific lesson/topic.” Yet, exposure to new tools was just the beginning of the process of learning about new forms of technology.

Based on the FPI’s demonstration and application principles, preservice teachers observed modeling of procedures for using new tools. Along with this modeling, preservice teachers practiced using the tool with a partner or their design group. The following quote demonstrates the transition along this process. “For instance, I didn’t know that Google had so many different applications such as Google Slides, and through the two hours that I was in class I found out how to work the website through instruction and activities (April).” While April concedes a lack of knowledge of Google’s applications, she then acknowledges the benefit of working through instruction and activities in class to develop procedural knowledge. Constructing knowledge of the digital tool’s affordances through the construction of a meaningful artifact, “a Google Slides webpage”, was perceived by participants as critical for future technology integration decisions.

Summarizing her experience with the process, Angie wrote, “I think now it is really impossible to plan a lesson without technology...it’s more about finding and using the RIGHT technology, not just finding any technology.” The TIAR makes the same assumptions as Angie; technology will be selected for the lesson. Angie concludes that technology selections will occur, and teachers must not settle for any technology. Through these processes and as indicated by the TIAR data, preservice teachers selected more appropriate technologies for their instructional scenarios at the end of the course, and participants’ experiences helped them learn the “ins and outs (Avery)” of several new tools as a means for improving their selections.

Implications, Limitations, and Conclusion

Several recent studies have applied the FPI to flipped courses. Some, as this study has done, compared the learning of F2F and flipped course designs. On the surface, Lo, Lie, and Hew’s (2018) results appear to contradict this study. In three of four disciplines studied, they reported that the flipped treatment group outperformed the F2F group. Critical to these results, though, was that instruction in the three F2F groups was primarily lecture-based. In the one flipped to F2F comparison that exhibited no differences in outcomes, the instructor stated that he embedded hands-on activities within the F2F course. Instead of countering the results of this study, these results rather seem to have a similar conclusion. The learning outcomes may be a result of the design of the learning environment. When designs included high leverage instructional practices such as hands-on learning espoused by the problem-centered principle, F2F and flipped approaches may prove equally effective.

Preservice teachers’ experiences with the problem progression, task level, and problem progression corollaries and the robust TPACK-application outcomes further support the need to apply them as intended by the FPI. This is not to say that incorporating the FPI as described by Merrill is a simple process. Studies of the FPI application vary drastically in their application of the problem-centered principle, and a recent study of a flipped course based on the FPI even observed the absence of problem-centered activities during the physical class meeting (Lo et al., 2018). The essence of participants’ experiences in this study, however, indicate the importance of the problem-centered principle, its embedded corollaries, and proper implementation.

A limitation to the results in this study was the variation of participants’ experiences in the field, particularly the mentor teacher’s TPACK, and how these contributed to the results. Nelson (2017) found that preservice teachers were impacted by the frequency and quality of their mentor teacher’s integration of technology. Technological competency was not considered as mentor teachers were selected, therefore, this variable was not measured. Knowing this could potentially impact preservice teachers’ implementation of the lessons factored into the decision to isolate planning as an outcome. First order barriers such as access and mentor teachers’ attitudes toward technology were evident in preservice teachers’ reflections and could not be controlled. The TIAR was purposefully applied to measure TPACK application as it was intentionally constructed neutral of a constructivist orientation and student-centered uses of technology. Its main focus was the alignment of components within a technology-integrated plan for purposeful integration and not evaluating the plan from a theoretical perspective. Applying the TIAR was intended to reduce the impact a mentor teacher might have on the score, as it was believed preservice teachers could score a maximum possible score even with first-order barriers present in the placement context.

The knowledge and skills for designing digital resources and technology-integrated lessons is often of practical significance for teachers. Emerging technologies regularly require teachers to design their own resources and activities for technology to be integrated purposefully (Laurillard, 2012). Exploring design practices for

preservice teachers represents a synergistic agenda for teacher educators, teachers, and design researchers (Svihla et al., 2015), and a problem-centered approach based on the FPI appears to be a promising method for structuring the development of these practices.

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A Proposed Educational Technology Standards of Thailand

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Abstract

Educational technologist performs as a catalyzer in supporting active and effective learning in an educational system. In Thailand, Educational technologists' roles are delineated in the Chapter IX of 1999 National Education Act 1999 that were practically media profession who analyze, design, develop, and deliver media in a teaching and learning system such as radio, television, text book, and printed media, as well as all types of communication technology, while using research as a tool in the process, and practical professional development as well. None of the study has been done to solid instructional technology standards and its proficiency in Thailand. To strengthen the field of instructional technology, the study is aimed to research standards and competency for Thai instructional technologists.

The study was employed by systematic reviews of current research and existing competency standards of educational technology after year 2010, coupled with an in-depth interview with experts in educational technology filed. The major standards of revision were retrieved from mainly organizations in the United States including: Association for Educational Communications and Technology: (AECT standards, 2012), the International Society for Technology in Education (ISTE standards, 2016), and including such as ISTE Standards for students (2016), and including major standards modified on the basis of ISTE standards namely the Washington State K-12 Educational Technology Standards, and Michigan Educational Technology Standards.

The study was found the proposed educational technology standards including six areas: 1.profound knowledge in technology and its adaptation to education, 2. system design, 3.professional development, 4.learning environment, 5. research and ethics, 6.localized and globalization. The proposed standards should be further developed and will be a potential countrywide implementation.

Keywords: educational technologists, educational technology standards, Thailand

Introduction

The rapidly changing world of today's transition to the digital age has had an impact on human society in all areas, so that we can adapt to those changes in order to survive sustainably. It can be said that the advancement of technology affects the work system in all professions, which face the challenge of change. Like the educational technology profession. Educational technologists are one of the top professions that play a role in the development of education. This is to facilitate and support the educational system and teaching for teachers to improve the learning of students to be effective.

The literature review found that educational technology standards were not developed or improved from the main organizations of the educational technology profession. It is only the research of graduate and doctoral students who develop the standards and competencies of educational technologists. There are a few and over 10 years of research that show the lack of continuous development and the lack of awareness of the importance of the profession that affects the role of educational technologists in the society. This has led to the development of standards of educational technologists. This problem has been the same as many educational technologists in many countries. In fact, educational technology plays an important role in supporting the development of change in the way that the educational system is good. On the other hand, they often have less role in society. This is due to the lack of a clear professional structure (Fox and Summer, 2014), or it can be said that this is a concern for the overlap of educational technology roles. (Browne and Beetham, 2010) This concern has occurred with broader educational technology. Research has reported that the challenges of 21st century technology educators affected by the advances in technology. How will they guide their educational goals? In addition, the development of the technology used in the teaching and learning of teachers to improve the knowledge and skills of students (Mayes, Natividad, and Spector, 2015). From this problem, the study is aimed to research standards and competency for Thai instructional technologists.

The development of educational technology standards is a positive impact on the professionalism of educational technologists in improving the performance, strengthening the educational professional organizations.

However, the development of such standards should be continued for sustainable professional development. This will be beneficial for the development of Thailand's education, which affects the learner's ability to continue.

Literature Review

Educational Technology Standards in Other Countries

For the development of international standards, the researcher has studied the standards of educational technology of AECT (2012), which has been defined five standards as follows: standard 1 content knowledge, standard 2 content pedagogy, standard 3 learning environments, standard 4 professional knowledge and skills, and standard 5 research. AECT is one of the world's leading educational technology providers, and Thailand is also one of the members of AECT. Therefore, a trend study of AECT technology standards is necessary.

In addition, the researcher has studied the standards of the International Society for Technology in Education (ISTE) is a not-for-profit organization focused on providing all educators with the ability to control technology to accelerate innovation in instruction and inspire learners to achieve high potential. It has developed standards for educational groups, including educators, coaches, teachers, and learners, details are as follows.

ISTE Standards for educators (2017) is a standard that encourages learners to have greater potential for learning. It also promotes peer collaboration and interaction with other educators in finding new approaches. The development of various areas to support the learning of the students to the highest efficiency. It consists of 7 standards, the first standard is a developer of continuous learning, technology and creation and participation in local and global learning network, standard 2 is a leader in driving a visionary advancement in developing digital learning and learning that is equal to the student's success, standard 3 is a positive inspiration for learners in the digital world, standard 4 is a collaborative effort with others, using concepts, solving problems using technology, new digital resources to create a real-world learning experience, standard 5 is a truly learning activity designer by bringing tools, digital technology is used in many real-world environments, standard 6 is a facilitator of learning with the use of digital technology to support the development of learning outcomes of learners according to creative standards, and standard 7 is a knowledgeable and knowledgeable analyst who promotes alternative learning, designing and implementing multiple assessments to help learners achieve their learning goals.

The part of the ISTE standard for teachers (2008) is defined in five aspects. 1) Teachers use content knowledge, teaching and learning by using technology to encourage students to learn to develop their creativity, 2) (teachers can design and develop learning experiences and assessments in the digital age, 3) (be a professional teacher who demonstrates competence, skill and expertise in innovation, 4) teachers promote and define responsibilities for digital citizenship, and 5) teachers participate in professional growth and leadership. The ISTE standards for teachers have been applied in the development of standards for students in order to improve their learning in various areas to increase their potential.

Moreover, ISTE standard for student (2016) developed standards for learners by focusing on student-driven learning processes, consisting of seven standards 1) students use technology to demonstrate their potential to achieve their learning goals, 2) recognize liberty and rights, responsibility, opportunities of living, learning and working in the digital world, 3) value learning resources, especially digital tools, to be used in self-learning and others, 4) use a variety of technologies in the design process and solve problems to create new things, 5) develop and use problem-solving and understanding strategies with technology-assisted methods, 6) students can communicate creatively with digital tools and media, and 7) digital tools are used by learners to extend their perspectives and learning. It also works with others effectively in both local and global teams.

However, the ISTE standards are the model used by states in the United States, which will be adapted to the context of their own state, for example the Washington State K-12 Educational Technology Standards (2018) have seven standards. Apart from that, Michigan adopted the ISTE Standards for Students as competencies for technology integration (MITECS) during the 2017-2018 school year, there are also Kentucky standards for teachers. Other countries have also adopted the ISTE standards, such as Pakistan.

Educational Technology Standards in Thailand

The development of educational technology standards in Thailand has been developed, but is still very limited and lacking continuity. Educational technologists' roles are delineated in the Chapter IX of 1999 National Education Act 1999 That the importance of educational technology has been determined in seven areas as follows: Educational technologists are professionals in the media by analyzing, designing, developing and providing media services in teaching and learning systems such as radio and television, text book, and printed media, as well as all types of

communication technology, while using research as a tool in the process, and practical professional development as well.

The study or research on the development of educational technology standards or related is still low and lack of continuous development. However, there are also those who develop this. Thapanee (2003) has developed performance standard for educational technology in higher education institutions in Thailand consists of 14 standards and 84 indicators; 1) Instructional design and instructional development standard, 2) Instructional media design, 3) Educational technology training, 4) Research and development, 5) Internal and external assessment, 6) Educational technology diffusion, 7) Graphic media production, 8) Printed material production, 9) Video/television production, 10) Audio material/radio production, 11) Computer media production, 12) Education technology consultation service, 13) Instructional media and audio visual aids service, and 14) Planning and management.

In addition, Wasan et al. (2006) developed the national standard for educational technology for the institute of graduate study. It consists of 9 standards, 34 indicators as follows: 1) the institutional leadership in educational technology, 2) the curricular structure of teacher education program, (3) the technology infrastructure of educational technology, 4) the technology innovations fostering the instruction in teacher education institution, 5) the personnel in educational technology, 6) the faculty members' performance in educational technology, 7) the instructional models fostering the pre-service teacher students' uses of educational technology, 8) the professional experiences, and 9) the pre-service teacher students' performance in educational technology.

From literary review by analyzing, synthesizing the research papers related to the standard, it is shown that Educational technology standards need to be developed urgently and should be continually developed to create professional standards for technologists to be strong and up-to-date with the rapidly changing digital technology world. For the benefit of education systems that affect learners' learning and instructor effectiveness to maximum potential.

Research Objectives

The study is aimed to research standards and competency for Thai instructional technologists.

Research Methods

Researchers have developed a study on the development of educational technology standards of each organization both in Thailand and abroad as follows.

1. Study and analysis of educational technology standard documents for educational technologists as well as teachers and educational personnel of foreign agencies.
2. Develop a draft standard for educational technology based on the review of research and educational technology standards from organizations in other countries.
3. In-depth interviews with experts in the field of educational technology were conducted to gather information, opinions and expert advice on the drafting of educational technology standards.

Research Results

According to studies, it has been found that researchers can synthesize draft standards of educational technology has six standards, as follow.

Standard 1 Profound knowledge in technology and its adaptation to education has three indicators include: 1.1) profound knowledge of both theoretical and practical education technologies, 1.2) profound knowledge about education, 1.3) knowledge of new technologies.

Standard 2 System design has 2 indicators include, 2.1) design of teaching and learning system, 2.2) design of media system.

Standard 3 Professional development has three indicators: 3.1) expertise in media production skills, 3.2) leadership in new technologies applied in teaching, 3.3) be a consultant to develop learning by using advanced technology.

Standard 4 The learning environment has two indicators: 4.1) the development of a learning environment that uses technology in various ways, 4.2) the organization of a diverse learning environment based on real conditions.

Standard 5 Research and ethics have two indicators: 5.1) Applied research in education and educational technology, 5.2) Research in development of media, 5.3) Ethics of Educational Technology and rese.

Standard 6 Localized and globalization has two indicators: 6.1) the application of knowledge in the field of technology and the use of local networks, 6.2) the creation of a broader network to the global network.

In terms of in-depth interviews of experts with interesting issues, as detailed below.

Standard 1 Profound knowledge in technology and its adaptation to education. "Standards 1 should identify indicators of educational attainment in relation to teacher professional standards and student performance in Thailand as teachers and learners are key target groups for educational technology. Therefore, standards of educational technology need to be consistent with the standards and competencies of teachers and learners." (Experts 1, 4 and 5)

Standard 2 Design System "should include theories of learning, psychological theory, perception theory, media characteristics in design." (Experts 3, 4 and 7)

Standard 3 Professional development "Identify skills, expertise in thinking, creativity, use of all learning materials, and technology in advanced platforms." (Experts 2, 5 and 6)

Standard 4 Learning environment "The ability to utilize the atmosphere and suitability of the classroom and other learning facilities should be discussed." (Experts 3, 4 and 7)

Standard 5 Research and ethics "Standard 2 should focus on innovative research to be in line with the Thailand 4.0 policy and should include research ethics, progressive thinking, application and contemporary thinking." (Experts 1, and 3)

Standard 6 Localized and globalization "Identify the actual implementation. In accordance with the policy of Thailand 4.0, but consistent with the culture of culture in the context of Thai society." (Experts 2, and 5)

In addition, experts have proposed that additional standards or clear indications be added.

1) Leadership standards should be added as most educational technologists play the role of a leader that is not as clear as it should be. Therefore, it should be defined as one standard that will improve the performance of educational technologists to a higher level. (Expert 2, 3 and 6)

2) The standard of the role counselor or facilitator of educational technology should be identified. (1, 3, 4 and 7)

Discussion and Conclusion

The standards developed by the researcher consist of six standards, 1, 3, 4 and 5, consistent with the AECT (2012) standards, but differ in their metrics and focus. Standard 1 Content Knowledge has a different focus: Standard: 1, which develops profound knowledge in technology and its adaptation to education, focuses more on the knowledge of the educational system that involves teachers. Next, standard: 3 professional development, for example, defines an indicator that identifies media production skills, being a consultant, and a technology leader, which are not the same thing. Standard 4: the learning environment is focused on the environment where technology is used to learn and the learning environment is realistic. And standard 5: research and ethics, the emphasis is on the name of the standard, the code of ethics, which shows the ethics is important and the research has two indicators, namely, applied research and development research.

While standard2: system design, conforming to standard 2 of ISTE For Teachers (2008) Some of the design, development, evaluation, and learning outcomes of learners. It does not mention the system. The standard 6: localized and globalization complies with ISTE standards for educators (2017) in Standard: 1 and Standard: 7 for students. However, based on expert interviews, some ideas need to be added to the standards that define the role of educational technology more clearly: the standards of leadership and the standards of counsel and facilitation. In accordance with the ISTE Standards for Teachers (2008) and ISTE for Educators (2017).

Conclusion

The standard of educational technology in Thailand consists of 6 standards; 1) profound knowledge in technology and its adaptation to education, 2) system design, 3) professional development, 4) learning environment, 5) research and ethics, and 6) localized and globalization Based on interviews with experts, it was found that the experts gave more suggestions on adjusting standards for greater coverage. The researcher has to take this effect to further study and make appropriate adjustments. The results of this study are consistent with the recommendations of the panel of experts to ensure that the educational technology standards are fulfilled before proceeding with the research.

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Student Behaviour in an Online Monitoring and Evaluation System

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Abstract

An online monitoring and evaluation system was developed to monitor and evaluate students' reading activities. This system was designed as an online learning environment (OLE). As the students display more community characteristics on OLE, the environment is getting stronger accordingly. At this point, it is wondered how student behaviours explaining the characteristics of being a community and how these behaviours affect other behaviours. In this research, an answer to the following research question was sought, "Is there a relationship between the number of log in OLE and the number of completion of tasks? What is meant with the number of log in the environment is the number of log in the online monitoring and evaluation system here, and what is meant with the number of task completion is the number of books read. Online monitoring and evaluation system was used during a school term at a Turkish secondary school. Participants of this research were 412 secondary school students. In this quantitative research, log files were used to collect data. Online secondary school. Participants were 412 secondary school students in the quantitative research. At the end of the study, it was found that both low and high-level readers were able to log in the system at a low level. This can be interpreted as that high-level readers focus on completing the tasks they are directly involved in, and therefore, they contribute to the system at a low level. However, it was observed that those who logged in the system at a high level and read many books (17.5%) were found to logged in the system significantly more than those who logged in the system at a high level and read fewer books (8.7%).

Keywords: Online learning environments, student behaviour, student participation behaviour, task completion behaviour

Introduction

The high rate of the reading book in a society is a sign that there are many people who have critical thinking skills in that society. Reading book is beneficial for individuals and thus the societies. Because reading is the basis of mental development, which is an indicator of the level of development of society. In order to help students gain the habit of reading books, students need to meet the books appropriate to their level and interests, and their reading processes should be also followed (Bull and McKenna, 2004; Williams, Bialac and Liu, 2006). After reading a book, students' readings should be evaluated (Hickman, Bielema and Gunderson, 2005). An online monitoring and evaluation system was developed to monitor and evaluate students' reading activities. This system was designed as an online learning environment (OLE). Different roles and behaviours have been suggested in the literature for strengthening the OLEs. In these strengthening studies, the main focus is on community characteristics of these online learning environments. The general opinion in the literature is that in the cases where OLEs happen to become strong communities, the success in the OLEs is high (see Yang, Wang, Shen & Han, 2007; Yeh, 2010). Different researches have examined what type of behaviours are necessary for these environments to make the environment efficient and to make the environment a community. The analysis of student behaviours in OLE is necessary to understand what the outcome of the behaviours is and to determine which behaviours are supported for learning.

In the literature, there are studies investigating which student behaviours are developed in OLEs (eg Kneser, Pilkington & Tresasure-Jones, 2001), which roles form which behaviours (eg Yeh, 2010) to understand the outcomes and functions of OLE on students' developed behaviours (eg De Wever, Schellens, Valcke and Van Keer,

2006). It is understood from the results of the studies in the literature that student behaviours can be influenced by the environment and roles, and behaviours can affect OLE and even student behaviours can be used as an indicator to understand the efficiency of OLE. In this framework, it is worthwhile to understand and interpret student behaviour in OLE.

It is understood from the results of the studies in the literature that student behaviours can be influenced by the environment and roles, that behaviours can affect OLE and even student behaviours can be used as an indicator to understand the efficiency of OLE. In this framework, it is worthwhile to understand and interpret student behaviours in OLE. In some studies aiming to examine the nature of the environment through the discussion records in the OLE, the frequency of participation of the students in the environment, the forms of participation (with or without task completion, active / passive etc.) and the content they shared in the environment were considered as the behaviours of students in the OLE (Blignaut and Troppil, 2003). It is also stated that, through these behaviours, predictions can be made regarding students' gains (De Wever, Schellens, Valcke and Van Keer, 2006). In some of the studies evaluating student behaviours in the cognitive category, asking questions, participating in discussions, explaining, criticizing and developing suggestions were examined as student behaviours. Some studies were categorized within the scope of student behaviours. Some examined all kinds of participation in the field as academic behaviours and the others examined them as non-academic behaviours. Beuchot and Bullen (2005) examined student behaviours through social behaviours. Yeh (2010) states that the roles performed shape the behaviours of the individual, and he classified student behaviours by analysing them. The classification of the behaviours are as follows: (1) high cooperation and high participation (Active collaboration), (2) high cooperation and low participation (Passive collaboration), (3) low collaboration and high participation (Individualized participation) and (4) low cooperation and low participation (Indifference)

Research Question

In the study, the answer to the following question was sought "Is there a relationship between the number of participants in the OLE and the number of task completion?" Here, what is meant with the number of log in the environment is the number of log in the online monitoring and evaluation system, and what is meant with the number of task completion is the number of books read.

Method

Research Context

Researchers conducted the study at the schools in a province located in the western part of Turkey through an Online monitoring and evaluation system aiming to improve students' reading habits. This system was designed as an OLE. The online monitoring and evaluation system for book reading activities which was used as an OLE was a system funded by TUBITAK (The Scientific and Technological Research Council of Turkey) and developed by the Çanakkale Onsekiz Mart University.

During one semester, the OLE was used in two schools. The use OLE measures students' reading habits through a scale at their first log in the system. The system identifies the students' areas of interest in reading books in their first entry and provides them with the opportunity to change their preferred fields of interest anytime along the process. OLE starts to recommend the most appropriate books to the students choosing among the ones available in the system considering the parameters defined through the scale and questionnaire given at the very beginning. The book recommendation system included in the OLE aims to assist students in the book selection process and to prioritize the books that the student may like in accordance with their habits of reading books. Students can choose a book that is recommended to them, or they can start to read a book which they themselves prefer.

Students obtain and read the book they want to study. There is no book reading session in OLE. Once students inform the system that they have decided to read a book, the OLE continues to guide students along the reading process. In OLE, students are informed about the number of people reading the chosen book, the number of people who like it, the number of people advising and the time recommended to read the book. The students who complete the book reading process states that in the system to complete the reading process. Upon this, the OLE asks students if they are ready to make the evaluation process in order to determine how well the chosen book was comprehended. Students can have a multiple-choice test in OLE. This test consists of 10 multiple choice questions

randomly chosen from the question pool to measure how well the read book is comprehended. The student's reading comprehension score is sent to the screen of teachers, students and their parents. After this stage, students are asked whether they want to write any comment about the read book, to recommend it to friends and whether they want to rate the book with star/stars. During one semester, students continue this process through the OLE.

Participants

The participants of the study were 412 secondary school students (188 male and 224 female). 211 of these students were 5th grade (51%), 139 of them were 6th grade (33%), 42 of them were 7th (10%) and 20 of them were 8th grade (6%) students.

Data Collection and Analysis

The data collection tool of the study were the records of the OLE system. The OLE system counts how many books students have read. The number of books that students have read is considered as “completed task” behaviours. The number of students’ log in the system is considered as “participation” behaviours. The system also keeps records regarding this data. The relationship between the number of students’ log in and the number of task completion was found out by chi-square analysis.

Findings

The chi-square analysis was used to examine whether there was a relationship between participation in OLE environment and number of task completion. The results are given in Table 1.

Table 1.

The relationship between the number of task completion and the number of log in the system

		The number of Log in the System		Total	
		Low level (0-14)	High level (15 and above)		
Number of books read	Low level (0-2)	n	303	29	332
		%	91.3%	8.7%	100%
(Number of task completion)	High level (3 and above)	n	66	14	80
		%	82.5%	17.5%	100%
Total		n	369	43	412
		%	89.6%	10.4%	100%

($X^2=5.30$, $df=1$, $p=.021$)

Low-level readers logged in the system at a low level (91.3%). High-level book readers logged in the system at a low level (82.5%). In other words, both high-level readers and low-level readers logged in the system at a low level. However, when we looked at the high level of log in the system, it was seen that those who read a lot (17.5%) were found to have logged in the system significantly more than those reading book very little (8.7%) (X^2 ($df = 1$) = 5.30, $p < .05$).

Conclusion and Suggestions

In this study, the relationship between students' logged in OLE environment and task completion behaviours were investigated. In the study, it was found out that both low book readers (91.3%) and high book readers (82.5%) logged in the system at a low level. This can be interpreted as that high-level book readers focus on completing the tasks they perform directly and therefore contribute to the system at a low level. It is possible to suggest that low-level book readers log in the system less as they have less number of task completion. In the study, it was also observed that those who logged in the system at a high level and read a lot of books (17.5%) logged in the system significantly more than those who had a high level of log in the system and read fewer books (8.7%). It can be interpreted from that the log in the system has an effect on the reading rates. Further studies are needed to investigate the relationship between different student behaviours. Moreover, under the light of the findings of this study, the researchers can examine the effects of the roles designed for instructional purposes and how they can influence students’ behaviours.

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Reflection Wrapper Activities to Promote Pre-Service Teachers' Metacognitive Strategies

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Abstract

This paper investigates the impact of reflection wrapper activities to improve pre-service teachers' metacognitive strategies in the higher education classroom. It reviews relevant literature describing what reflection wrappers are, how to use these activities, and their significance to enhance pre-service teachers' metacognitive strategies, such as planning, monitoring, and evaluating.

Introduction

Prior research suggests that when students are shown how to self-regulate their study behavior and knowledge, it could have long-lasting positive effects on their learning (Gezer-Templeton, Mayhew, Korte, & Schmidt, 2017; Lovett, 2013). These skills can be developed gradually during class time by teaching alternative study strategies or outside the classroom by giving students assignments to practice these skills. For example, metacognitive strategies that teachers want to promote in education can be embedded easily by employing a tool known as an exam wrapper. One of the desired outcomes of exam wrappers is enabling students to self-evaluate and make plans for improved future study strategies. Lovett (2008) developed the exam wrapper concept, while exam wrappers were first introduced as a tool in a posttest analysis by Achacoso (2004). The reflective post-exam questionnaire has since formed the backbone of the exam wrappers that are used today.

Reflection Wrappers

The reflection wrapper includes diagnostic questions that facilitate student self-assessment and understanding of lessons, help with exam preparation, and promote metacognitive skills. These tools have gained in popularity by prompting students to reflect on three major components of learning: exam preparation (thinking about study skills used), types of errors made in study or on exams, and adjustments for future learning (modifications to study habits to better prepare for the next class or exam). Reflective wrappers include exam wrappers and reflective thinking activities.

Exam Wrappers

Exam wrappers are short questionnaires administered around the end of a lecture, assignment, or assessment to train the student to think through the steps of metacognition, i.e., planning, monitoring, adapting, and evaluating (Root Kustritz & Clarkson, 2017). Lovett (2013) described exam wrappers (or cognitive wrappers) as concise, straight-forward activities that urge students to assess their performance (and the instructor's feedback) on an exam with directions for the future in mind. Gezer-Templeton et al. (2017) described them as brief, reflective writing activities that ask students to evaluate their applied study approaches to their performance on an exam while concentrating on modifying future learning practices. For example, students can fill out exam wrappers after they take a performance exam. Such wrappers include short questions asking about their exam preparation, what the most difficult questions were, and what they might do differently before the next performance exam. Unfortunately, there are few published studies on the use of exam wrappers as a strategy in a blended learning environment (e.g., a flipped classroom) to improve metacognition.

Reflective Thinking Activities

In addition to exam wrappers, reflective wrappers also include reflective thinking activities that encourage students to engage in active learning through problem-based tasks to develop higher-order thinking skills while thinking about their thinking. For instance, the instructional design of the flipped classroom tends to have activities, such as pre-class asynchronous metacognitive activities, and to record lectures out of class time. This affords more opportunities to engage students with questions about the content and discuss difficult concepts or topics in active learning. Thus, students are empowered to explore and solve problems in groups to achieve their learning goals before class. Students are expected to demonstrate an understanding of the task and topic by problem solving on a discussion board before class to build their basic knowledge of the content and discuss complex tasks with friends or the instructor outside the classroom (such as online) through a pre-class asynchronous metacognitive activity or inside the classroom (via face-to-face learning).

Significance of Wrappers

Exam wrappers include three basic types of questions:

1. “How did you prepare for the exam?”
2. What kinds of errors did you make on the exam?
3. What could you do differently next time?” (Lovett, 2013, p. 23)

Responding to the exam wrapper helps students develop self-regulated learning (SRL) skills (Gezer-Templeton et al., 2017; Lovett, 2013) and metacognitive strategies (Lovett, 2013). SRL involves learning certain skills, such as self-assessment, goal setting, goal implementation, and monitoring progress (Zimmerman, 2002). Wrappers do not take up much class time, require minimal time from the student, are easy to adapt across different courses, and address several components of metacognition (e.g., performance evaluation, assessment of strengths and weaknesses, behavioral adjustment, and strategy identification).

The exam wrapper helps students learn more from test results and improve their performance on future tests (Lovette, 2013). It has thus come to be seen as an effective and valued post-exam reflection tool for promoting self-study habits (Gezer-Templeton et al., 2017). It also assists teachers in suggesting learning strategies and providing encouragement (Butzler, 2016). Furthermore, exam wrappers have allowed students to reach their own conclusions about the learning process (Lovett, 2013), and they are an effective tool for helping learners use their developing metacognitive strategies (Butzler, 2016; Lovett, 2013; Soicher & Gurung, 2017).

Based on sound pedagogical and theoretical principles, the reflective wrapper aims to foster metacognitive skills by training students to recognize what information they accurately understand, so they can devote more effort and time to information they do not understand (Root Kustritz & Clarkson, 2017; Lovett, 2013). Reflective wrappers could therefore help independent lifelong learners continuously assess the outcomes of their actions to build new knowledge.

The literature has reached a common understanding of what wrapper activities are. However, there is still a pressing need to understand how and when instructors can implement reflective wrappers and connect these activities to an environment with a mechanism for training metacognitive skills while meeting the criteria for applying exam wrappers (e.g., short questions, repeated use, use immediately after students receive their graded activity or performance exam). It is also important to connect reflective wrappers to evidence of advantages to different aspects of student study habits.

Implementing Exam Wrappers

It is easy to implement exam wrappers due to several factors (Butzler, 2016; Lovett, 2013). First, they are short (1-2 pages), often containing only short-answer questions. Second, they do not require much student time to complete or teacher time to assess. Third, teachers can easily adapt the exam wrapper for different majors and any learning task. For example, Lovett (2008) asserted that exam wrappers could be used for assessing lectures, homework, quizzes, and discussion. Fourth, exam wrappers are repeatable tools for subsequent quizzes, with some changes to avoid repetition. Fifth, this reflection helps students evaluate their performance, assess their weaknesses and strengths, identify the best strategies that work for them, and make appropriate adjustments. The metacognitive strategies students practice by using exam wrappers in a course provide substantial benefits, and teachers can encourage students to apply these strategies to other tasks and classes (Lovett, 2013). In higher education, beyond checking their grades, students typically choose to put the test out of their mind and proceed on to the next task.

Nonetheless, it is imperative for educators to carefully explain the reasons behind students' performance on a given test (Lovett, 2013).

Lovett (2013) explained the primary method of using exam wrappers. Students prepare and ask about the first exam using their regular study strategies. No intervention is required before the exam. The teacher has students complete exam wrappers after their graded exam is returned to them. The teacher collects the exam wrappers, not to grade activities but rather so they can be returned to the learners before their next exam. The teacher will also want to review students' responses to gain insight into their learning. This practice leads to a better understanding of how the students evaluate their own strengths and weaknesses. The students must begin studying and preparing for the next exam once they are done reviewing any recommendations on the first exam wrappers to include their own suggestions.

A review of the literature uncovered certain points of controversy. For example, some studies found that students did not appear to change their behavior after using exam wrappers, while other studies had positive results. The goal of implementing exam wrappers in a universal design for instruction is to train students in metacognitive skills and meet the criteria of successful exam wrapper use. This in turn could reveal how to imbed metacognition within coursework, providing insight into future directions for pedagogical practices with wrappers in schools and universities. This activity allows students to practice metacognitive skills and see an immediate change in their academic performance.

Lovett (2013) evaluated the use of exam wrappers in four courses across multiple disciplines (calculus, chemistry, introductory biology, and physics) to enhance metacognitive strategies during an academic semester. The findings demonstrated no change for students enrolled in only one course, and there was no control group. Higher gains were seen when learners used the exam wrapper across the four courses, but the researcher did not address whether using them in one course was more beneficial than not using them at all. She recommended that metacognitive skills be taught like any other skills and that they benefited from feedback and practice. Showing even less positive results, Butzler (2016) investigated the effects of implementing SRL tools (e.g., exam wrappers and notetaking) on chemistry students' achievement. The findings of a paired-samples *t*-test showed no significant difference with the addition of SRL tools.

Root Kustritz and Clarkson (2017) investigated the use of exam wrappers to help students in a first-year veterinary anatomy course self-assess their quiz preparation and employed a control group. Students in the experimental group filled out an exam wrapper after they completed the second and third out of four quizzes. The exam wrapper contained questions about quiz preparation, where they felt they had the most trouble with the quiz, and what they might do differently before the next one. The findings demonstrated no high percentage change in scores from the second to third or third to fourth lecture or quiz; however, the final exam scores improved for the experimental group. The researchers attributed students not changing their behavior from one quiz to another to a probable lack of formal training in metacognition. As a result, students did not understand the value of completing the exam wrappers or the potential advantages of utilizing their reflections. The researchers mentioned that a future study could describe the results when learning objectives particular to metacognition are involved in coursework in the veterinary curriculum.

In contrast, Achacoso (2004) found positive effects from using exam wrappers. Students increased their metacognitive strategies after using them, which was confirmed by their ability to monitor and adjust study strategies and an overall increase in their mean exam scores. Similarly, Thompson (2012) investigated using exam wrappers to enhance metacognitive self-monitoring practices among college students in a Spanish course and compared the results to a control group. The researcher used comprehensive testing to promote greater use of self-monitoring practices with modest results. The exam wrapper group did not show more gains in self-monitoring strategies—as measured by the metacognitive self-regulation scale of the motivated strategies for learning questionnaire—compared to the group without exam wrappers. However, the analysis showed that students in the control group were more proficient in Spanish at the beginning of the study, and the self-monitoring practices changed in the experimental group when students completed posttest reflection exercises and talked explicitly about study strategies in class. In other words, the mean metacognitive self-regulation score increased for students who had completed exam wrappers.

Gezer-Templeton et al. (2017) investigated students' metacognitive strategies, assessed the correlation between study behavior and student performance, and evaluated students' perceptions of exam wrappers. Exam wrapper activities were given as an extra credit assignment after the first three exams in a food science and nutrition course. The researchers analyzed student responses and exam performance, and the findings showed that most students with poor exam performance overestimated their exam scores, which meant students' self-assessment skills could be improved. However, the results also demonstrated the ability to make and implement goals to develop study strategies during the semester. The researchers observed a modest correlation between improving exam

performance and using study strategies, especially for students with a B average on exams, indicating that students within the middle of the grade distribution may benefit most from exam wrappers. Most students believed that exam wrappers helped them improve their study habits and exam scores, and they planned to use the exam wrapper process in future classes.

One of the most important requirements for creating a suitable environment for improving metacognition is that learners must prepare for scheduled classes by reviewing the class content online. This preparation enables learners to interact productively with their peers and teachers by actively participating in discussions on in-depth questions during class. Thus, learners may need to be more motivated to study the class content ahead of time. This motivation can be achieved through the integration of SRL in a flipped classroom.

Çakıroğlu and Öztürk (2017) investigated problem-based learning in a self-regulated flipped-learning (SRFL) approach to develop the SRL skills of 30 male and female Mechatronic undergraduate students. A qualitative design was used to collect the data through discussion-board messages, an observation form, and interviews with select participants. The results showed that students' skills improved but were still moderate. Learning outside the classroom helped them develop environment structuring, goal setting, and planning skills at a high level. The study recommended examining the relationship between the SRFL approach and problem-based learning in different disciplines. Future research could employ an SRFL approach by integrating SRL activities with the flipped-learning approach, and a mixed-methods design could be used for different SRL strategies. Future studies could also use pre-class asynchronous metacognitive activities with the self-reflection metacognitive instrument and exam wrappers.

Conclusion

This literature review addressed exam wrapper issues from different perspectives, providing insight into future avenues of research. However, the study could not answer all concerns about how to implement reflective wrappers to improve metacognition. More research is thus needed to answer this question and determine whether the flipped classroom is a better learning environment to implement and promote metacognitive skills and evaluation practices by having students think about their own thinking.

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Mission HydroSci: Meeting Learning Standards through Gameplay

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Abstract:

Mission HydroSci (MHS) teaches water systems and scientific argumentation toward meeting Next Generation Science Standards. MHS is a game-based 3D virtual environment for enacting transformational role-playing, wherein students must learn new knowledge and competencies in order to achieve the game missions. MHS was developed for middle school science as a replacement unit of about 6 to 8 hours using analytics and a teacher dashboard to support teachers supporting students.

Introduction

Mission HydroSci (MHS) is a game-based 3D virtual environment for teaching and learning key concepts and knowledge of water systems and building competencies in scientific argumentation in ways that support meeting Next Generation Science Standards (NGSS Lead States, 2013). Meeting these new science education goals for middle school students requires rich learning contexts for exploring substantive science ideas through engagement in scientific practices. Our goal is to meet these educational goals for all learners by using online learning to serve those in distance education and rural communities as well as more traditional and well-resourced classrooms, and to use gaming to engage and support students who typically do not see themselves as successful science learners.

MHS is a research and development project funded by grants from the U.S. Department of Education. The grant support has enabled a team of researchers, science educators, learning and game designers, creative arts professionals and software developers to build MHS through an iterative process (Laffey, et al. 2105; Laffey, et al. 2016). The process started with envisioning a powerful fit between emerging technological capabilities and the requirements of teaching and learning to NGSS. Next came conceptualizing a complete system to engage and teach students a robust curriculum and then building and testing each component of the system. The building and testing process has included prototyping, creating design documents such as requirements specifications and storyboards, building initial versions, which can be taken to usability testing and then refined. Once we felt a substantial portion of MHS was playable and met our requirements specifications for teaching and learning activities to implement the curriculum as a game, we conducted usage testing in live classrooms. The usage testing taught us about the practical challenges of using a game in classrooms as well as identifying many areas of game play that needed improvement. Our intention and obligation to the funding sources is to undertake a field test using a randomized control trial (RCT) to rigorously evaluate the impact of MHS game play. The RCT will be undertaken in Winter, 2019. However, to test the feasibility of conducting a large field test in classrooms we undertook a preliminary field test in the Spring of 2018. This report and showcase describes MHS and presents some insights about the use of MHS in classrooms from interviews with 12 teachers who participated in the 2018 feasibility testing.

Rationale for MHS

While MHS is a research project with goals of understanding and testing the potential impacts of a gameplay approach on teaching and learning and of developing game play strategies that map to teaching and learning approaches, it is also a product development project aspiring to build a game that middle school science teachers will use to meet important learning objectives in their science curriculum in ways that align with the NGSS. MHS targets general and earth science courses by meeting learning objectives for understanding water systems and building competencies in scientific argumentation. The MHS game provides an active learning environment for meeting these learning objectives by engaging students in a narrative about needing to investigate water resources and use scientific argumentation to complete missions critical to the survival and accomplishments of the members of their scientific enterprise. The enterprise is set on an earth-like planet in the future as the science cadets (our player and a set of non-player characters who serve as guides, partners and sometimes antagonists) explore mysteries and prepare for survival on the planet. Along with the narrative game play MHS includes learning progressions for water systems science and scientific argumentation, a visually exciting environment, substantial interaction and feedback, and applies transformational role playing as an approach to integrate learning with game play.

The theory of transformational play (Barab, Gresfali & Ingram-Goble, 2010) shows how specific design strategies can optimize the potential of games and gameplay to lead to desired learning outcomes.

The design strategies to enact transformational play include the student taking on the role of a protagonist who must use subject matter knowledge to make decisions and take action during play, and having these actions and decisions transform the problem-based situation. In turn the student's understanding of the subject matter is transformed and so is the student's identity. Virtualization and role playing experiences in MHS are intended to make realistic actions possible and bring the consequences of actions to dynamically impact the world and the learner.

Building competence with scientific practices, such as scientific argumentation, requires learning a progression of competencies, thus multiple practice settings and iteration with feedback must be provided. The game experience helps sustain the student through the many activities as well as makes it OK and natural to fail and try again. MHS is a first person narrative adventure with a sustained learning experience of 6 to 8 hours of instructional time for gameplay and 1 to 2 hours of supplementary classroom or discussion board activity for the teacher to clarify, supplement, and extend the learning from the gameplay.

Game Play

Unit 1

Unit 1 introduces students to (1) gameplay including game controls, characters and narrative, (2) scientific argumentation as a process of using evidence to judge between competing claims and (3) the argumentation engine that will be used to conduct arguments during game play. The design task of unit 1 is to help the player get off to a good start, but also to set the stage for engaging at one's own pace, so as to learn how to succeed in the game and not just to move through the game. The tutorial nature of some of the starting tasks are counter balanced by interesting and fun visuals, learning about interesting NPC characters, and an exciting start to the game.

The unit starts with the player awakening on a space station orbiting an alien but earth-like planet. The player is introduced to ARF who will be an assistant for the player's exploration and activities. ARF is presented as a buddy, given an avatar of a dog, and a high form of artificial intelligence to assist the player. The player also meets Dr. Toppo who is the mission leader and sets up challenges for the player throughout the game. After learning some basics of how to navigate and play MHS as well as being introduced to other NPC's and tools to be used throughout the game, the space-craft is rocked with an explosion and our player must escape the station and fly to the alien planet.

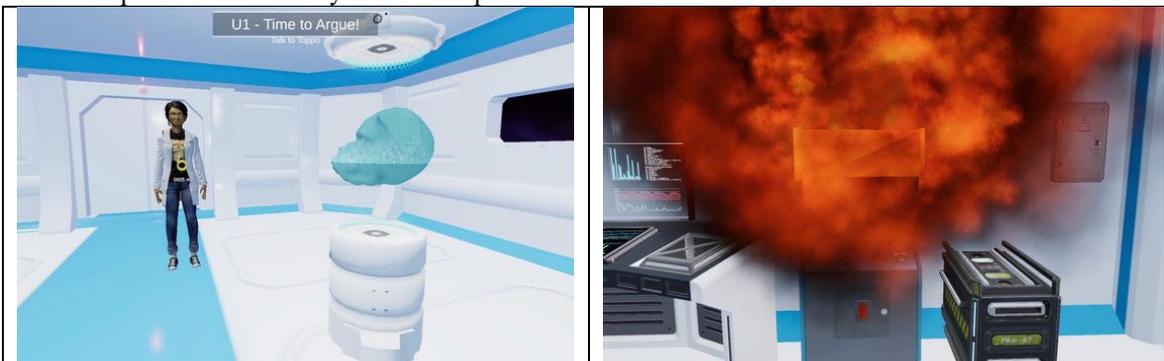


Figure 1: Meeting Dr. Toppo and ARF on the spacecraft and the explosion.

Unit 2

Unit 2 teaches players about topography and using a topographic map as well as understanding watershed and how the relative size of the watershed is related to the amount of water flowing through it. After crash landing on the alien planet our player practices some of the skills they learned in unit 1 while collecting scrap to repair a broken hoverboard and tracking down the communication equipment which they will need to move rapidly on the large terrain and find the rest of their team. In order to find the team they must use a topographic map and respond to clues and feedback framed using topographic terminology. Once they have located the team, our player is assigned the task of finding which watershed is larger and thus best for setting up the base camp for the expedition. After traveling to key waterfalls and gathering evidence our player engages in an argument where she must use evidence to support the claim of which watershed is largest.



Figure 2: Finding the team and reaching the waterfall to collect data about watersheds.

Unit 3

Unit 3 teaches about surface water with the learning objectives of having the player be able to predict the spread of a dissolved material through a watershed and identify the direction of water flow based on a map of a watershed. This is enacted narratively through one of the NPCs, Sam, who needs to set up her camp but her supplies are scattered all over the terrain. Our player must find the supplies and figure out which waterways to use in order to float them back to Sam's camp. Upon completing the task, our player returns to the base only to find that Sam's base is polluted and she asks our player to solve what's causing the pollution by tracing the source of the pollution. The player does this by throwing sensors into the nearby river and eventually will find wreckage from the space station explosion. Our player works their way up the river and then must create a good argument using reasoning to connect evidence with a claim in order to get the pollutant removed. Next, our player discovers that the aliens had left irrigation devices to support growing food in gardens, which will be extremely important for the success of the expedition. Unfortunately, the pumps are old and need to be replaced. By succeeding at solving the first of the dungeon-like puzzles the player unlocks new pumps and then must use their knowledge of surface water flow to pick which irrigation systems to restart.

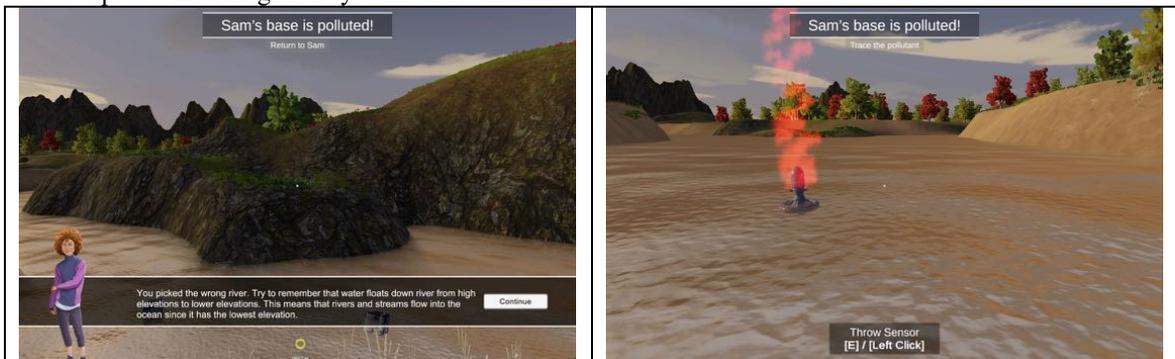


Figure 3: Sam telling you that the crate was tossed in the wrong river and tossing sensor in river to collect evidence for finding the pollution.

Unit 4

Unit 4 teaches about groundwater with objectives of understanding water tables, predicting rates of infiltration based on permeability of the soil type, and explaining the movement of water from the surface to the ground system. Our player is sent off to explore recently discovered ancient alien ruins and finds a drill that the aliens apparently used to access underground water. The drill isn't currently operational, so the player must solve the second puzzle in order to restart the drill and access the water table. This provides a source of water for the expedition but also has the downside of flooding the new bunker facility that Riley, another NPC, had just built. Our player must then explore the bunker to identify if the flooding was caused by drilling or by Riley having built the bunker in the wrong place. Our player must go through the bunker collecting soil samples in order to build a model of how the underground water

will flow and the permeability of the different soil types. By doing this the players collect evidence for which claim is correct and subsequently answers if it was player or Riley's fault for the flooding. Our player must construct 2 complete arguments with claims, reasoning and evidence to sort out fault. Next our player must engage in an engineering task to identify which fountain to flood in order to send water to the base camp.

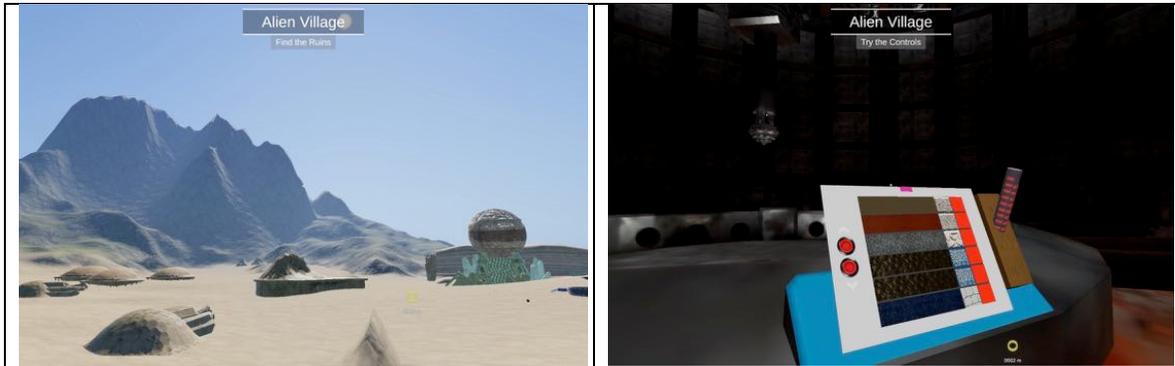


Figure 4: Finding an alien village in the desert and using their drill room to access underground water.

Unit 5

Unit 5 teaches about the movement of water through a cycle focusing on state changes that occur in atmospheric water. The learning objective is for students to understand the energy required for atmospheric phase changes. The player arrives on an tropical island at the request of one of other other cadets, this time Bill. Bill wants to show the player a process that he just discovered, but first the player must solve another of our puzzles. This puzzle requires students to transport seaside water by changing its phases from solid, gaseous and back. By doing this, the player also gains a better understanding the relationship of humidity and temperature. After successful completion the player follows Bill to learn about his new process. He's stumbled across the means to produce salt by "destroying" the water. Unfortunately for the player, an emergency occurs in which the player is trapped without access to drinking water. The player must then figure out how to make drinkable water with only saltwater available to them. Bill doesn't believe that this is possible and the player must convince him through argumentation. After successfully creating drinkable water, the player survives the emergency. Afterwards, the player is asked to recreate the process by which drinkable water is created but on a much larger scale.



Figure 5: Helping Bill create salt from seawater and collecting evidence from the humidity meter to convince Bill that drinkable water can also be created from seawater.

Unit 6

Unit 6 is the culminating experience for our player. There is a planet wide emergency taking place and it's up to the player to figure out what is going on. It seems that water levels are dropping dramatically and if the player can't solve the issue, the planet will no longer be viable for habitation. The player travels back to the previous Unit's locations and takes measurements has to how the water levels in each having changed. The player finds that the Sam's river levels are dropping, Riley's lake is drying out and the humidity levels on Bill's island are lowering. No one believes your findings though and you must convince them that the evidence you've collected leads to something extra-natural. Due to the fact that levels are dropping planetwide, it must be something regarding the alien's advanced technology that must be causing it. Having convinced the group, the player engages on a fantastical voyage that culminates with them transporting to outerspace in order to save the planet.

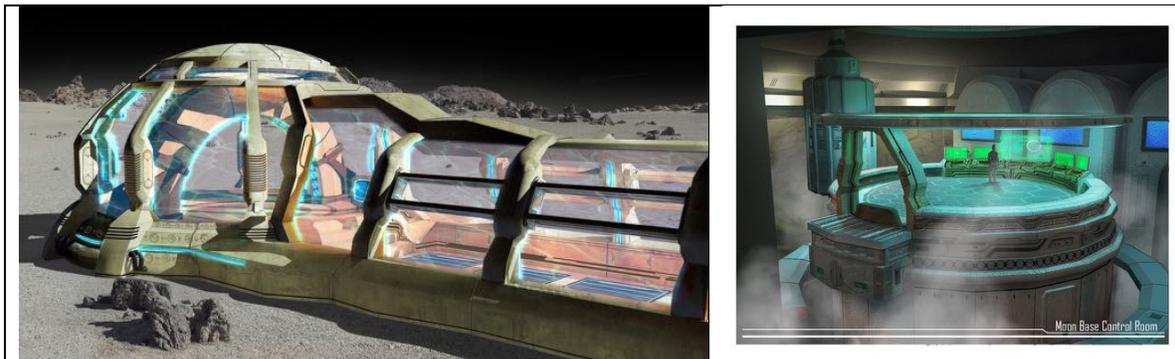


Figure 6: Concept art of the alien walkway needed for teleportation to the planet's moon and the control room for solving the final puzzles to save the planet's water.

Argumentation

A key innovation of MHS is the development of an argumentation engine that does not rely upon preselected evidence sets and structures (Griffin, et al. 2016). Reliance upon fairly simple multiple choice formats can lead to naïve argumentation strategies which are not generalizable to scientific argumentation outside the game context, such as using a process of elimination without reasoning from evidence. The MHS argumentation system uses pseudo openness and regular expressions to create logic rules for how different components can combine. The argumentation engine also allows us to input a number of argument scenarios from simple, such as merely stating a claim, to more complex, with multiple evidence items and reasoning statements

We created a user interface with similarities to a solar system with the claim represented as the sun, reasoning statements as planets, and evidence statements as moon-like entities for the full system. This new structure reimagines the visual representations of connections between claim, evidence and reasoning while still adhering to its underlying model. Players are given the largest possible tree structure without pre-set drop-zones; allowing students to fill out their solar system as much or as little as they wanted. The system therefore allowed us to facilitate pseudo openness and used a simplistic implementation of regular expressions to create logic rules for how different components can combine. We then created a priority list of all the possible player feedback; so that if a player's argument matches two of our logic rules; we can display the most desired feedback. Further, MHS implements support for understanding and making arguments throughout the game play, not just while in the argumentation engine. We highlight claims, reasoning and evidence when encountered, provide narrative for framing an argument such as discussing driving questions, and provide game activities to help players distinguish between claims, reasoning and evidence as well as activities to help players practice critiquing arguments.

Our implementation of support for learning argumentation in MHS follows the empirically-based learning progression suggested by Osborne and colleagues (2013). Their work offers a progress map with levels incorporating construction and critique of scientific arguments. MHS follows this progression by starting with having students make claims, moving to providing evidence to support claims, and then

having students create full arguments. Next students are asked to provide a counter argument to a faulty claim as well as having several chances to critique arguments throughout the game play.



Figure 7: The argumentation engine from unit 5 where the player is convincing Bill that drinkable water can be made from seawater. At this point the player has some pieces of evidence, which are not relevant and will get feedback to make a stronger argument.

Dungeon-like Puzzles

Units 2-5 introduce concepts and have students use their new knowledge to solve a problem, typically to help one of their space cadet buddies. We also wanted students to have the opportunity to use the knowledge, such as about soil permeability or water evaporating and condensing, in a context where they could easily fail and then try again. Adding puzzles to MHS provided an opportunity for putting knowledge into practice, alternative explanations, providing natural feedback, allowing players to fail and retry, and adding fun. We developed a puzzle schema, which we call dungeon-like puzzles wherein players have to move through a dungeon-like space to reach some objective. Movement through the space requires solving mini puzzles in each room or floor to advance to the next. For example a player may have to use knowledge of soil permeability to regulate water flow to fill a waterway to float resources from one room to a next, or use knowledge of evaporation to move water from one area in the dungeon to a next.

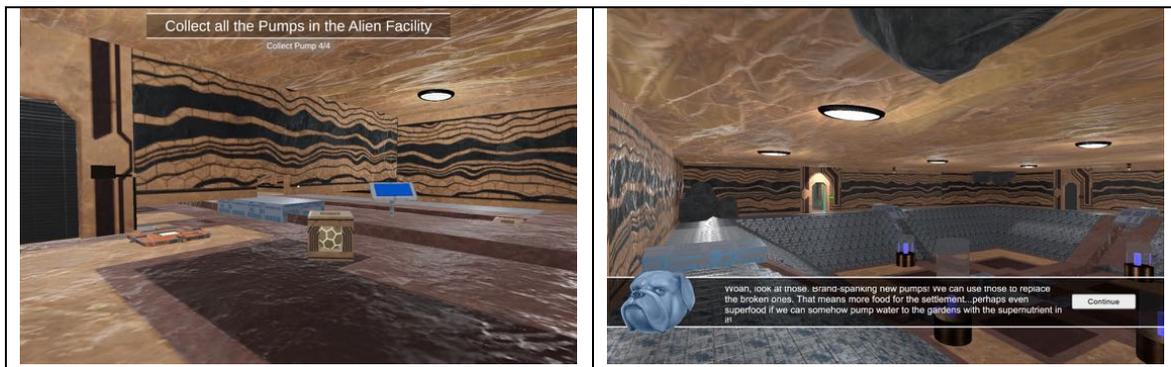


Figure 8: First dungeon puzzle where the player must figure out how to move the power cube to another room for opening the water flow and the second dungeon showing the locked pumps the player needs the flowing water in order to access.

Learning Analytics & Teacher Dashboard

We employ Learning Analytics to provide monitoring and awareness for teachers and to create potential for an adaptive system for student learning and assessment. The analytics track individuals' specific choices, and then analyzes those discrete choices against a backdrop of learning outcomes and argumentation competencies; thus assessment is built into playing the game. The analytics populate a teacher dashboard to visualize student activity and progress. The dashboard for visualizing student activity is designed from a performance support framework to optimize acting upon insights such as recognizing when a student is falling behind or getting off track.



Figure 9: The teacher dashboard shows a column of students and a grid for their progress through the quests and tasks of MHS.

Some Key Feedback

As part of a last design research phase before preparing MHS for an impact study, in the Spring of 2018 we asked 12 teachers to implement a partial version of MHS in their classrooms. The test included 8 days of game play for the kids and followup interviews with teachers. We learned a lot from this test which confirmed that MHS could be feasibly implemented in classrooms and that teachers were generally quite enthusiastic about using MHS with all of them volunteering to be part of any further testing we conducted.

The MHS implementation had a number of bugs and glitches because MHS was not complete nor fully tested against all the operating systems employed by schools for our test. In addition we also found that many of the computer systems students used were under-powered for the MHS implementation. This teaches us that we need to invest in performance optimization of the game, do more complete testing before our impact study and carefully screen schools as well as assist them in using appropriate computers. The state of MHS during the spring 2018 test led to more work on the teachers, school tech support, and our team as we addressed bugs, glitches and slow downs which impacted the teaching and learning experience.

While the MHS implementation included some frustration, the students proved to be highly engaged. Some comments from the teachers reflect on the classroom experience and kids being focused and engaged in MHS play:

Response: I mean, it made my classroom management for the last ten days great actually. They're all engaged and usually when you have a normal class setting, you're gonna have kids doze off or going out, or so, no. Twenty-five kids working on it for a good 40 minutes of class period.

Response: Oh, it was actually pretty exciting to see some of my students that normally may not be as engaged kind of a little more excited about that. So it was mostly like my boys that are gamers that you could definitely tell that they were excited about. I would say that we had almost 100% engagement while playing the game almost every day that we did it. It was kind of also interesting to watch some of the kids help other students. They were more eager to help and show their

knowledge of like, “Oh, you just have to do this.”And so there was just a lot of excitement that came with playing the game.

Response: The days went fast. Like even the kids said like the normal 47-minute class didn't feel like 47 minutes. It flew by because everyone was moving and talking and working.

Typically we think of a single player learning game as simply an individual learning experience or even potentially isolating. However a number of teachers reported on their classrooms during game play as being very social places. One of the comments below reflects a positive social atmosphere that contrasts somewhat with the teacher's experience of how middle school students often interact.

Response: It was very collaborative. I liked that, and they were leaning over and helping each other, and they seemed to be excited and engaged.

Response: I mean, like some people would say something, “I can't figure this out.” And they'd get up and go over there and say, “Go over there, go here.” Yeah. I'd say I wish it happened more in my normal class but no, in the normal class, I know a lot of kids that are gonna say, “I don't understand.” But when they're sitting there staring at the game, they say I don't get it, and nobody says, “Oh, whatever, you're dumb.” They went and kind of helped them, so, I guess it gave them more of a comfort level and then, those that were done I guess had a feeling of accomplishment, hey, I know how to do this, I'll show you. ... there were kids helping kids that usually wouldn't help kids back in a normal classroom setting.

One area needing substantial improvement is the student use of the argumentation engine. We designed, developed and usability tested the argumentation mechanisms, but in the wild, actual classrooms, we found a substantial number of players trying to brute force their way through the tasks. Some students had over 50 trials on a single argument. Scientific reasoning and argumentation is difficult for middle school students so this starts as a challenge, but perhaps the students found the argumentation tasks too tedious in the flow of the game, lacked confidence in their ability to succeed at the tasks, or required more reading and thoughtful activity than the players wanted to invest. Subsequent to this testing we have done substantial revision to leading up to the argumentation tasks, support within the tasks, improved feedback, and improved support for the teacher as she/he seeks to help the students. One teacher summed up what she saw in her classroom.

Response: They got frustrated when they reached the argument stage of course. They wanted to answer now. They didn't really want read to find the answer, so, that was – I think that was the frustration level.

Response: It just became like a manipulation guessing game. Well, I have this reasoning, let me try evidence one, two, three, and four. Oh, that doesn't work, let me try one, two, three, and five. Oh, that doesn't work, let me try one and two.

While argumentation needed improvement to meet our expectations for student learning, teachers reported that students were learning from the game play:

Response: I had a girl who for two years I've been trying to teach about why the oceans are salty and things like that. And all of a sudden, she's like, "Oh, no way! It's salty because water's evaporating." And I'm like, "Really? You got it from there from an argument in a game?" Like it was just so cute to see them get so excited because they learned something.

Response: I think it was a fun way to learn science. I think it just made it a lot more interactive than me standing up and lecturing, and [students] taking notes.

Response: this is coming from a perspective from somebody who understands the scientific content. Once I saw them figuring it – figuring out things in the game, once I realized, “Ah, this is what they're supposed to do here.” It's a great way to teach that concept,

Response: A lot of them were playing the game as if they were actually the character and I guess it was almost like first person. First person experience and that they were actually trying to solve the problem as if they were the ones who were trapped or whatever, and you feel like, so they actually had a reason to try and kind of be in control of their own learning, whereas when I give them certain assignments that they're not that impressed with especially if they're on paper. They're like, why

are we doing this? What does this have to do with me? That kind of thing. Why do we need to know this?

Response: I wish there was more games like this because it really engages students and it – I think it’s more authentic and I think it makes them think more like a scientist.

Teachers also reported that the game play enabled students who were not typically high achievers to engage, achieve and even become leaders in the classroom.

Response: I had students who, like for the first time that they’ve been with me, seventh graders, and I’ve had them for two years at that point. They said this was the first time that they felt like they got to use their strengths to show that they actually knew science. I thought that was kind of touching.

Response: Yeah, that was actually really neat cuz I mean, the cool thing about the game was that some of the boys that maybe aren’t so good at paperwork really – I mean, they took off with this and were like the leaders, and so they got to help other kids when they were having problems, or they finished ahead of other people that normally, they’re never the first ones to finish or – so it was really cool to see some of these kids that normally, aren’t the leaders. They became the leaders and that was neat. And then some of the girls that aren’t really gamers but are more textbook learners weren’t – I mean, they’re used to having everything come easy. I think this was a little hard for them because they just don’t play video games very much.

Response: Yeah, one of them is gifted but he’s also autistic and has severe – it’s like his social skills and being engaged sometimes. And he has a hard time communicating on paper but he’s super, super sharp, and so that really – he was able to really shine during this. So that was really awesome actually. He ended up being a really – a leader which was really cool because it gave him a chance to go around and talk to other kids too, so. But he helped me.

Response: I could definitely say that and not only just the SPED kids, but some of my – the normal, I hate to say normal, but yeah. Normal kids but that were really kinda low and never seemed to really get anything. As a matter of fact, one of those girls, she was the first to finish and then she was bee bopping around, guiding people and stuff and typically, she’s the girl that when I call on her, I cringe because I know she’s gonna get it wrong.

Gaming seemed to bring out non-typical school responses. Typically high performing students did well in MHS but some struggled as they found gaming to emphasize different approaches than they were used to and enabled other students in the class to shine. Differences were also noted between boys and girls as well as across grade levels, but not all the differences were consistent from teacher to teacher.

Response: I had some kids that were so into it, it was pitiful. They were just – they were chomping at the bit and I had some kids that, “This is stupid. I wanna do bookwork.”

Response: These students in our seventh grade that participated definitely interacted vocally but more just in their reactions and our eighth graders interacted vocally and physically in a sense that they would go to the person next to them and they would help them out, explain things, and kind of verbally talk through the problems whereas our seventh grade was kind of more like, “Whoa, look how funny that person looks.” And they just kind of found like, “Oh, you have to meet them in the corridor or in the walkway through the mountain.” And so it was kind of interesting to see that big of a change between the two grades since I mean, they’re in the same setting.

Response: You could go through and when you’re going through and you’re setting the sensors in the river, the kids that really do a lot with their just studying stuff, they would set one or two sensors and expect all the data to flow in, and the guys sitting next to them were like, “No, you gotta go all up and down the river. Go in the little inlets and all that and see where it is.” So they would be helping out in that respect whereas the ones that were really like I said, the book learners, they would expect they push this button once and all the data to flow into their mind.

Next Steps

As noted in the introduction the MHS team is planning a substantial field test of MHS for the winter/spring of 2019. To reach the field test we have prioritized several objectives. First, we need to

achieve technical soundness, optimization to perform on as low a performance computer as possible, and clear direction for what systems will work. Second, improvements across a range of quests and tasks to better achieve learning outcomes. Third, making argumentation a better fit to the rest of the game play and providing support for students who are likely to struggle with the competencies. And fourth, support for low readers by adding audio for dialog, low gamers by adding better feedback, clearer graphics, more tutorials and simplifying some game mechanisms and activities, as well as support for high gamers by enriched graphics, rewards and side quests. More information about MHS can be found at MHS.missouri.edu or by contacting the authors.

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Portrait of a Modern Online Graduate Student in Educational Technology: a Panel Discussion

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Abstract

This paper summarizes the discussion at The Association for Education Communications and Technology (AECT) Conference that was held in Kansas City, Missouri on October 23-26, 2018. The objective of the panel was to discuss the current state of being an online graduate student in educational technology and identify future support and research directions to support the community. The panel consisted of two faculty members and three students from two large universities within the United States. The diversity of the group is within their individual experiences and current place in formal education and career. Each panelist was asked a series of questions. They were then able to describe the current online environment from their perspectives. Several common themes arose including program support, online community built, project based work, and finding balance with school, work, and life. These are discussed in turn along with future directions identified by the panelists.

Introduction

Across the United States, colleges enrolled more than two million students exclusively at a distance in 2014 (Allen & Seaman, 2016). Many of those students are graduate students as many institutions prefer to start offering graduate programs at a distance due to less required curriculum credits (Allen & Seaman, 2016). The popularity of online programs could be attributed to adult learners wanting more flexibility in learning environments and being ready to access education (Ilgaz & Gülbahar, 2015).

To gain a better understanding of how online graduate programs in educational technology are viewed and being implemented by research institutions, a panel discussion *Portrait of a Modern Online Graduate Student in Educational Technology* was held at The Association for Education Communications and Technology (AECT) Conference in Kansas City, Missouri on October 23-26, 2018. The objective of the panel was to discuss the current state of being an online graduate student in educational technology and identify future support and research directions to support the community. The panel consisted of three students and two faculty members: (1) Anna R. Leach from The Ohio State University, (2) Cara A. North from The Ohio State University, (3) Natalie R. Gintert from The Ohio State University, (4) Dr. Ana-Paula Correia from The Ohio State University, and (5) Dr. Leanna Archambault from Arizona State University. Each panelist was asked to discuss why they chose educational technology, identify challenges in programs and provide insights into building online community and the future of online programs.

The discussion began with each participant sharing their unique backgrounds in formal education and how it has shaped their perspectives. They also shared a little about their personal background to provide context to what they manage outside of the online program. The student panelists also discussed the challenges of balancing their outside life responsibilities with those that were specific to the online classroom. They described how projects brought them together and created transferable skills, outlining various projects such as one that required working with a client internal to the university who needed aid in building an online learning environment and improving an existing online course. The project took the entire semester and included a needs analysis, multiple reports, and a final presentation to the client. Another class project involved evaluating a learning tool and consisted of a context report, a pilot plan and tryout, and two live class presentations. The skills built from these projects were transferable skills such as the ability to work with a client, present at a conference, and create innovative learning environments. In addition, the panelists also reviewed the practicum process that is the culmination of the master's program. The practicum is an applied educational technology online course that consists on a 12-week project with a real-world client. The work in this class is structured in different types of deliverables and overseen by the student's advisor. It culminates with a presentation to the client and the student's committee since this is the program culminating project. Students shared how the practicum project and other portfolio activities impacted their world outside of the online courses and after graduation. Being able to handle the large workload of online courses while keeping up with professional and family demands is a unique challenge, and the panelists shared their experiences, struggles, and strategies when it came to managing it all.

The faculty members shared their universities' program structures and describe the expectations for the students. Faculty described specific support structures, including online discussion forums designed to get students involved before classes begins as well as efforts to offer them a programmatic well-round and rich learning experiences. Strategies for keeping online students engaged, not only in class, but in the online program as a whole were discussed. Supporting graduate students in an online degree program as individuals and understanding their complex needs, as learners, parents, and employees, among a host of other roles, was a key topic of discussion.

The remainder of this article summarizes the discussion that occurred at the panel and is intended to serve as a record for the online graduate student community that were unable to attend.

Please introduce yourselves and share your background for the audience.

Anna Leach:

I am currently a PhD student in Information at the University of Arizona. I finished my Master of Learning Technology degree online through the Ohio State University College of Education and Human Ecology in the fall of 2017. While working on the master's degree, I worked part-time, remotely from Tucson Arizona for the Ohio State University as a data analyst. I returned to school in 2016, 12 years after completing my Bachelor of Arts in Mathematics in a traditional face-to-face program. I have had online classes before being accepted into the masters program, but only one at a time and only occasionally. I am also a wife and mother of 2.

Cara North:

I am currently a PhD student in Educational Studies with an emphasis in Learning Technologies at The Ohio State University. I started in the Master of Learning Technology degree online through The Ohio State University before transferring into the doctoral program. I am a full time learning experience designer for the College of Education and Human Ecology at The Ohio State University and have worked in learning and development for all of my professional working career. I've worked for various non-profit organizations and as an instructional designer for Amazon.com. I'm also addicted to volunteering and serve as President-Elect of the Central Ohio Chapter of the Association for Talent and Development, Founder and past-President of Toastmasters International at The Ohio State University, Community Manager for the Training Learning and Development Community, and was recently elected to Communications Officer for the Research and Theory division of AECT. I also co-host a learning and development podcast called Instructional ReDesign with my good friend Joseph Suarez.

Natalie Gintert:

I just recently graduated with a Masters in Learning Technologies and work full time as a Program Manager. I run training programs that teach mid-career professionals leadership management skill. With the use of my degree, I'm currently working on implementing online learning into one of our credit bearing programs - The Certificate in Public and Nonprofit Leadership.

Dr. Ana-Paula Correia:

I am an associate professor in learning technologies in the College of Education and Human Ecology at The Ohio State University. Recently I have started a new leadership role as the director for OSU's Center on Education and Training for Employment. I am currently the faculty co-coordinator for OSU's master of Learning Technologies. I share this role with my colleague, Rick Voithofer. I have more than 25 years of experience in learning design and instructional systems technology. Specifically, my expertise in distance education, online and mobile learning, collaborative learning and entrepreneurial educational approaches have been published in many academic journals. In 2017 I co-authored the book, *Teaching Online Simplified: A Quick Guide for Instructors* with my former doctoral student, Farrah D. Yusop. At OSU I've founded the Learning and Experience Design Research Group, a group dedicated to investigating learning design processes and pedagogies to create deep learning. I am an active contributor to the AECT, serving as President (2011-2013) for the Research and Theory Division.

Dr. Leanna Archambault:

I am an associate professor in learning design and technologies in the Mary Lou Fulton Teachers College at Arizona State University. I am the program coordinator for ASU's Masters of Education program in educational technology. My research areas include increasing sustainability literacy among pre-service and in-service teachers, teacher preparation for online and blended classrooms, the use of innovative technologies to improve learning outcomes, and the nature of technological pedagogical content knowledge. I'm the Co-Editor of the *Journal of Online Learning Research*, focused on K-12 online and blended learning, and I am the Associate Chair of the Information Technology Council for the Society for

Information Technology and Teacher Education. I am also co-PI on a grant funded by the U.S. Department of State, to provide technology-related professional development to international teachers during a semester-long residency at ASU.

Why did you choose to be a part of an online masters program in the field of educational technology?

Anna Leach:

I have always enjoyed the idea of training or teaching people to become more skilled in their jobs. For example, as a data analyst, I had the opportunity to train fellow university staff members on the student information system. Teaching them how to use MS Access to gather data about their populations so that they could make data driven decisions. I love the expression on people's faces when they realizes what they can do. However, asking staff to sit in a face-to-face classroom for 8+ hours can be difficult and retention of the information is unlikely. We recognized that it would be much easier for the person to be able to have the information readily available to them for their own consumption. This is where technology can and should be utilized. With this real-world example and my desire to start pushing my career into the teaching and research arena, I started to explore programs; educational technology was an obvious choice.

Cara North:

I fell into the profession of learning and development after I started my professional career in a call center. Since then I have worked in corporate and higher education settings in learning and development. Seeking a degree in educational technology was important for me to ensure that my on the job knowledge wasn't full of holes. I appreciate the theories and history that I've learned throughout the program and I can see how it's made me a thoughtful designer.

Natalie Gintert:

For me, I was looking for a degree program that merged my work experience and my bachelors degree. I received my undergraduate degree in Electronic Media Productions, and ended up working in Higher Education in training and professional development. So, I really saw educational technology as a way to merge my skills. Additionally, I wanted to learn more about the theories behind online learning, specifically how do you build communities well online. I felt like it was just a natural fit that the program that was teaching you about using technology in education used technology to deliver the learning online. I found a few degree programs that were teaching educational technology, but were not offering course with the use of technology. So, I end up in the program I graduated from because I appreciated that it was talking the talk and walking the walk.

Dr. Ana-Paula Correia:

When I started my position at The Ohio State University I was pleasantly surprised and excited to find out that I would be teaching exclusively online to a newly created online program in the learning technologies. The master of Learning Technologies (MLT) is a professional degree that focuses on applying current research to solving problems of practice relating to the use of technology to support learning in a various in-person, online, and blended contexts. Students in the degree take a core sequence of seven courses, a research course, one elective course, and a practicum course, completing 30 credits in total. This was the perfect opportunity to continue researching about online learning and teaching while bringing to life many teaching strategies that I had tested and validated in previous online courses at a different university. I instantly embraced this opportunity.

Dr. Leanna Archambault:

After two major college reorganizations, it was necessary to combine one masters in ed tech focused on K-12 teachers and another masters in instructional design focused on the workplace/higher education. We came together as a faculty and decided to move the program to an online format to be able to target a national or even international audience. The program emphasizes the design of learning technology environments, systems, applications, and instructional materials for multiple learning contexts. The program prepares learning design and technology professionals for a variety of settings, including business

and industry, and for formal and informal educational settings, such as K-12 and higher education, museums, and nonprofit, and government organizations.

What do you believe are the greatest benefits of the online masters program?

Anna Leach:

Flexibility and reachability. As a parent, it is difficult to be able to find care for children around a school and study schedule. Online learning allowed me to attend class with a sick child on my lap or while in the audience of taekwondo practice. I was able to keep my family as a number 1 priority while still reaching for my goal. The flexibility of the online program made the impossible feel possible. Second, I say reachability because of the people that can be reached. I enjoy meeting new people and gathering perspectives. There were people from all over Ohio in our program! The insights brought to the program made it a richer experience.

Cara North:

Online education allowed me to control much of my learning. If I wanted to dive deeper into a topic, I could and often bringing those insights into course discussions were valued. I appreciated seeing many of the instructors wear a facilitation hat versus being a sage on the stage. This allowed for more authentic learning experiences.

Natalie Gintert:

I found the online format to be easy to fit into my everyday life. I'm a working professional and my days are typically mapped out from 8:00 am to 5:00 pm. So, I really loved that I could schedule my education into my busy day. I could look at my schedule and when I had 15 or 20 minutes I could take a break from work and focus in on learning. I didn't have to wait until class time to learn something new. A Lot of times I would learn something in the course that I could apply right away at work. There was no, taking notes and trying to remember to implement it later. I had that instant connection to how to make this practical.

Dr. Ana-Paula Correia:

One of the greatest benefits of an online masters program, from a faculty perspective, is the opportunity to offer a high demand "product." Such is going to meet the needs of many professionals that are eager to advance on their careers or go after a career shift. Additionally, when starting a new online program, faculty and staff have the responsibility to create and maintain high quality online learning and teaching experiences. One aspects of the master of Learning Technologies that our team at The Ohio State University is particularly proud is the Practicum experience. In every course, students create learning artifacts that are included in a portfolio that is developed as part of the Practicum. However, the biggest strength of the Practicum experience is to work with a real-world client, identify an instructional problem and address that problem with a tangible solution. The Practicum is a structured online experience carefully guided and supervised by the student's advisor. It includes five distinctive milestones, as for example, establishing a memorandum of understanding and regular progress reports to the advisor and client.

Dr. Leanna Archambault:

I think one of the greatest benefits for our students is the flexibility afforded by the online format. Our students take 1-2 courses in a 7.5 week format. This allows them to focus intently on course content, while juggling their work responsibilities. They can complete the degree in as little as 18 months or if necessary, take one course at a time and go at a slower pace that would allow them to better balance work and family obligations. It also allows for rolling enrollment, so students can start the program in either in the fall, spring, or summer. Many students have indicated that without the online format, completing a master's degree would not be possible. They need to be able to continue to work and care for their families, so online courses are realistically the only viable alternative.

In addition, the online format allows us to attract student from a vast array of contexts and backgrounds. Given the diverse nature of backgrounds, students have the opportunity to work with one another and share their knowledge and understanding, applying design to various contexts.

What are the challenges of an online masters program in educational technology? What strategies have you utilized to overcome these challenges?

Anna Leach:

Time management was and is a big hurdle for me, but I also feel the sense of isolation can be an issue in an exclusively online program. With respect to time management, it was important for me to know what was expected of me as soon as possible with respect to the program and the individual courses. Trying to plan workload around work and family is critical to successful time management. It is better for me to know what the schedule is and important due date even before the class began. It was also crucial for communication between the instructor and myself to be timely. To overcome or avoid a sense of isolation in the program, I had to recognize the community that was available to me. The discussion boards, although they can be underutilized or not utilized properly, were a place that I could read others work, but the synchronous sessions in which students either presented or spoke or chatted were really where I felt a sense of community most. These chance to learn together and have timely conversation helped the program feel like a community of learners instead of isolated learning.

Cara North:

My biggest challenge is balancing school in addition to being a full-time learning experience designer. It has been difficult to sacrifice time away from my family and friends but I keep telling myself it will be worth it. I also struggle with making myself do tasks that I find boring or not applicable. For example, despite being an instructional designer for ten years, I still had to take an introduction to instructional design. I wish I had the opportunity to demonstrate the competencies in the course to test out of it. I found I was disengaged in the course but took the assignments to push my skills more. For example, despite the course wanting a report, I created a report and a digital visual aid in a tool I hadn't used before so I could learn a new skill. While I was motivated to do that, I fear many online graduate students aren't.

Natalie Gintert:

I found it difficult to accomplish the weekly discussion posts. Sometime, I felt like assignments were just a way for the instructor to make sure I read the materials. Not to see if I was actually learning and understanding the concepts. Is a discussion prompt always the best way to see that a student is understanding the materials? I would argue no. I think we need to think about how students can start to apply the concepts as soon as we give them to them. Not just discussing how they "felt" about them. But having them think about how they can use the in their life and work.

Dr. Ana-Paula Correia:

One of the biggest challenges to overcome in an online masters program is the feelings of isolation and disconnectedness as a learner. Feeling disconnected from their peers and instructors as well as from the program, department, college.... Another important challenge is not having their unique skills and knowledge as professionals in specific fields valued or even acknowledged. As adult learners (Knowles, 1996), these students have much to offer. For example, adults want to know why they should learn something. Just to say this is good for them to learn is not enough. A reason for learning something needs to be offered. Adults have many life and professional experiences that they have accumulated (e.g., work-related activities, family responsibilities, and previous education). While teaching, instructors need to connect learning to this knowledge/experience base and use it whenever it is relevant to the topic. Adults are goal-oriented. Upon enrolling in a course, they usually know what goal they want to attain. They, therefore, appreciate an educational program that is organized and has clearly defined elements. Instructors must show participants how this class will help them attain their goals (Yusop & Correia, 2017).

Dr. Leanna Archambault:

One of the challenges we have faced, in addition to those already mentioned, is being able to structure longer term group projects given the 7.5 week format. It's a fast pace, and while there are a number of advantages, one of the challenges from a design perspective, is getting students organized into groups. They struggle trying to coordinate across time zones and work/family schedules. We have tried to address this by better aligning content across courses so that projects can have a longer term. We have also been mindful to make sure the learning outcomes indicate a need for group collaboration and have been strategic about where we incorporate these projects.

From an administrative perspective, we have a lead instructor for each course (who is typically a tenured/tenure-track professor) and then a number of academic associates (AAs) who each have a group of students for whom they are responsible. This structure works well with academic associates who have experience, but it can be a challenge to attract and retain them, given the nature of the supplemental work, so that is an ongoing focus. Making sure that the AA's stay on track and that there is a close working relationship between the lead instructor and the AAs is important.

What are systems and support structures from a program and/or university level that can be helpful to graduate students in completing the program. How can faculty help support online graduate students?

Anna Leach:

My favorite part of the program was the opportunity to present the information that I learned. Not only did my professors have facilitation as part of the curriculum, but they also pushed us to present the materials from projects at conferences. Prior to this program I had never considered a class project to be material worthy of presentation, but their suggestion gave me confidence in my abilities. Because of that, I have presented with my group and met many driven individuals which has grown my community further. I have also made myself more marketable in the profession and to the PhD programs that I applied to.

Cara North:

One of the best ways for faculty to support online graduate students is to get to know them and their strengths and areas of opportunity. I knew I wanted to grow in visual design and analyzing data and I was able to work with my professors to target assignments to challenge me in those areas.

Natalie Gintert:

I think providing opportunities for students to apply their new concepts is key for a successful program, online or in person. I think sometimes academic programs get too caught up in making students good writer, which is good. But, how can I translate the 5 research analysis papers that I've done into skills I can use for a job. Sure, I know how to think critically and I have an understanding of current research in this area, but do I have anything where I can show an employer "this is what I've done and here is the system I used to create it".

Dr. Ana-Paula Correia:

I order to support online students, faculty needs to establish a frequent and consistent communication system with their students . Not only for checking students progress towards graduation, but as importantly to build and enhance their confidence as online learners. I believe this instructor presence needs to be particularly strong on the first weeks of the course to establish a working relationship. Even prior the class starts I get in touch with the students enrolled. I always send a welcome email that spells out the expectations for the first two weeks of classes. Also if there are any live sessions during the semester I let students know the dates and times so they can make arrangements to attend these sessions early in the semester. I use chat and video conference to stay in touch with my online students. The message is that we are in the learning journey together and that I am there to help and guide them towards success.

Dr. Leanna Archambault:

It's important for online graduate students to know that there are many resources offered by the university that also are available to them, including writing center support as well as counseling services. Making sure students are aware of these supports often falls to faculty to share/encourage students to seek them out. Often, getting students simply to reach out to the instructor takes some encouragement, particularly when "life happens." I was encouraged to read of Reesa-Marie Dawkins' statement included in her syllabus that reads, "When life happens, send me an email...I can give extended grace periods, tutor you one-on-one by phone, be a good listener, offer a list of campus resources, and help you catch back up, if you have fallen behind" (Supiano, 2018) I try to take a similar approach, but I have to emphasize to students that they need to reach out and let me know so that I can help. Being approachable and student-centered is essential when teaching in an online program, and given the hectic nature of all of our daily lives, it's imperative for faculty to be understanding and to work with students as issues arise to help ensure their success.

How important is the online community in the program? How did you build your online community? What supports has your community provided?

Anna Leach:

The online community was critical to my success. As we have all mentioned, we learn from each other and our faculty. Their support and the ability to be supportive is the right environment for learning. Dr. Correia taught me to put our work out in the open, to be shared. She introduced me to the AECT conference and Dr. Savenye; who then introduced me to Dr. Archambault. Cara introduced me to twitter and an entire world of instructional design professionals who apply the research. And for the first presentation at a professional conference, Natalie and Cara were by my side. My community has brought me intellectual and emotional support. As I said before, I had a fear of feeling isolated, but this community kept me grounded.

Cara North:

I would be nothing without my online community. I often tell peers that it is easily the number one mistake I've made in my career as a student and professional. Network, network, network. I learned this lesson the hard way when I moved to Columbus, Ohio and left my job as an Instructional Designer of 5 years for Amazon.com. While working at Amazon, I had a balanced team of designers and editors and I didn't realize how valuable they were until I went from a team of 40 to a team of 2 in my role at The Ohio State University. While I could still network with my former colleagues at Amazon, I found they spoke so much corporate jargon that it was not beneficial to me as a learning designer. In 2016, I met a learning and development professional through a local professional development society, The Association for Talent and Development. He changed my life by telling me that Twitter was the number 1 professional development tool for learning and development professionals. I was so engaged by what he said, I decided to sign up for Twitter. Two years later, I have a network of learning and development professionals from all over the world. I like to say that when you work with me, you don't get me but you also get my network. My community has provided me a wealth of knowledge and helped me identify opportunities for leadership and engagement. The best part is that I have a passion of helping others connect and I try to pay that forward by offering opportunities to others.

Natalie Gintert:

As Cara stated, the community was everything for me. I would not be as enthusiastic about online learning or educational technology without my community. I learned so much from the students I actually accomplished projects with. In our program we worked through a large project with an outside clients, so it was a really easy way for me to learning how to actually "do" it in a low risk environment. At the end of the day that will be what I remember the most, the people and what I learned from them. I know that I could reach out to any of my team members and ask them for some feedback and have a better product because of it.

Dr. Ana-Paula Correia:

The online community in the program is critical to everyone's success. To the students' success, but also to the faculty, staff and the program in itself. One strategy that I use is creating a space and opportunities for getting to know each other. There are multiple ways to get to know your students online. For example: Use a discussion board on the learning management system you selected to create a discussion thread titled "Class Introductions". Ask each student to introduce themselves in the discussion board by stating their name, gender, current job or working experience, country (for international students), etc. Ask students to post photos of themselves, their families, pets and/or place where they live. Most international students will be proud to share information about their countries and customs. Encourage students to use audio segments and video clips in their introductions. As the course instructor you should be the first to post your introduction on the discussion thread using different types of media to model what is being asked from the students. A virtual cafe is set-up in class to allow for social interactions throughout the entire course. This year we have invited faculty and students for an happy hour that is going to take place at the student union where remote students and faculty can join via videoconference. This is a program level initiative to support community building.

Dr. Leanna Archambault:

The online community is absolutely essential for students in an online masters program. As faculty, we make connections, but then encourage students to build upon these introductions and extend them, creating a vast support network. Particularly in their first core course “Foundations of Educational Technology” students create a multimedia “All About Me” presentation using any medium of their choice. After this assignment, students quickly form bonds and enjoy having one another from one course to the next. We hold informal “Coffee Chats” online where students can come by and talk to faculty and advisors. We also have an Ed Tech listserv that students subscribe to. This allows them to stay connected with program alumni, many of whom are now professionals in the field, and are looking to hire from our recent program graduates. This listserv has served as an excellent source of online community, particularly when it comes to job or internship placement.

How do you envision online graduate programs to evolve in future? What will your online program look like in 2025? Will there be a need for it?

Anna Leach:

I expect them to keep improving, but yes, there will always be a need for them. I expect them to utilize new experiences and opportunities, in combination with new and existing technology, to create better learning. I expect them to continue to push their students to be innovative. I expect the online educational technology program to be the best online program.

Cara North:

What is old is new again. The future of online graduate programs for me is to model an apprenticeship. For example, in educational technology often students learn about theories and lack real world experience to build upon those theories to build learning artifacts that could be used in a higher education or corporate setting. Students in online graduate programs may struggle with making connections to internships and work opportunities so having a system in place like a matchmaking application to pair work with capable students would also be a great advance that would result in more win/win opportunities.

Natalie Gintert:

I’m hoping my 2025 not only is technology more advanced, but our thinking about how to use the technology is more advanced. I think there will always be a need for online programs, people will always be busy. But, I’m hoping we moved away from checking an online box to more project based... application of a concept.

Dr. Ana-Paula Correia:

There is going to be a need for online programs in 2025, but current online education needs to evolve into rich and authentic learning experiences. For example, internships, employment during college, volunteering, and extra-curricular activities provide opportunities for people to showcase how they apply their knowledge and skills, make decisions, and create solutions in real working situations. As part of the master of Learning Technologies, we have an optional 1 credit course that online students can enroll to be part of a virtual internship opportunity. The purpose of this course is for online students to have the opportunity to engage in real-work experiences in a variety of workplace settings. These experiences do not require the students’ physical presence in the internship site as most of these will be supported by technology and are unpaid. The goal is for students to strengthen their professional portfolio and augment their programmatic experiences, especially at the master’s level. These experiences are mainly in 4 to 6-week projects and may consist of: (1) participating in the development of an educational product through various activities (e.g., conducting a needs assessment, reviewing various prototypes, assisting with the design); (2) assisting with design and development of training modules; or (3) assisting leadership on making learning technology-related decisions.

Dr. Leanna Archambault:

I think technologies that facilitate learning will continue to advance and we will see increased use of personalized learning in the masters program. There is certainly a need for the program to continue to

evolve to better meet the needs of students. Currently, we only have one elective in the program. We may want to expand to allow for additional student choice in the masters program. In addition, expanded internship opportunities prior to the applied project, to allow students more real-world work experience may be another direction to pursue. Across so many industry areas, we see a growing awareness for the need for instructional design, so making sure our students have the necessary skills to hit the ground running is always a primary focus. This ensures the necessity for our program, but we need to be willing to make adjustments to make sure the degree continues to be relevant.

The panel presentation shared the challenges and rewards of participating in an online master of educational technology program. Each institution has constructed ways to support the student for success and suggested ways that the program can do better. Each panelist conveyed that time management and organization are keys to success online. They also believe that progression in technologies will help facilitate learning. Finally, they emphasized the need to create rich experiences for authentic learning.

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Recognition of Punctuation in Voiced And Unvoiced Speech For iB-CET*

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Abstract

The paper discusses the feasibility of punctuation recognition in oral delivery through voiced and unvoiced speech detection. The paper is firstly focused on introduction of iB-CET, in an attempt to clear away possible illiteracy of linguistic perception and speech recognition technology. Secondly, the paper provides some touches on how linguists interpret punctuation, thus inducing the third part in interpreting engineer's concept on punctuation relying on Bark wavelet transform parameters and subspace analysis in speech punctuation recognition. Finally, through experiments, the paper convinces readers that punctuation in speech can be accomplished, hence leaves much thought for the notion of punctuation recognition in speech for oral delivery.

Keywords: punctuation; voiced and unvoiced; iB-CET

I. Introduction

The present Internet-base College English Test (iB-CET for short) is getting popular, though some scholars are still arguing against its credibility and feasibility. Designed and planned in May, 2007(Jin Yan, & Wu Jiang, 2009), the iB-CET got started among 53 colleges and universities in 20th of December, 2008 so that China made a milestone in computer-based test rather than paper-based test for high education in history(Liu Jian-gang, & Dong Jing, 2011). The main feature of iB-CET aims at oral delivery in the exam. This marks the very breakthrough in oral test to paper-based CET, owing to the contribution of speech recognition technology based on auto-computer scoring system. The oral test takes a proportion of 10% in the whole test marks in iB-CET, making a revolution in the paper-based test system, hence the iB-CET system comes into life, a wonder in Chinese education for English teaching. Anyhow, for whatever reasons and senses, the design and plan worked and became accepted by the authorities and faculties in educational fields(Jin Yan, & Wu Jiang, 2009).

However, the most challengeable argumentation results in the credibility of speech recognition of test contents in oral delivery, because nobody can find a satisfactory explanation on the technology and software design of speech recognition model in oral delivery on the official Website of CET(www.ccets.org). All doubts come from the

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ignorance of linguistic perception and speech recognition on oral delivery detection model of the target language, leaving much to be explained by linguists and computer engineering scientists.

This paper attempts to clear away possible illiteracy of linguistic perception and speech recognition technology through an illustration by oral test scoring method with recognition on punctuation in voiced and unvoiced sound in oral delivery, trying to convince people involved that iB-CET could work in some ways.

II. Linguistic Perception on punctuation

Linguists feel strongly the movement in higher education to replace or supplement traditional pedagogical methods (eg paper-based or face-to-face learning) with online learning has seen considerable acceleration in the last few years, especially in relation to distance learning(Lisa Emerson, & Bruce MacKay, 2011). In traditional pedagogical methods, students can easily respond to teachers according to the contents in written form, deliberately noticing all kinds of punctuation while uttering in perfect pauses, making no syntactic or semantic mistakes. For example, in paper-based oral test, students are usually required to read the text as to be tested about their fluency and accuracy in understanding of the content. Hereby, we have to notice that students can make perfect contextual understanding of the reading material with assistance of punctuation such as comma, full stop or exclamation marks. Since the material is entirely text based, the students can easily take care of the structure of the content, making a perfect answer to examiner, which leaves us with a conception that punctuation is very important in syntactic and semantic understanding of the material in paper-based test. So, a question emerges into people's mind what is the role of punctuation in learning and test?

Throughout its history, punctuation has been employed for varying purposes(Robert J. Scholes, 1990). What was originally used to signal breath breaks in reading aloud has in the course of time come to signal for the most part division into structural units in both silent reading and reading aloud, thus serving to disambiguate meaning and provide clues for coherence of the written. Punctuation in the written is not an adequate substitute for prosody in spontaneous spoken discourse; punctuation has, therefore, only a remote relationship to prosody. However, in the case of reading aloud, the relationship is much closer. And even in the case of written texts themselves, punctuation can be used to simulate spontaneous spoken discourse, "What the hell!" for example.

We know that the written was originally without punctuation; such a script is formally designated as *scriptio continua* (continuous speech). The last chapter of James Joyce's Ulysses, Molly Bloom's soliloquy, is written almost entirely without paragraphs, capital lettering (except for proper names), and punctuation. The text thereby becomes extremely difficult to read, whether silently or aloud(Daniel C. O'Connell, & Sabine Kowal, 2008). This can be well met with the ancient Chinese book "Origin of Chinese Characters".

Hereby we come to a question: in what way can we define punctuation? We can define it in elocutionary and syntactic functions. In elocutionary function, punctuation serves as a set of instructions for reading a text aloud, more specifically as one aspect of written speech(written form and a kind of phonetic transcription(sound form) for prosody (stress, pause, and intonation). In syntactic function, punctuation serves to convey meaning. It does so by identifying lexical elements and clausal, phrasal, and sentential structure(Robert J. Scholes, 1990). In these two functions, we can then logically come into the definition of punctuation: punctuation is interpreted as notation for breathing. Merriam-Webster's Collegiate Dictionary(11thed., 2003, p. 1009) defines punctuation as "the act or practice of inserting standardized marks or signs in written matter to clarify the meaning and separate structural units", and "to break into or interrupt at intervals". The Modern Chinese Dictionary(1sted., 1978, p.69) defines punctuation as the written form marking sentence reading and intonation. The Usage of Punctuation (National Standard T) established by the Chinese Standard Bureau claims a precise description that punctuation serves as a written form of records, punctuation is used for the purpose of making pauses, indicating intonation and sentencing or paragraphing.

So linguists will easily come into a conclusion of punctuation that in our times, every sentence is made of words and a specific punctuation mark. A sentence does not make any sense without a punctuation mark. This can be perfectly demonstrated in early Greek texts of the fourth century BC, where punctuation was employed for paragraphs that marked the beginning of a new topic. Latin documents of the sixth century, for example, employed no critical signs, marked neither words nor sentences. The Usage of Punctuation (National Standard T) established by the Chinese Standard Bureau defines a sentence as "a linguistic unit making sense of expression through intonation with pauses in front and end". From the description, we can get the message that punctuation is highly related with sentence and intonation. Though there is none special punctuation mark for intonation, still we can feel it by the function in punctuation marks of full-stop, question and exclamation.

In conclusion, when we define punctuation, we have to take into consideration of diction, sentence, paragraph, logic, syntactics, semantics, pragmatics and intonation as well, making sense of easy comprehension.

This is very practical concept of linguistics, which is fundamental for applied study and scientific research. As for the computer processing, engineers can also follow the concept of linguists that punctuation marks be detected by voiced and unvoiced speech based on syntactic analysis, semantic analysis, pragmatic analysis and emotional analysis. How do engineers follow the concept of linguists?

III. Engineering Perception on punctuation

Two scholars Reeves and Nass, from Stanford University, found that people treat modern communication media as if they are human beings, so established principles of interpersonal communication also predict human responses to computers and television(Zhao Li, 2009). Before phonograph was invented, people could only keep their memory on paper, called written words. Things changed when people invented recorder, and people can keep their memory in sound, called signal speech which can be divided into the voiced and the unvoiced.

In auto-translation research, computer engineers employed corpora in written words to build up natural language processing systems so that machines can intelligently find the punctuation through sentence and paragraph boundary from perspectives of syntactics, semantics, pragmatics. Mainly for the sake of the text-to-speech system, in early stage, people found the development of a sentence boundary disambiguator(Romportl J., Tihelka D., & Matousek J., 2003). Later, people designed an appropriate classifier where the essential task is to set up its internal parameters when they began to make sure of sentence boundary detection. For instance, B. Say, & V. Akman illustrated an example in their paper(1996) that punctuation can be served as a boundary detection device as follows:

He was happy. He found his book.

(He was happy to find his book. / He was happy because he found his book.)

Meanwhile, during 1976-1986, come computer scientists undertook punctuation detection on written form based natural language processing on the probabilistic analysis of a large corpus. They treated all sentence delimiters plus non-letter and non-digit characters as specially-marked, individual words which might have features and referred to by constraints. In this way, punctuation marks are used to detect clause boundaries or lists of similar categories. Also, in recognizing subjects, punctuation marks such as dashes to the left of a finite verb dramatically decrease the probability of the preceding word to be a subject. In the corpus studies, of all the finite verbs preceded by a punctuation mark, less than 5% have been found to have the preceding word as the subject. Thus we enjoy the fruit of translation soft-wear all around the world.

In recent decades, people are rushing into the research on punctuation based on sheep recognition in oral delivery. This is the follow-up of punctuation based on written form. Engineers use different ways to accomplish their goal, such as statistic language model based on Bintree and voiced or unvoiced speech detection.

1. Statistic language model based on Bintree(Qian Yili1, Xun Endong, & Song Rou, 2006)

Bintree is based on Statistic language Model to realize its task. In mainly analyzes a sentence into two in matching with punctuation. The practice takes it for granted that every word w_i ($1 \leq i \leq n$) on assumption of $W = w_1 w_2 \dots w_n$, when the sentence is already divided into separate words. Bintree can show that between each word $w_{i-1} w_i$, there is a potential linguistic pause, thus for every sentence there are n words consisting $n-1$ possible pauses. These pauses from left to right might be pos , $pos \in (1n-1)$. If a pause mark or notice is inserted into the potential pause point, say comma “;” in form a new sentence in $W' = w_1 w_2 \dots w_{i-1} \Delta w_i \dots w_n$, based on language training model, we can meet the function to figure out the probability on pauses in the sentences $P(W') = P(w_1), P(w_2 | w_1) \dots P(w_i | w_{i-1} \Delta) \dots P(w_n | w_{n-2} w_{n-1} l)$, which means finding out the best possibilities $arg \max pos P(W')$.

2. Voiced and unvoiced speech detection

There are very few articles talking about punctuation detection on sound form (speech). Speech pauses are considered as punctuation marks of spoken language. Lots of linguists take speech pauses as voiced punctuation marks, indicating intervals in speech. Computer engineers have been making full use of sound corpus, especially of voiced or unvoiced detection. The following table indicating the characters of punctuation marks(Table 1 characters of unvoiced speech¹)

¹ Supported by The National Natural Science Foundation of China: programs of 60572159, 60573184, 60473139. the experiments are undertaken with more than 3,000 sentences from sound corpus (slow speed for 2.59 syllables /s, the average length for each syllable between voiced and unvoiced takes 114. 21ms.

Table 1 characters of unvoiced speech

characters	Punctuation marks						
	Punctuation marks in end			Punctuation marks in middle			
	.	?	!	,	,	;	:
Length coverage of unvoiced (ms)	1315– 2294	513– 2800	433– 3311	106– 1481	165– 2277	566– 2764	404– 2803
Average length of unvoiced (ms)	1794	1088	1132	628	738	1066	882

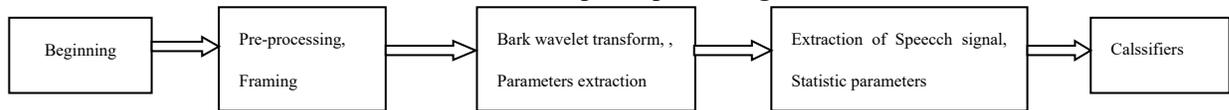
Therefore, we can draw a conclusion that we, at present, can arrive at a very practical method to realize sound-based punctuation according to table 1 by matching punctuation characters. For the very reason, the paper puts more touches on the solution of voiced and unvoiced speech.

For the detection on voiced and unvoiced speech, there are several methods to get accomplished, such as the one based on Bark wavelet transform parameters, the one based on subspace analysis, and ones in adaptive thresholding approach or using fuzzy rules, only to mention a few. As an illustration, let us take a glance at the two followings.

2.1. based on Bark wavelet transform parameters

The detection on voiced and unvoiced based on Bark wavelet Transform parameters is to make use of the ability of frequency segmentation and energy focusing on Bark wavelet to extract statistic parameters of speech signals in sub-bands. The processing flow chart can be shown in conclusion as follows(chart 1).

Chart 1 The unvoiced speech processing flow



2.2. based on subspace analysis

The detection on voiced and unvoiced based on sub-analysis is to work out redundant information in speech signals. The algorithm is based on statistical analysis of the above mentioned wavelet-based frequency distribution of the average energy, zero-crossing rate, and average energy of short-time segments of the speech signal. The algorithm first classifies the input speech into voiced, unvoiced and uncertain parts by comparing features with predetermined thresholds. Then, the uncertain parts are treated in three conditions and dynamic thresholds are computed by extracted features of the input signal. Finally, the dynamic thresholds are used to classify the uncertain parts. The performance of the algorithm has been evaluated using a large speech database. The algorithm is shown to perform well in the cases of both clean and noise-degraded speech.

IV. Experiment and result for detection

Only facts can count. In order to get best performance for the detection on voiced and unvoiced, we tried our experiment in the location of language lab, gate of Southeast University and open space.

1. Experimental subject

Our research aims at the solution to the detection on voiced and unvoiced for programs of “Model and Application for Internet-based English Oral Test System”, “Teaching Model Reform under the Platform of Internet-based English Oral Test System” and “Model and Application Network for CET”. As the first step to realize auto-scoring performance, we did the experiment in the hope to solve punctuation recognition problem.

2. Examinee

In the first experiment, we asked 10 post-graduates(6 male, 4 female) in English class in the Foreign Languages Learning Center to read 210 sentences from their textbook. So in two periods, English teachers could get 2100 sentences. According to the computer-engineers’ design, 1000 sentences were for training purpose while 1100 sentences were for recognition data mining. The average speed of reading were designed at 8.2words/s, a bit slower than the speed of VOA in Special English, in a sample of frequency at 12KHZ, with a filter of window in 2133ms length and 10ms offset. We asked the students to do the other experiments with the same requirements, both in the gate and in the open space.

3. Condition

The experiments subjoined natural noise so as to meet the real situation in language lab in the iB- Cet. Only in this way can we get the best result we were expecting before. The noise was made by the computer, designed for the sound/noise ratio at 20db, 10db, 5db and 0db.

4. Procedure and result

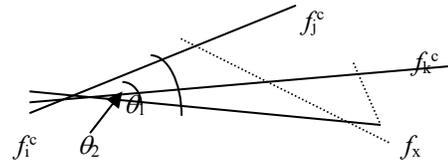
Our experiments applied subspace analysis to detection on voiced and unvoiced for punctuation recognition in programs of “Model and Application for Internet-based English Oral Test System”, “Teaching Model Reform under the Platform of Internet-based English Oral Test System” and “Model and Application Network for CET”.

At the beginning, we tried to find out the shortest path for algorithm in characteristic space by using Nearest Feature Line(NFL in short), which is illustrated in the following chart(chart 2 and 3).b

Chart 2 characteristic points on NFL



Chart 3 the shortest path in algorithm



Secondly, relying on subspace analysis, we input recorded sound hinted into the subspace characteristic of sound, figuring out voiced and unvoiced according to the volume of recorded sound hinted(Zhao Li, Zheng Yumin, & et al., 2001).

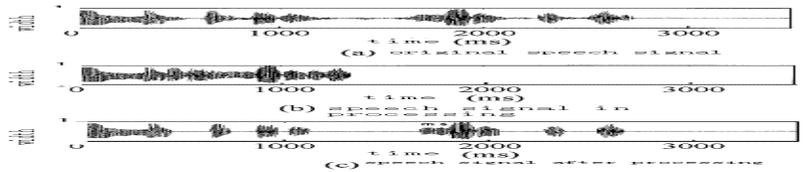
Thirdly, we tried to figure out the related matrix based on training data, thus finding out the features and volume of the related matrix. To make it simple, the threshold value(θ) is the decisive value and when the final value is bigger than θ , it means voiced, and the other way round when θ is smaller: $\frac{X^T B X}{X^T X} > \theta$. Hereby, X stands for Feature vector in each frame, with i times in subspace. B stands for matrix of recorded sound hinted. The experiments results are demonstrated in the following(table2 and Chart 4).

Table 2 experiments results

illustration

SNR ²	20db	10db	5db	0db
Beginning	100	100	98.7	97.7
End	100	100	98.3	96.7
Average	100	100	98.5	97.2

Chart 4 voiced and unvoiced detection



During the experiments, the detection went on in each frame, and the detection result comes from the figure with tolerance in 10 frames without mistakes. From table 2, we can arrive at a satisfactory result as expected with a average recognition of 97.2%, and in chart4, the voiced and unvoiced detection is well and clearly demonstrated.

V. Punctuation recognition

After we accomplished the task in detection on voiced and unvoiced, we can build a set of rules to disambiguate a punctuation mark in composing software to visualize punctuation marks. The rules are defined as follows:

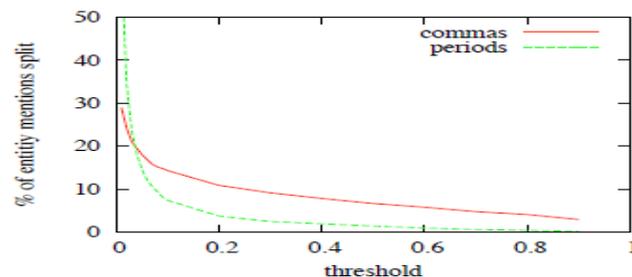
1. result := T (true, punctuation mark is the unvoiced before the voiced)
2. if the preceding token is a number sound, result := F (false)
3. if the following token is with the voiced and followed by the unvoiced, result := T
4. if the preceding token is voiced in rising tone and followed by unvoiced, result := T
5. if the preceding token is voiced in falling tone and followed by unvoiced, result := T
6. return the actual value of result

As for special punctuation, such as comma, period, exclamation or question mark, we apply the data described in Table 1 in matching the length in “ms”. Besides, we can apply emotional speech recognition to accomplish exclamatory and questionable marks in punctuation(Wang Zhiping, Zhao Li, & Zou Cairong, 2006). We

² Sound and noise ratio

can also use a method to split a noun-phrase(NP in short) merging for missed punctuation so as to choose a lower threshold in order to reduce NP merging, resulting in more splits that shorter speech sentences. Thus, comma and period for example, in shorter sentences, are more likely to break entities, especially if they involve long phrases(Chart 5)(Benoit Favre, Ralph Grishman, & et al., 2008).

Chart 5 comma and period inserted in threshold



VI. Conclusion

The concept presented in this paper focuses on detection of voiced and unvoiced so as to accomplish punctuation recognition. The paper also made some touches on speech NP splitting and emotional speech recognition. The voiced and unvoiced detection has great to do with punctuation recognition in speech. It is very important and vital for the iB-CET in oral test, carrying realistic and practical value in Chinese English teaching.

The importance of doing this research lies in the concept, which was based on paper rather than on speech itself. Since the notion of a sentence is very different in speech compared to written text, it is very crucial in education when technology has reached the peak to match human's intelligence.

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We appreciate our great thanks to those postgraduates fighting for their academic papers in figuring out precise data in the programs of "Research on the Production of Patent from Teaching Mode"(2242018S10036) supported by the Fundamental Research Funds for the Central Universities, and "A Study on English Education Planning in the Transition from Secondary to Tertiary Education"(17YYD001) supported by Jiangsu Social Science Foundation, China.

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AOT-Using Open Educational Resources with Connectivism Enhance Creative Thinking in THAI Students

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Abstract

This research is proposed to improve the development of the open educational resources in the connectivist environment, by focusing on the creative thinking skills in Thai secondary students. The aims of this research are in twofold, firstly, to develop the open educational resources (OER) which promote creative thinking skills in Thai secondary students, and secondly, to evaluate the use of the open educational resource (OER) on the development of the creative thinking skills in Thai secondary students. The study was conducted with 100 secondary students from Chanhunbamphen school, Thailand. The students were required to study English by using an open educational resource (OER) system in the connectivist environment. The learning achievement test, and the creative thinking test were used to measure the level of learning outcome and creative thinking skills. The data were analyzed by using the arithmetic mean, standard deviation, and t-Test Dependent. The results indicated that the high-order thinking skills score of Thai secondary students significantly increased when comparing between the pre-test and post-test score ($p = 0.01$). This study suggested that the Open Educational Resources development should consider the connectivist environment and 5R of openness concept to promote high-order thinking. The research further suggested five phases of OER development, namely, 1) Stimulate 2) Scope 3) Improve 4) Integrate 5) Allotment.

Keywords: Instructional Design, Teacher Education, Open Educational Resources, Creative Thinking skills

1. Introduction

Thinking skills are important. The process of thinking is complex, diverse and mixes of many skills. Teaching is the key to develop the higher-order thinking skills by relating to the learner's effort and the interest in learning. Teaching practices must be appropriate and parallel with the socio-cultural environment which is constantly changing (Gonzalez, 2012). Especially, the advanced technology these days can support classroom activities including gaining and receiving the contents, information and data through the Open Educational Resources (OER). The OER has been recognised as one of the learning tools that could facilitate the acquisition of knowledge. Retrieving information from the internet is convenient and also without costs. The sources are various such as open courseware and content, open software tools, open materials, Repositories of Learning Object, websites, personal blog or even the comments in social media in the form of graphic and narrator which is easy to understand and stimulate the learning and creative thinking skills. Using these technologies for classroom activities is the important factor for teaching. Moreover, using the tools in the appropriated time can help the learners to achieve the learning goals as well. The OER provides virtue opportunity of students to obtain the knowledge in an effective and efficient way. Despite the potential benefits offered by using OER, there is considerable little research on how to effectively use the OER to support the learning in Thailand. In addition, fostering students' thinking skills to adopt the OER is yet to be investigated in Thai education.

2. Research Objectives

The following research objectives were framed to guide the development of this research:

1. To develop the open educational resource (OER) which promote creative thinking in Thai secondary students.
2. To investigate the use of the open educational resource (OER) in promoting the creative thinking skills in Thai secondary students.

3. Statement of Problem

In this research, the problem addressed by the researcher focused on the lack of using open educational resources to promote students' high order thinking skills in Thai educations. After conducting the empirical investigation on prior research, the researcher found that the aspects related to the creating skills of thinking with the current learning materials administrated were mainly conducted in a traditional way. As such, classroom activities which related to the use of the open educational resources for Thai students are still lacking. In addition, fostering students' thinking skills to learn in open educational resource context is yet to be investigated in Thai education.

4. Connectivism Theory

The theory of Connectivism was developed by George Siemen (2005). He mentioned that Connectivism is one of the educational theories that could support the rapid change of knowledge and discovery of new knowledge. In current digital age, the knowledge life is shorter than it used to be in twenty years earlier (Gonzalez, 2012). This is due to the fast development, progressively evolving of the technology which consequences shorten the time spent on new knowledge discovery from the immense available of information. As a result, learning solely through classroom based is not sufficient anymore. People need to develop themselves to handle the changing of technology and culture as well as the new knowledge that might impact their lives.

Siemens (2005) defined eight principles of Connectivism, which are:

- Learning occurs through a diversity of perspectives and opinions regarding the subjects.
- Learning is constructed through the network of nodes from a particularly important source of information
- Learning is not merely a result of learners but also technology discovery
- Capacity to continuously acquire knowledge is more important than what knowledge had existed.
- Supporting and maintaining the connection is vital in supporting continuous learning.
- The ability to recognize the connectivity between the existing information, opinions, and concepts is one of the central skills in learning
- To have an up to date and accurate knowledge is the main aim of Connectivism theory
- *"Decision-making is one of the learning process"*; which learners need to pay particular attention by taking into account the reality. This is due to the knowledge as of today might be obsolete or otherwise proving to be wrong in the future.

Siemens (2005) also proposed six main components required in learning based on Connectivism theory, which are:

- A platform where both instructors/teacher and students/learners could be connected
- A platform for an individual to express their ideas (blog, journal)
- A platform where everyone can discuss, share and exchange the ideas (discussion forum, open meetings)
- A platform to search and explore the existing knowledge (portal, website)
- A platform where students/learners can learn in a structured course (courses, tutorials)
- A platform to be updated regarding the new information or knowledge (news, research)

Connectivism drawing the concept of knowledge acquisition in the digital age where information and knowledge distribute and spread all over the network. Learning can occur at any places and in the informal learning environment. Learning is no longer an individual cognitive process but rather in a network of a community. In a network, learning arose from the sharing of knowledge, exchanging of ideas and opinion, communication between each node of knowledge by taking into account the rapid change, up to date and accuracy of information. The connection between each node of knowledge required different kind of supporting activities, learners and suitable time in order to create the most effective learning environment.

5. Open Educational Resource (OER)

Knowledge sharing can distribute through various approaches such as writing a blog, sharing on social media, uploading on YouTube. Open Educational Resource (OER) is one of the effective approaches which allow everyone to have free access to the educational related materials. The development of the OER system requires information technology management and other supporting tools. OER is accessible through public domain which defined by the copyrighted license indicated the permission to use the material for educational purposed. The information available in OER covers from learning material, course material, modules, text book, video lecture, course exercise and assignments as well as examination papers. To access this information, related applications and tools are required. Current use OER systems and applications available in public domain are included Open Courseware, Open Education

Resources free software, Open Source software, Open Source Initiative, Open Content, Open Publication License and Creative Commons. OER can be categorized into 3 main forms which are content, tools and capacity (Downes , 2009).

- Content: in general, most Open Courseware applications can be considered as a content form which focused more on offering a different kind of learning materials.
- Tools: tools can be used to develop learning material and medium. Currently, both free and commercialized versions are available worldwide.
- Capacity: referring to the EOR systems that contain a large amount of information and providing with the effective searching capacity. This type of OER systems is sometimes referred to as a digital library.

Wiley (2014) identified 5 “R’s” characteristics of OER as:

- Retain: the right to make, own, and control copies of the content.
- Reuse: the right to use the content in a wide range of ways.
- Revise: the right to adapt, adjust, modify, or alter the content itself.
- Remix: the right to combine the original or revised content with other open content to create something new.
- Redistribute: the right to share copies of the original content, your revisions, or your remixes with others.

However, accessing, reusing, redistributing, revising and remixing the available materials in OER is restricted by the copyright license and different type of license offering a different degree of actions one can perform with the materials. Creative Commons (CC) (Creativecommons.org, 2002) license is one of the most frequently used licenses which can be divided into 6 different licenses, include:

- CC-BY requires the user to give the proper credit to the original works with the permit to be used for commercialization.
- CC-BY-SA requires the user to give the proper credit to the original works and indicate if the changes had been made with the permit to be used for commercialization. Redistribution of the new version of material under the same license.
- CC-BY-ND requires the user to give the proper credit to the original works and indicate if the changes had been made. The materials are allowed to be used for commercialization. However, users are not allowed to redistribute the modified version of the works.
- CC-BY-NC requires the user to give the proper credit to the original works and indicate if the changes had been made. However, users are not allowed to redistribute the modified version of the works.
- CC-BY-NC requires the user to give the proper credit to the original works and indicate if the changes had been made. However, this material or modified version is not allowed to be used for commercial purposes.
- CC-BY-NC-SA requires the user to give the proper credit to the original works and indicate if the changes had been made with the restriction not to be used for commercialization. Redistribution of the new version of material under the same license.
- CC-BY-NC-ND requires the user to give the proper credit to the original works and indicate if the changes had been made. However, commercialization and redistribution of the modified version are not permitted.

Open educational research is the tool to support learners in learning and gaining creative thinking skill. The data based in the library is also the open educational resources which include the information, tools and media. The data based has the specific access and publish by creative common that makes learning complete.

6. High Order Thinking Skills (HOTs)

Creativity skill is one of the demanded skills. The creativity is defined as "the cognitive skill of proposing a solution to a problem or making something useful or novel from ordinary" (Hwang, Chen, Dung, & Yang, 2007, p. 193). It involves a wide range of higher order thinking. Anderson and Krathwohl (2001) revised Bloom’s taxonomy of learning theory by considering the level of thinking based on its complexity. The taxonomy includes:

1. Remembering is to recognize and able to recall the relevant knowledge from long-term memory.
2. Understanding is understanding the meaning through interpretation, comparison and explanation.
3. Applying is the implementation or use of the knowledge learnt.
4. Analysing is to determine related to overall structure or manage different
5. Evaluating is a decision that has been reviewed and criticized.
6. Creating is to put the elements together to form coherent or the collaboration of all components.

The higher order thinking involves the analysing, evaluating and synthesizing the knowledge obtained in the earlier stage (Anderson and Krathwohl, 2001). To be able to obtain the creativity skills, a student needs to be able to

understand the content clearly, able to apply, analyse evaluate and putting the relevant knowledge together to generating the new ideas.

According to Guilford proposed the concept of "divergent thinking" in the 1950s, when he noticed that creative people tend to exhibit this type of thinking more than others. He, thus, associated divergent thinking with creativity, appointing it several characteristics, as follow: (Guilford 1971 cited Aree Rangsinan 1989)

- Fluency refers to the ability to produce a great number of ideas or problem solutions in a short period of time
- Flexibility refers to the ability to simultaneously propose a variety of approaches to a specific problem
- Originality refers to the ability to produce new, original ideas
- Elaboration refers to the ability to systematize and organize the details of an idea in a head and carry it out

According to Osborn's method of Brainstorming, Osborn claimed that there are two principles which contribute to "*Ideative efficacy*". They are the defer judgment and reach for quantity. Following these principles, he established seven steps of brainstorming with the intention to reduce social inhibitions among group members, stimulate idea generation and increase the overall creativity of the group. These seven steps are 1.) orientation 2.) preparation 3.) analysis 4.) ideating 5.) incubation 6.) synthesis and 7.) evaluation.

Creative thinking is the highest thinking skills which learners should be developed by continuously integrating the skill into the lessons and classroom activities. According to Dhevakulcreative (2009), thinking skills could help the learner to improve their capabilities, patience, intuitiveness and interests in their tasks, also making use of their time to improve their life.

7. Creative Open Educational Resource (CreativeOER)

Designing for learning is important specially to develop a higher order of thinking. Therefore, activities involved, learning instruction and the tools usage should be carefully designed when developing the higher order of thinking. Wiley (2014) suggests 5 Rs component of openness as having a significant impact on learning. Incorporating the 5Rs with the creativity characteristics, the Creative Open Educational Resource (CrOER) is proposed as presented in Figure 1.

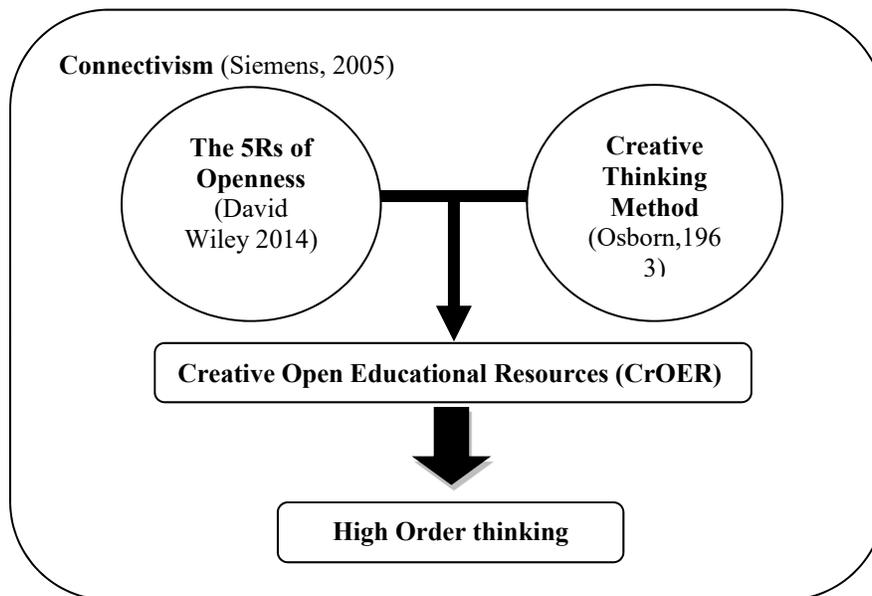


FIGURE 1 Creative OER framework

8. Methodology

8.1 Research Design

This is a quantitative study that covers five steps in the research procedure. Firstly, this research began by analyzing and synthesizing the principles and learning theories on the related field which were Connectivism theory, the open educational resources and high order thinking skills. In the second step, OER was designed by using Creative OER framework. After that, OER was developed according to the design in step 2, so that the students could participate in activities provided for this study. In the fourth step, the Creative Open Educational Resources (CrOER) was implemented to promote high order thinking skills in the classroom. Finally, this research study was carried out to evaluate the CrOER, by using the pre-test and post-test. Data were analyzed by using purposive sampling and arithmetic mean, standard deviation, and t-Test Dependent.

8.2 Research Procedure

In this study, the total number of 100 secondary students from Chanhunbamphen school participated in this study. Figure 2 presents the research procedure used in this study. The study began by asking students to complete the quiz to measure the creativity skills at the beginning of the study, i.e. before students were exposed to the learning activities by using Google Form. The creative thinking skills assessment was developed based on Guilford theory by addressing four components of creativity namely, fluency, flexibility, originality and elaboration. After completing the pre-test, students are then introduced to the learning activity. The learning activities were designed and divided into six steps as follow:

1. Search Problem: students were asked to watch a video clip introducing to the learning problem. Then, they were asked to analyze the problem from the media and post it on OER learning platform to brainstorm with their classmates. Social media such as YouTube and Facebook are used as a mean of communication.
2. Set Up Idea: in this step, students were asked to do some research to generate the ideas to solve the identified problem. The teacher provided some guidance and instruction on how and where to look of reference and relevant knowledge. The tools used in this step are OER webtools and YouTube.
3. Select Idea: After generating the ideas, students were guided to select and provide the supporting reason on how the problem could be solved by using the identified ideas. The students were then asked to present the potential guideline on how to solve the problem by considering the reliable references and share the information with other classmates. Teacher and other classmates would be asked to provide comments and raise any questions and issues that might have an impact on the given problem and the presented solution. Several tools could be used as this steps such as OER Websites, Youtube ect.
4. Summary Idea: In this step, students were asked to summarize the guideline to solve the problem as well as a suggested solution by synthesizing the information and comments given by their peers and teacher to generate the new knowledge. The OER tools used in this step were Facebook to communicate the idea and the OER websites.
5. Share Idea: After summarizing the idea, students were required to present the new knowledge gained in step 4. The OER tools and elements that could be used in the presentation are Video Clip, e-book, Web site, Page Facebook or Blog.
6. Score Idea: both teacher and students were asked to evaluate the idea presented in step 5. The teacher evaluated the assignment according to the criteria and providing the comment. Students were asked to provide feedback on the presented ideas of their peers. The OER tools used in this step were Facebook, Youtube.

After complete the learning activities, students were asked to answer to the creativity test questions.

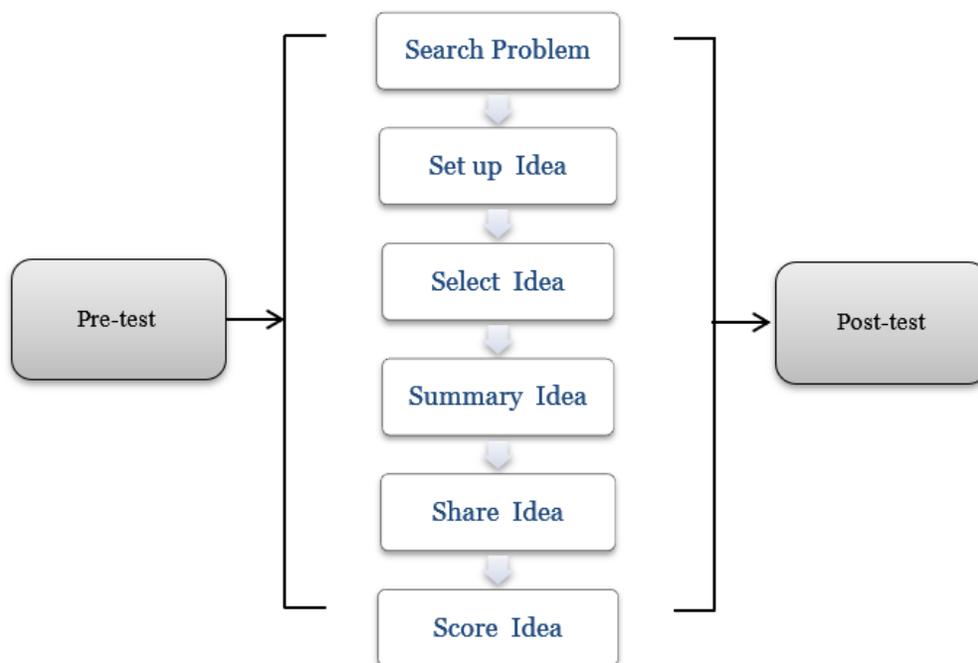


FIGURE 2. 6S of Creative OER Procedure

9. Analysis and Discussion

The question items of pre-test and post-test to evaluate the creativity of students were evaluated according to the corresponding creativity components and the level of creativity as presented in Table 1.

Table 1: The criteria of creativity measurement

Components of Creativity	Level of creativity		
	Good	Fairly	Need for Improvement
Fluency	The student was able to correctly answers more than 70% of the question items	The student was able to correctly answers at least 50% but not more than 70% of the question items	The student was able to correctly answers less than 50% of the question items
Flexibility	The student was able to organise, categorise most of the items in variety approaches	The student was able to organise, categorise the items in three to five number of approaches	The student was able to organise, categorise some of the items in one or two approaches
Originality	The student was able to adjust, alter, modify, and apply most of the items accordingly	The student was able to adjust, alter, modify, and apply some of the items accordingly	The student was able to adjust, alter, modify, and apply a few of the items accordingly
Elaboration	The student was able to elaborate, systematize and organize the details of most of the items accordingly	The student was able to elaborate, systematize and organize the details of some items accordingly	The student was able to elaborate, systematize and organize the details of a few items accordingly

Table 2 presents the frequency and percentage of students' creativity score obtained from the questionnaires. The score highlights the pre and post test score according to four dimensions, namely, fluency, flexibility, originality and elaboration.

Table 2. Frequency and percentage of students' creativity before attending the class

Components of Creativity	Level of Creativity number (%)					
	Good		Fairly		Need improvement	
	before	after	before	after	before	after
Fluency	21.4	57.1	37.1	42.9	41.5	0
Flexibility	25	46.4	39.3	42.9	35.7	10.7
Originality	17.9	42.9	32.1	50.0	50.0	7.1
Elaboration	10.7	32.1	17.9	46.4	71.4	21.4

In this study, the Creative OER Procedure which consisted of six steps, 1.) search problem 2.) set up idea 3.) select idea 4.) summary idea 5.) share idea 6.) score idea (6 S CrOER) to promote creative thinking was implemented. The level of creativity was divided into 3 levels which are good, fairly and need for improvement. The good creativity level shows to have a higher proportion of items based on the post-test score in every creativity component as compared to the pre-test. Similarly, the fair level of creativity also had an increasing percentage of post-test scores in all components. In contrast with the first two levels, the number of items that were categorized as needing further improvement level of creativity showed significantly lower post-test score in all components. This result indicates the improvement in fluency, flexibility, originality and elaboration of the students after experienced with the OER application. The items that were initially categorized as the need for improvement of the fluency has reduced to zero. This indicates the potential usefulness of OER to improve the creativity level of the secondary students. Finally, based on the evaluation, this tool has been evaluated at "The Most Satisfied Level" by both teachers (instructors) and students (attendees).

Table 3. The pre-post test score (T-test)

Test	n	Points	S.D.	t	sig.
Pre - Test	100	12.41	2.34	9.967	.000
Post – Test	100	16.76	1.43		

Based on the initial result, the statistics were used to observed the significant level of the pre and post-test. Thai secondary students' posttest score gained from high order thinking skills part was higher than the pre-post test score at the statistical significance at level .01.

9. Conclusion

This research presents the use of OER as a tool to promote the creativity skills for the Thai secondary students. The study consisted of 100 students. The designed learning activity involved six steps, which are, problem searching, set up the idea, selection of the ideas, summary, share and score the selected idea. The OER was used as a learning platform to carry out the activity. The OER tools used in this study consisted of several tools which could be divided into two categories. The tools used to support learning were E-paper, search engine, YouTube, and the other uploaded online materials/Resource and the tools which used for communication such as a forum, blog, news as well as social media such as Facebook. The research study was carefully addressed the Creative Common licensing agreement. The pre and post-test were used to examine the level of creativity. The result indicated the higher level of creativity after students were experienced with the OER based learning activity. This result suggested that the OER has the potential to promote the higher order of thinking and creativity skills.

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The Turkish Language MOOC: Türkçe Öğreniyorum (Learn Turkish)

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Abstract

In this study the Turkish Language MOOC: “Türkçe Öğreniyorum” is presented. Firstly, the language MOOC phenomenon is introduced, and the trend and issues about language MOOCs are addressed briefly. Secondly, the case of “Türkçe Öğreniyorum” will be shared with related statistical research data of 6254 participants. Thirdly and finally, conclusion and a few final remarks on the foreseeable research directions within the field of MOOLCs is shared.

Keywords: MOOC, MOOLCs, Massive Open Online Courses, Türkçe Öğreniyorum, Learner Profile

Introduction

Large-scale teaching traces back to first implementations of distance education in the 18th century. It takes its roots from teaching machines, computer-assisted instruction, learning management systems, open education and open educational resources movement and continues to evolve with the emergence of massive open online courses (MOOCs) (Sanchez-Gordon & Luján-Mora, 2018). MOOCs are freely accessible learning materials and media used for learning, teaching and assessment (Bárcena & Martín-monje, 2015). The term MASSIVE implies that a MOOC should allow the access to a very large number of students such as from 1,000 to 100,000 students, without leading to a significant problem for its functioning (Sanchez-Gordon & Luján-Mora, 2014). The term OPEN has several meanings such as open enrolment, open content, open learning platform and being free of charge. Open enrolment means that course should be open to students outside the university that organizes it, and it should not require any prerequisites, such as previous studies or a degree possession. Open content implies that the content generated by the course should also be published with an open license so that the new content could be reused by others. Open learning platform indicates that the course contents are spread in different places such as websites, blogs, wikis or multimedia repositories. In addition, an open learning platform can also mean that the technology or the platform on which the course is offered is also open. Finally, the course should be free of charge. The term ONLINE implies that the course is done remotely via the Internet, and it does not require physical attendance at a classroom (Gaebel, 2013).

The first MOOC - Connectivism and Connective Knowledge organized by George Siemens and Stephen Downes- was offered in 2008 for free. Approximately 2,300 students enrolled in that course. A big increase occurred in the number of both courses and students in a decade. According to the report of MOOC search engine Class Central (2017), over 7.000 of MOOCs delivered by single university platforms and 33 big MOOC providers from all over the world as of 2017. The number of students is over 50 million (Sanchez-Gordon & Luján-Mora, 2018) as of June 2017, Table 1.

Table 1. Statistics for Main MOOC Providers as of June 2017.

Provider	Country	Students(millions)	Courses	Partners
Coursera	United States	25+	2,000+	150+
edX	United States	10+	1,500+	100+
XuetangX	China	7+	400+	N/A
Futurelearn	UK	6+	400+	100+
Udacity	United States	4+	170+	N/A
MiriadaX	Spain	3+	600+	100+
FUN	France	1+	270+	90+
MexicoX	Mexico	1+	60+	40+

Resource: Sanchez-Gordon & Luja'n-Mora, 2018

MOOLCs: Massive Open Online Language Courses

In the current context of a globalized and technologically connected but still linguistically diverse world, the knowledge of one or several languages is an indispensable skill to live, work or connect technologically and socially (Perifanou, 2015; Perifanou and Economides, 2014). It also must be combined with digital ones in the contexts of work, personal and social life at the local, regional and global levels (Pegrum, 2016). Open access to language courses and resources is needed more than ever before in order to meet the needs of linguistically and culturally diverse learners who live and work in a global society (Perifanou, 2015). This justifies requires to create, measure and evaluate second language teaching initiatives in new formats such as MOOC since they have a great potential to present a genuine, free and collaborative learning environment which is open to different geographical, temporal or social situations (Cuevas, 2017). Nowadays, the number of MOOCs and Open Educational Resources (OERs) connected to foreign language learning have increased, and there is a growing interest for them. However, it is scarce in comparison with other disciplines such as economics, technology or science. While Perifanou (2016) reported 29 MOOLCs from 67 different MOOC platforms/providers in total as of 2015, MOOC search engine Class Central reports 191 foreign language MOOCs with 106.5k followers as of October 2018 (Class central, 2018). In addition to providers listed in Class Central Mixxer, Instreamia, OpenLearning and TandemMOOC platforms provide MOOLCs with a connectivist way of learning and by emphasizing the role of social and cultural context (Perifanou, 2016).

Although a considerable amount of research has been conducted in the last decades with regard to digitally enhanced language teaching and learning that has shown the tremendous possibilities technology can offer (Perifanou & Economides, 2014), there is a limited research on MOOLCs since it is an emerging technological platform and it is still considered as "neonatal" (Sokolik, 2014). From a methodological point of view, MOOLCs appear to have great potential for self-directed language learning as: (a) there is a possibility for the use of audiovisual materials; (b) the use of the Internet allows oral and written interaction between language learners at the same proficiency levels; (c) MOOLCs favor collaborative learning; (d) allow language learners to proceed at their own pace, (e) they promote learner autonomy; (f) encourage the sharing of Internet-based resources; (g) favor empathy and cooperation between students sharing the same interests. (Chacón-Beltrán, 2017). On the other hand, in reality, the professor who designs a MOOLC has a restricted freedom when creating the communication and evaluation activities and tools (Read, 2014), since it does not you can always choose the platform in which you will implement your course or the type of resources and activities that this platform allows you to implement.

Linguistic communication should be the backbone of these courses (Sokolik, 2014) as second language acquisition theory indicates learners not only needs comprehensible input (Krashen, 1985) (i.e. activities to practice their reading and listening skills) but also opportunities for output (Swain, 1995) (i.e. activities to practice their oral and discourse skills). However, many of the existing MOOLCs have continued the tradition of online language courses that focused on grammar, written writing or vocabulary, avoiding the complications of oral practice in a foreign language and the interaction between the participants (Martín-Monje, Bárcena & Read, 2014). Input activities can be provided easily in MOOLCs but output ones can not basically due to unbalanced teacher-student ratio. One of the distinctive features of MOOLCs is unbalanced teacher-student ratio unlike a traditional distance language learning platforms with a balanced teacher-student ratio and a wide variety of communication, feedback and assessment tools (synchronous & asynchronous). Most of the existing MOOLCs are essentially self-paced

language learning materials with low interactivity and feedback. On the other hand, many of the design proposals for MOOLC tend towards a new model of personalized (Zapata-Ros, 2013) or adaptive (Godwin-Jones, 2014) learning since adaptation to the profile and the individual interests of the participants causes better involvement in the course, which requires the development of more sophisticated tools by educators, designers and programmers.

The Turkish Language MOOC: Türkçe Öğreniyorum (Learn Turkish)

There are two traditional distance education programs to teach Turkish as a foreign language, and a comprehensive, well-structured, non-profit MOOLC. Distance education programs are provided by Anadolu University and Yunus Emre Institute, where the MOOLC is provided by Yasar University under the name of "Türkçe Öğreniyorum (I learn Turkish)".

The objective of "Türkçe Öğreniyorum" Project is to develop a worldwide distance learning platform to teach Turkish as a foreign language, which is sensitive to individual differences and can differentiate the content according to the needs of the learner. The primary goal of "Türkçe Öğreniyorum" is to provide continuous global access to qualified self-paced learning materials for the Turkish language learning as well as to make them accessible to people at risk of social or professional exclusion such as irregular immigrants and refugees. It was developed under "the Differentiated Distance Education of Turkish as a Foreign Language" project, supported by TÜBİTAK with the project code of 115K270. It is limited by level A1, which is referenced in the Common European Framework of Reference for Languages

There are 53 chapters in "Türkçe Öğreniyorum". Each chapter bearing 5-minute lecture videos, 2-minute real-life drama videos, reading-listening-writing-pronunciation activities, approximately 40 games. The course contains forum, virtual meeting tool, one A1 level dictionary with 1.500 vocabulary and one glossary for grammar rules. There are approximately 6000 questions to practice in total in the course. Approximately 40.000 words of text in Turkish translated into English, Arabic, Russian and French language to offer support to learners in the development process. "Türkçe Öğreniyorum" runs on Sakai LMS, which is integrated with Kaltura Video Platform and Google Analytics. Learning analytics data is gathered from the Diagnostics tool, Motivational Beliefs and Self-Regulated Learning Strategies Questionnaire (MLSQ), Logs of exercises, LMS Statistics, and Google Analytics. Diagnostics tool covers demographic information of learners, their primary and secondary languages, prior knowledge of Turkish, and home country. The aim of this tool is to collect data about learner profile in terms of the region they live in and the language they speak. MLSQ is used to detect cognitive and affective readiness of the learner in terms of intrinsic value, test anxiety, cognitive strategy use, and self-regulation (Pintrich & DeGroot, 1990). Logs of exercises record activity events of the learner (number of tries, given responses etc). Sakai CLE collects site usage statistics regarding learner visits, tool activity, and resource activity. Google analytics provides a rich source of data such as learner preferences (demographics, interest, age, geo, etc.), time spent on modules, page statistics (page view, page exits, behavior flow, etc.), preferred technology (device, browser, operating system, screen resolution, screen colors, etc.), video events (video view duration, numbers of play, pause and skip attempts, etc.).

Project team contains 2 instructional designers, 4 subject matter experts, 1 graphic designer, 1 video developer, 1 multimedia developer, 1 photographer, 1 system administrator, 1 software developer, 4 translators, 7 actors, 6 voice actors, 3 cameramen, 2 production specialists, 2 post-production specialists, 1 cinema director, 1 scriptwriter, 1 assessment and evaluation specialist and 2 consultants.

Structure of content of "Türkçe Öğreniyorum" was based on five theoretical approaches (Ozan, et al., 2018). First one is the theory of transactional distance, which establishes a relationship between dialog, structure, and learner autonomy (Moore, 2007). Second one is theory of self-regulatory learning, which is critical especially in distance education because of the absence of the very active role of the instructor and the requirement for high-autonomy (Hsu et al., 2009), goal setting, self-monitoring, self-evaluation, use of task strategies time planning and management (Dabbagh & Kitsantas, 2005). The third one is the Theory of Multimedia Learning (ToML). Forth one is Tomlinson's (2001) approach for differentiation of instruction. The final one is Notional-Functional Approach (Ellis, 2005; Halliday, 1986; Hymes, 1971) as second language teaching theory. Learners can follow the content according to his/her interest, pace and needs. They can follow the content in any order, they don't need to follow it in a linear sequence. There is no time limitation to complete the course. Self-assessment tests and feedback in each

activity were placed in each module. Learners can take those self-assessment tests multiple times, there is no limitation in the number of trials in tests as well.

6254 learners from 136 different nationalities and 104 different countries enrolled in the course as of June 2018. 31.68% of them were female and 65.80% of them were male. 158 (2.52%) people did not want to indicate their gender. 26,16% of those who want to learn Turkish as a foreign language is between 18-24, 40,87% are between 25-34 years of age, and rest of them (28,61%) is above 34. 54.28% of learners learn Turkish because of academic purposes. 44,42% of them listed business as a reason.

50,98% of the learners are Syrian. However, only 2.13% of the them stated that they were lived in Syria. The majority of the registered learners (66.49%) live in Turkey. The mother tongue of 81% of learners is Arabic. Arabic is followed by English (2.94%) and Persian (1.58%) respectively. 60.70% (n = 3796) of the learners do not know any other foreign language. 32,08% (n = 2006) currently speaks one foreign language.

11% of the learners have primary or secondary education, 31% of them have high school or equivalent degree, 44% of them bachelor degree, 11% of them have a masters degree and 3% have Ph.D. degree,

A chi-square test of independence was performed to examine the relation between residency and education level. The relation between these variables was significant, $\chi^2(3) = 237,104$, $p < .001$, Cramer's $V = ,20$. Learners, who live in Turkey, less likely have a graduate degree.

44% of learners work. 29% of them are students. 15% of them stated that they were not working. 74% of them do not have an online course experience. 68% of them uses social media. Men are more interested in "Business", "Developments in the World", "Science and Technology" and "Sports" than women while women are more interested in "Fun and Life", "Language and Culture" and "Literature" than men.

Conclusion

In this study, language MOOCs discussed briefly and the Turkish Language MOOC: "Türkçe Öğreniyorum" was presented a case. A satisfactory model for designing language MOOCs has not been found, yet. It is an emerging field. However, there is a consensus on that courses must be accessible in different devices, including mobile devices, and be integrated into the real life of the participants, taking into account the different special learning needs that may arise and the people at risk of exclusion (Morgado, Teixeira and Jansen, 2015). Integration of social networks and peer review activities into this large-scale teaching platforms, which has an unbalanced teacher-learner ratio, might transform participants from individual learners to social agents who have communicative competence. Self-regulation is also critical especially in MOOCs because of the absence of the role of the instructor and the requirement for high-autonomy. Learners in MOOCs are responsible for their own learning by arranging the time, pace and strategies. "Türkçe öğreniyorum" has low learner-instructor dialog. Therefore, it was designed in a less structured context to reduce transactional distance.

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Meeting Divers Learning Needs – Using Interactive Videos in Higher Education

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Interactive Video (IV) is receiving increased attention in higher education in recent years. The concept of IV shifted with the development of the IV technologies, especially with the further development of the assessment and learning analytics features. This paper briefly reviews the research about IV use in higher education. It also introduces our experience in using one of the IV tools at Purdue University. Future research is suggested based on our research and experience.

Development of IV

IV has been used in higher education for several decades. Combining tutorials and simulations with reflective questions, the early IV was a supplemental learning resource that helped students to understand the abstract textbook content (Hansen, 1989). With the student self-paced learning design, early IV not only provided a medium for observation but also provided an environment for learning reflection (Hansen, 1990). However, the early IV is considered similar to computer-assisted instruction (CAI) (Hansen, 1989), which is effective in designing drill and practice of basic skills (Kulik, 1994) but failed to adapt technology to fit the needs of multiple learning preferences (Mayer, 2009).

With regard to the limitation of the early IV, Hansen (1989) pointed out the future IV design and development should include the following principles: first, it should follow a student-centered approach; second, it should provide multiple interaction approaches; third, it should serve as a model for student self-assessment; fourth, it should provide feedback to students; fifth, it should be able to monitor student progress and provide the instructor with a profile of the students' understanding; and sixth, the design should be open and allow for future revision.

Currently, the most popular IV tools in higher education are Kaltura, Camtasia, Adobe Captivate, Articulate 360, Edpuzzle, and PlayPosit (Hayden, Fleischer, & Taylor, 2017; Kolås, 2015). These tools are no longer simply a combination of video and questions. These tools intend to ensure videos are being viewed and encourage student engagement, improve retention of knowledge, and promote deeper reflective learning (Hayden et al., 2017). In addition, they provide multiple features to meet diverse teaching and learning needs, such as video editing, embedding questions, and providing feedback. These tools can incorporate text, images, external links, maps, multiple-types of quiz questions, polls, and discussions directly within the video. Some tools even include an open-source platform to encourage resource sharing between institutions. To some extent, the development of current IV tools is a good response to Hansen's (1989) principles.

The Effectiveness of IV in Higher Education

With the development of IV technology, researchers report that students in both e-learning as well as traditional classroom environments achieve better learning performance and have a higher learner satisfaction when IV is incorporated into the learning experience (Zhang, Zhou, Briggs, & Nunamaker, 2005). Compared to using traditional video in class, other research found IV helps to engage students in online class and decrease the dropout

rates when students watch the video (Kovacs, 2016). In addition, faculty believe that the new IV features contribute to increase students' awareness when watching a video, which makes it a good tool for both formative and summative assessment (Kolás, 2015; Kovacs, 2016).

Based on recent research, one of the most frequently used features in today's IV tools is in-video quizzing. Research demonstrates that using testing as a study tool improves long-term retention of learning materials (Roediger, & Butler, 2011). In addition, quizzing and immediate feedback benefits information retention in multiple learning settings (McDaniel, & Fisher, 1991; Lacher, & Lewis, 2015). Griswold, Overson, and Benassi (2017) conducted an interesting study in a graduate occupational therapy class. Without using any IV tools, the participants took online quizzes through a learning management system while they were watching the pre-recorded lecture video on another platform. They were asked to pause the video several times to take the quizzes and were allowed to go back to watch the video while they were taking the quizzes. The results show the online quizzes helped to improve student test scores in a final unit exam.

Today, many IV tools make taking quizzes much easier than this. Multiple types of quiz questions along with other interactions can be embedded into the video directly. In other words, videos and quizzes can be easily included into the same platform, without the need for students to access multiple areas in order to complete the activity. For example, Students who need additional time to work on the quiz question have the option to pause the video and review it. Students who are comfortable with the material and prefer to move quickly through it can do so as well. Captions are generally included with IV, so students who prefer to read text rather than view it have this option as well. Review features are especially important for students whose primary language is not the same as the material presented as well as students with learning disabilities.

In Cummins, Beresford, and Rice's (2015) study, an IV tool was used to design quizzes based on a series of instructional videos for a college level programming course. The researchers found the majority of student think the in-video quizzes were useful in helping them understand the video. The study also found that students interact with the videos in very different ways because of different learning styles. The researchers recommend considering student behavior and motivations when designing quiz questions using IV tools (Cummins et al., 2015). Figure 1 shows a screenshot of an in-video quizzing designed for an ESL program in a community college.

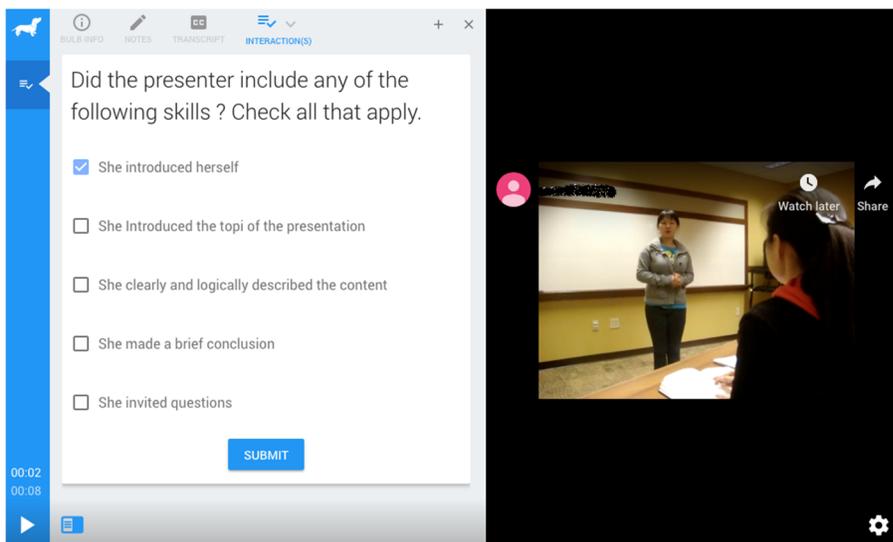


Figure 1. A Check All question created with PlayPosit.

Note: Captions are not included in this screenshot because it is the end of a student's presentation.

Another very popular feature in IV tools is learning analytics, which helps instructors understand and optimize learning and the learning environment by measuring, collecting, analyzing, and reporting data about learners and their context (Long & Siemens, 2011). Most of the aforementioned IV tools provide analytics on both course-level and individual-level. Course-level analytics show how the class is progressing with each of the activities and each of the quiz questions (Blackstock, Edel-Malizia, Bittner, & Smithwick, 2017). Faculty can use analytics to determine what to cover during class time for ensuring the specific needs of each class are met. Individual-level analytics show student understanding, level of effort, and other related learning behaviors on each

of the activities and quiz questions (Hayden, et. al 2017). This information can be used to identify struggling students for additional support before the student becomes too far behind.

However research also shows the limitation of some IV analytics. A study conducted in a postsecondary level medical course shows the standard generic and direct feedback responses that some IV analytics provide do not meet students' multiple learning style (Ovalle, Schofield, O'Hara-Leslie, & McLain, 2017). To effectively improve learning, students who interpret the quiz questions differently need a specific explanation for why their answer is correct or incorrect (Ovalle, et al., 2017).

The current study on IV analytics is still limited. More research about student/faculty perceptions as well as the effectiveness and usefulness of IV analytics is needed in the future. Figure 2 and Figure 3 show PlayPosit's learning analytics at course-level and individual-level, respectively.



Figure 2. Course-level Learning Analytics

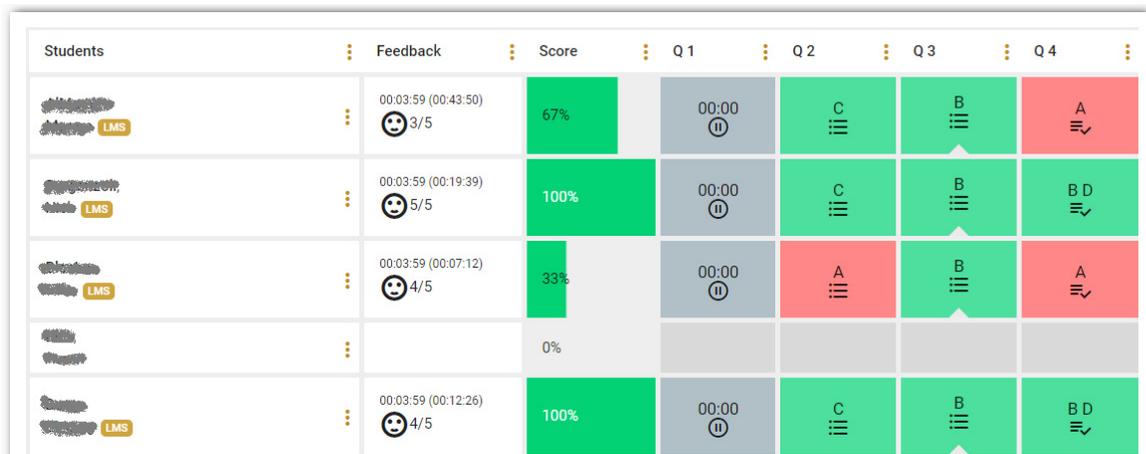


Figure 3. Individual-level Learning Analytics

Although a number of studies claimed IV tools effectively improved learning outcomes (Hayden et al., 2017; Kolås, 2015; Kovas, 2016; Zhang, et al., 2005), there still some studies show no difference between using IV tools and using other teaching strategies on student test grades (Bennett, 2018; Lacher, & Lewis, 2015). Researchers point out students grades are not sufficient in assessing the effectiveness of IV in education (Austin, Lawson, & Holder, 2007; Lacher, et. al., 2015). Additional factors, such as the nature of the instructional content, instructional methods, and related instructional material should also be considered (Hattie, 2009). In addition, researchers suggest future studies focus on comparing perceived learning styles and performance on testing (Bennett, 2018), evaluating and analyzing a wide range of activities rather than focusing on a single assessment (Kolås, 2015), and investigating how students engage with the IV materials (Cummins et al., 2015).

Using IV Tools at Purdue University

Purdue University has been using instructional videos in different learning environments, including face-to-face, fully online, and hybrid courses. Most of these videos are pre-recorded lectures/instructions, which are used as required learning tasks for preview and overview of specific topics. Many faculty want to use IV tools to make these traditional videos more engaging to all types of students. Our needs assessment shows we have more than 30,000 full time undergraduate students and 9,000 graduate students, including about 9,000 international students from 122 countries. A total of 7,085 students participate in some form of distance or online learning. In addition, over 100 faculty are from non-English speaking countries. With regard to this situation and the aforementioned instructional video use at Purdue, we decided that the IV tool that we choose needs to include the following features:

- allow closed captioning;
- allow embedding instructions, comments, interactive communications, and assessments;
- force watching without skipping any part of the video;
- include assessment analytics;
- allow integration with Blackboard Grade Center.

Prior to PlayPosit, Purdue had been using Kaltura as a video production tool. As mentioned before, it is also a commonly used IV tool in higher education. However, the limited interaction feature in this tool cannot meet the teaching and learning needs at Purdue. Based on our market analysis, we chose to pilot PlayPosit. Compared to Kaltura, PlayPosit provides more detailed learning analytics and multiple interactive activities, which helps faculty create instructional materials to meet diverse learning needs in both online and face-to-face class. In addition, it can be used as a class engagement tool that can collate real-time student responses in face-to-face classes. Table 1 shows a brief analysis of these two tools.

Table 1.
Comparison of three different IV tools used at Purdue University

Features	PlayPosit	Kaltura
Video Editing	Yes	Yes
Authoring Interface	Users need basic training	Users need basic training
Search Public Video	Yes	No
Upload Video	Yes but has limitation on size	Yes
Caption	Yes	Yes
Integrate with Blackboard	Yes	Yes
Types of Interactions	Multiple choice, Y/N, free answer, poll, discussion, reflection, etc.	Multiple choice only
Course Copy	Need to re-assign the link	Easy to copy
Learning Analytics	Detailed analytics for individual students and course level	Very limited analytics
Accessibility	Passed accessibility check	Passed accessibility check
In Class Engagement	Yes	No

Although many faculty showed interest in this new tool, we had difficulty finding users in the first semester. We hosted two campus-wide showcase events in order to provide information about the tool and identify potential faculty interest. Research shows the main barriers to video use in higher education are course development time and professional development in the technology (Leahy, 2015). So we provided faculty ample time to consider how they might incorporate IV in their courses, and we provided professional development through technology training and instructions on facilitating course design with this tool. With the help of our pilot team, some faculty created a few sample videos for their summer courses. Most of these faculty decided to create course-wide activities and assessments with this tool for the following semester. Through direct assistance with the process, we found faculty use this tool differently in their classes. The learning materials that are created using this tool can be concluded in the following categories:

- for pre-view and review
- for online class instruction
- for observation and reflection

- for formative assessment
- for taking attendance
- for lab tutorials

We have several successful use cases during the two-year pilot. For example, in a college level planetary science program, the instructor initially used one interactive video in a course that he had previously taught. He used this as a way to assess effectiveness as compared with his previous teaching method for that particular content. This trial IV was used to provide an interactive online resource students could access on Blackboard as part of a face-to-face course. The instructor discovered that IV provided a good way for him to provide low-stakes, formative assessments for his students. This was important to him because his course is based on mastery of the material and his teaching philosophy involves allowing students to have multiple opportunities to demonstrate mastery. He set his IV to allow students to retake the embedded quizzes as many times as they liked. He is currently using IV as a major component of his totally online version of this course. Each interactive video is only worth a small percent of the grade, but it is one of many ways for students to perform a self-assessment of the material as well as to demonstrate mastery.

During our pilot, most feedback from faculty focused on questions about IV material design and development. However, we also found that several technical barriers prevented some faculty from adopting this tool in their classes. These included: 1), limitations on size and video type that can be uploaded within this tool; 2) video links breaking during course copy; and 3) limitations in allowing multiple users, such as instructor and teaching assistant, to create/edit a same video. These problems increased instructors' workload when they were trying to adopt this tool in their classes, especially when they were trying to create a large number of IV for a single course. Since only a few faculty created formative assessments with this tool, there was no issue reported in learning analytics.

We have documented several lessons learned in order to decrease barriers to implementation. We suggest the following: 1) faculty limit video length to limit file size; 2) institutions use the most current LMS releases in order to avoid system bugs that can create issues like links breaking; 3) IV developers provide permissions or roles that allow faculty and teaching assistants to work together on common video assets without compromising security of video assets for other courses. We also recommend that faculty begin with creating a trial interactive video before revising an entire course using IV. This gives the instructor an understanding of the time and effort it takes to create an interactive video. It also provides an opportunity to discover the most effective ways to incorporate various IV features within a particular field. Once an instructor has discovered what works and does not for their specific course, additional IV can be created, minimizing revisions and wasted time.

Conclusion

Based on our research and experience, a good IV tool needs to be easy to use and provide multiple interactive activities to meet multiple learning needs. It should be seamlessly integrated with a learning management system, provide dynamic feedback to students, and be able to provide detailed individual/course level learning analytics. Researchers point out that taking advantage of the multiple forms of interaction and communication should be considered as a goal for IV future development (Ovalle et al., 2017). Therefore, more research studies are needed in evaluating different types of IV communications and activities (Kolås, 2015) and how students engage with these IV materials (Cummins et al., 2015). In addition, multiple factors, such as instructional content and instructional methods, need to be considered in the future studies (Hattie, 2009). To get the best use of IV tools, more research about faculty perception as well as the effectiveness and usefulness of IV analytics is also needed in the future.

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Design and Development of Time Self-management System for College Students

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Abstract

Based on the fourth generation of time management concept, as well as the comprehensive analysis of common time management software, the current situation of Chinese college students' time management and the psychological characteristics of Chinese college students, this research designed and developed a time self-management system suitable for college students, trying to provide technical support for their time management, help college students improve their time management efficiency and enhance their quality of life.

Keywords—Time management; College students; System design

I. INTRODUCTION

College students are the hope of the nation and shoulder the mission of building the country. College students' time in school is precious, and its time utilization is directly related to the quality of the country's future talents. However, the current time management situation of college students is not optimistic. Zhang Xiaofang has found that 73.3 percent of college students think that there are more problems in the use of time. 51.5 percent of college students are not good at planning their daily and weekly schedules according to their actual situation. More than 1/2 college students arrange and use their leisure time according to their feelings and interests, and less than 1/5 students plan their leisure time[1]. There are many problems in college students' time management, which need to be solved urgently.

The situation of time management of college students is poor. In many cases, it is not the subjective cause of college students, but the lack of corresponding concept of time management. In the face of sudden changes in

school life, there is no guidance, no awareness of time management at the time of admission. On the one hand, college students have heavy academic tasks and many things to accomplish. On the other hand, many college students have poor management of time, fail to make good use of time, but do not know what to do with time. Some students can't catch the key transaction, don't know how to arrange the order of things, in the face of seemingly complex transaction do not know how to start. College students tend to rely on their minds to remember their plans without the right tools, making them unsustainable. From the research at home and abroad, in the students' learning, especially the college students' study and life, learning time management can play very important role on improving the students' study and work efficiency. It is also help to improve the students' academic performance, alleviate psychological pressure and reduce anxiety.

With the popularization of computer and other intelligent devices in college students, more and more college students use electronic means to assist their study and life, and help themselves to manage their time by computer. However, there are many problems with time management software for college students.

The goal of this study is: based on the latest time management concept, design and development for college students' time management system, guide students to grasp the macro time, scientific planning, and promote good habits.

II. TIME MANAGEMENT THEORY AND SUPPORT TECHNOLOGY

A. Time Management Theory

1) Time Management Concept

The concept of time management originates from the academic field, but time itself comes from life, and time management is closely related to life, so it gradually becomes a popular concept in the process of later development. Although the passage of time does not change the speed of its passage by any external force, it does not mean that we are going to be a slave to time, and on the contrary, we must manage the time through a scientific approach and conduct more transactions within a given time according to its own arrangement. The use of time should change from passive to active, systematic, focused and planned active allocation of time. The central principle of time management is to try to concentrate the necessary bulk time on the most important tasks.

In the literature on "time management", many scholars believe that the true connotation of time management lies in people's self-management. Self-management is not simply the assignment of work or study tasks, but the initiative to plan, allocate and use time according to goals, guided by system theory. In the end, in addition to achieving the set goals, we should improve the work efficiency, explore the potential of the subject, and help the subject achieve a sense of achievement of self-worth[2]. The ultimate goal of studying time management is not only to manage time in an efficient way, but also to seek creative development of people and promote better self-planning.

2) Fourth Generation Time Management

So far, the time management concept has undergone several generations of evolution. Among them, the first three generations marked by "Memorandum", "Calendar" and "Plan Manual" respectively pursues the management of time too much, but neglects students' psychological experience, which easily leads to the students being in a tense state for a long time.

In contrast, the fourth generation no longer emphasizes how to arrange time and affairs, but take "important things first" as the first principle. "Important but not urgent" affairs can achieve a balance between output and capacity, focusing on it will help to improve the efficiency of time management and quality of life for college students. Although the fifth generation time management concept has also emerged, its main target group are corporate employees, which are not in the scope of this research.

"Important things first" is represented by a four-quadrant time management matrix, as shown in Table 1. In this table, urgency means that it must be dealt with immediately. Importance is related to goals, and whatever is valuable and conducive to the achievement of personal goals is important. The first is urgent and important and requires immediate attention. The second type of business is important but not urgent, including networking, writing mission statements, planning long-term goals, and nip in the bud. The third type of business is urgent but not important, including sudden visits, some meetings, and some activities. The fourth is neither urgent nor important.

TABLE 1. FOUR-QUADRANT TIME MANAGEMENT MATRIX

	Urgent	Don't urgent
Important	<p>The first quadrant</p> <ul style="list-style-type: none"> ● Crisis event ● Projects with deadlines looming ● Tasks to be completed within a limited time ● Urgent problem 	<p>The second quadrant</p> <ul style="list-style-type: none"> ● The preparatory work ● Preventive measures ● To build a relationship ● Identify new development opportunities ● Make plans and take necessary leisure time
Unimportant	<p>The third quadrant</p> <ul style="list-style-type: none"> ● Some emails, some phone calls ● Some reports, some meetings ● Receiving visitors and public events ● A lot of immediate, urgent things ● Many popular activities 	<p>The fourth quadrant</p> <ul style="list-style-type: none"> ● Trifles, work that kills time ● Some calls and emails ● boredom ● "Escape" behavior ● Watch too much TV

Generally, people are sensitive to the degree of emergency, but put off important things. Focusing on the first kind of business will lead to a larger and larger scope of processing, which will eventually lead to crisis management and occupy all the time and energy. Emergencies are usually a priority for others, but not necessarily for themselves. Highly effective people strive to reduce the number of third and fourth categories of business, whether urgent or not. Increasing the time spent on transactions in the second quadrant usually reduces the number of transactions in the first quadrant.

The emphasis of four-quadrant management is on the second class of transactions. Because the second type of business is the balance between output and capacity. As we invest more time in preparation, prevention, planning, and capacity-building, we reduce emergency time in the first quadrant. The survey found that companies with high performance and efficiency tend to spend 65-80% of their energy on the second quadrant and 15% on the third. Poorly run companies tend to do the opposite.

B. Support Technology

The main technologies involved in this study are shown in Table 2.

TABLE 2. DEVELOPMENT TECHNOLOGY LIST

Develop Content	Technical Support
Development Environment	Microsoft Visual Studio 2005
Data Storage	Microsoft SQL Server 2005
Interface Processing	Adobe Photoshop, Html, DIV, CSS
Function Development	Asp.Net, C#, JavaScript, Ajax
Development Architecture	Data access layer, business logic layer, interface presentation layer
System Framework	B/S mode

III. ANALYSIS AND DESIGN OF TIME MANAGEMENT SYSTEM FOR COLLEGE STUDENTS

A. Common software analysis

Through the analysis of the existing time management software such as “Memorandum”, “Calendar” and “Plan Manual”, we found that most of them have the following problems: they are mainly based on the first three generations time management concept, their functional orientation is not consistent with the situation of college students, and they have complex operations or unclear interfaces. Therefore, it is necessary to design a time management system which has a high level of management performance, meets the actual needs of college students and has a good operation experience.

B. Demand analysis

1) User demand analysis

A questionnaire survey on the time utilization and demand of college students was conducted, and the questionnaire effective recovery rate reached 92%. The content and results of the survey includes five aspects:

- Personal information of the respondents. Among the respondents, girls make up 86% and boys make up 14%. Undergraduates accounted for 79% and postgraduates accounted for 21%. The samples are distributed in all grades and various professions, and have certain representativeness.

- The basic situation of time use. More than 60% of the students spend most of their time on “learning”, ”living” and “entertaining”, “learning” accounted for the largest proportion of them. College students usually have more discretionary time than primary and middle school students, but nearly half of them think they feel busy during that time.

- The customary way of time management. Among the respondents, 60% have a clear goal, but only 1/3 have detailed plans, only 1/3 can carry out the plan at a high level, and less than 30% are satisfied with the time management plan. This can be summarized as “more goals, less planning, less execution and poor satisfaction”. Fortunately, more than half of the students have the intention to improve their time management ability by learning.

- Compliance with the fourth generation of time management concept. 97% of the students are accustomed to taking urgency rather than importance of affairs as the preferred dimension, which does not conform to the fourth generation time management concept.

- The application of time management software. 88% of the students have never used time management software, and more than half are willing to try. Thus, the time management software for college students has a great potential for application.

2) Functional requirements analysis

The system is put forward to solve the problems of students' time and personal events, curriculum arrangement and so on. The key lies in the analysis of student time, especially the time distribution of college students. The existing software has not in-depth analysis of this, and this research as the main content. Based on the statistical analysis of the questionnaire and the fourth generation time management concept, specific functions of this system include:

- Set up a course in combination with the learning situation. The most frequently used type of affairs for college students is learning affairs. Class is an essential and important matter for students, and it is also a part of the system to be carefully designed. The system should provide the setting of the schedule, the inquiry of the schedule, and be able to distinguish the information of single and double weeks, and provide the information of teachers and classrooms in class.

- Set and handle the information of life affairs. College students' life and other affairs occupy a lot of time, and there are differences in the roles they play. It will play an important role in the time management of college students to handle daily affairs well. Therefore, for daily non-learning transactions, you should be able to provide Settings, and can query and manage. Transaction setting is a large part of daily time management. Transaction setting should have starting and ending time. When setting, it should be able to distinguish its importance from its urgency.

- Set roles and schedule tasks based on goals. According to the fourth generation of time management theory, transactions should be set according to individual roles. The system should provide life goals, term goals, etc, and determine transactions based on goals and roles.

- Set priorities and reminders for important affairs. The system needs to be able to clearly distinguish the important transactions in the learning and life affairs, mark and remind the important transactions, and promote the user to execute the plan around the important transactions.

- Provide the ability to query scheduling. The system should provide weekly scheduling queries, daily time utilization, event sequencing, etc. Weeks time can intuitive tell users this week schedule use of information and the time utilization intuitive way to tell users, today how many time is to use on the useful things, how much time can also be used.

- Supervise records of implementation results and follow up on training habits. According to the fourth generation of time management standards, transactions should have timely feedback summary. The problem of college students' bad habit of wasting time is more prominent, because it is difficult to change the bad habit formed gradually after the relaxation of the pursuit of study. Therefore, the system should be able to timely monitor and record the implementation results, and track the cultivation of habits.

- Provide software usage assistance and supports time management. Questionnaire statistical results show that the majority of students and have not used the time management software, so the application of the software

should be provided tutorial, its content is set in line with the principle of concise, the user can quickly master the software usage, and establish the use of interest.

C. System design guidelines and basic principles

The main task of college students is to master knowledge and grow up healthily. Considering that their time is flexible and variable, the system design should give full consideration to the specific situation of college students' learning, choosing, making friends and healthy life, as well as make a balanced allocation of them. Specific principles include:

- Harmony and consistency. The core aim of time management is to improve college students' effective comprehensive coordinated development, finally realizes the personal knowledge level, physical quality, psychological quality, mental outlook, the harmonious development of the communication ability and so on. In the process of system design, different time arrangements of college students in study, life, family and other aspects should be taken into account to provide various management approaches for college students.
- Balance functions. In view of the different types of time management, there should be a relatively unified form of classification, so that users can easily look at the overall situation, to balance the use of each part of the situation, and do not overemphasize the neglect of a certain type of business. In the design of the system, the steps of goal, event and feedback should be separated into separate blocks, so that the system is in accordance with the order of thinking in form.
- Surrounding center. The system design should take individual differences into account, and provide each college student with personalized central tasks, so that all their goals and plans are around their central tasks. In the system, students should be explicitly provided with life goals and term goals, and help analyze their roles and responsibilities.
- Flexible. The design of the system should reserve certain modification space. For time-sensitive and time-sensitive transactions, it should be able to adjust timely and minimize the impact on other plans. Provide recording and feedback capabilities for event execution.

D. The function module design

According to the analysis of functional requirements, the system mainly includes five major modules, as showed in Figure 1.

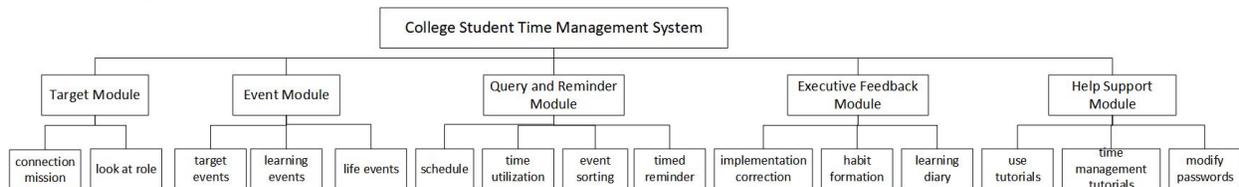


Fig. 1. The system structure

The modules are as follows:

- Target Module. Function of this module is: Users input the life ideal, semester goal, role and other content, from the macro direction to grasp the university time. Provide the event name for the formulation of "target event", provide the basis for "daily event" and "learning event", and do not involve the time and information of specific event.
- Event Module. Function of this module is: The user enters information such as start, end time and repeat period of a specific event here to determine the specific time distribution of the event.
- Query and Reminder Module. Function of this module is: Visually query the five-day time schedule, provide the user with an intuitive calendar schedule, and provide a time utilization ratio.
- Executive Feedback Module. Function of this module is: Help the user to record events, habits, to the user feedback for the user to record time use of the space result of experience, objectives, plans to provide the reference for the next step for the user.
- Help Support Module. Function of this module is: Use all functions of the system for users and provide a time management tutorial for users. Users can view this part of content at any time during use.

The target module is a prerequisite for scheduling time. Users should first determine their life goals, semester goals, etc., and set their personal roles and role matters according to the mission information. Then, the target event is determined according to the role transaction guidance, and the learning event and daily event are made according to the personal role. The event information generates the time schedule and executes the plan

according to the schedule. Finally, the implementation of time arrangement is recorded, and the habit cultivation is obtained by systematic statistics. Help the support module support the overall time utilization. The relationship between each module is shown in Figure 2.

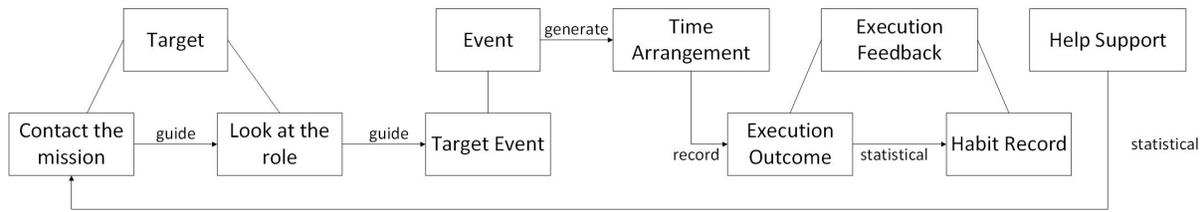


Fig. 2. The relationship between each module

E. Workflow design

After determining the functional modules of the system, the process design of the time management system for college students is carried out in accordance with the process sequence when it is used. The process is shown in Figure 3.

If you don't have an account, you need to register before you log on to the system. After logging into the system, if there is any modification to the target or event, it will enter the corresponding page operation. You can query the schedule in the system and execute it according to the schedule. After the execution of the event, the execution status and experience of the event can be filled in. The system will record and count the execution status. You can exit the system at the end of the access.

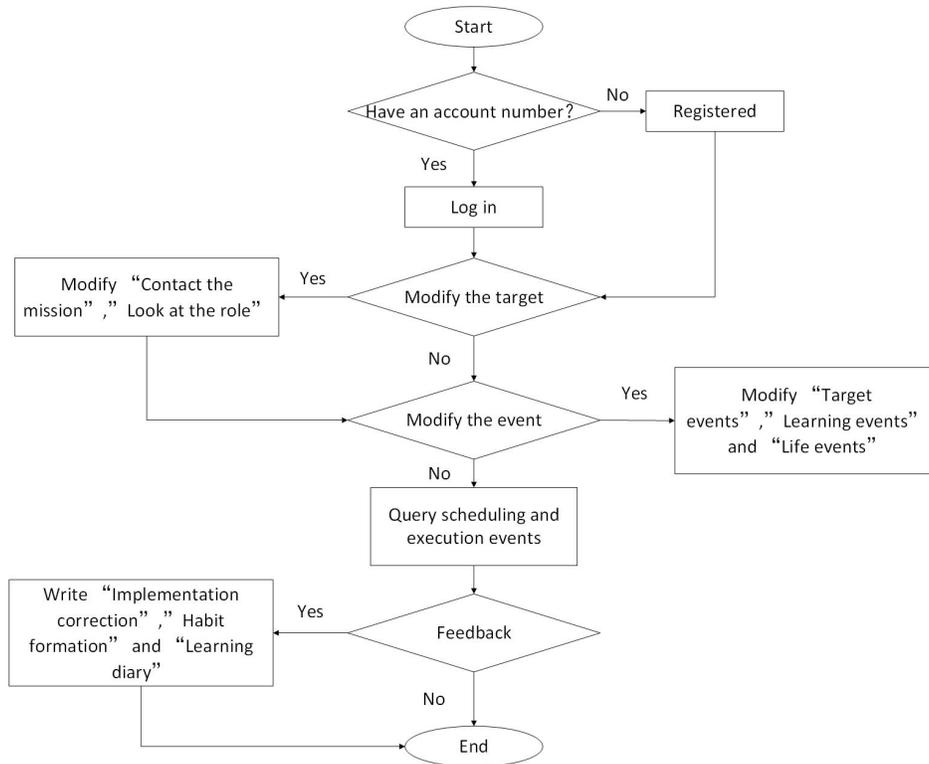


Fig. 3. The workflow

F. Database design

The database used by the time management system for college students is SQL server2005. The database name is "db_TimeManage", and the data tables contained in the database are shown in Table 3.

TABLE 3. Database: db_TimeManage

Order	Table Name	Functional Description
1	tb_User	User Table
2	tb_Role	Role Table
3	tb_Course	Course Table
4	tb_Task	Event Table
5	tb_Execute	Executive Condition Table
6	tb_Diary	User Diary Table
7	tb_Resource	System tutorial and Time tutorial

The data table contents of database db_TimeManage are as follows:

- tb_User. Used to record the user information, including login user name, password, and other related fields and life ideal, mission statement, universities, semester goals a, second and third term target term target a few fields. Where the user number is the primary key, it is also the identity column.
- tb_Role. It is used to record the user's role and role goals, including fields such as user sequence number, role, target 1, target 2 and target 3. A user can set up up to seven role records. Where the role number is the identity column.
- tb_Course. Used for storing course information, including user serial number, course serial number, course start and end time, class start and end time, class name, teacher, classroom, single and double week, etc. The course number is the main key.
- tb_task. Used to store events, including user sequence number, event start and end time, name, remark, repetition, habit formation, importance, emergency, etc., where event sequence number is the primary key.
- tb_Execute. Used to record event execution, including event date, event sequence number, execution, etc., where the execution sequence number is the primary key.
- tb_Diary. Used to record user diary, including user serial number, diary date time, diary title, diary content, etc., in which the diary serial number is the main key.
- tb_Resource. Store system tutorials and time tutorials, including resource Numbers, resource titles, resource types, resource content, and other fields, where resource Numbers are the primary key.

G. Interface presentation layer design

On the basis of functional module design, the page effect diagram after login system is designed. The interface strives to be clear, compact, harmonious and has a good interaction experience. The design effect is shown in figure 4.



Fig. 4. Page design renderings

On the main page, there are site logo bar, navigation bar, notification area, work area, footer information and

other areas. Among them, the function selection is realized by clicking the link and the drop-down menu on the navigation bar. The work area USES the iframe framework. When selecting the function, the information of other areas is retained. The content of the operation is displayed in this section, which is the main area of the page.

IV. IMPLEMENTATION OF TIME MANAGEMENT SYSTEM FOR COLLEGE STUDENTS

This chapter is on the basis of system design, using the related system development technology, to realize each function module of system, mainly including the login module, object module, the event module, query module, feedback module, help support module page. Main pages of the system are shown in Figure. 5, 6, 7 respectively.

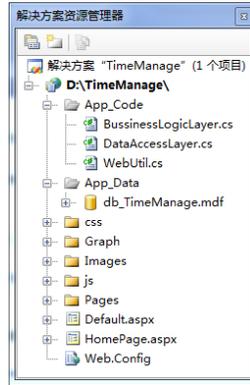


Fig. 5. The system directory



Fig. 6. The login page



Fig. 7. The system's front page

V. SUMMARY AND PROSPECT

A. Summary

Based on the fourth generation of time management theory, this paper studies the current situation and characteristics of college students' time use, and analyzes the existing problems of existing time management software. On this basis, summarizes the time using the actual demand of college students, put forward the design scheme of the system, and use ASP.NET, ADO.NET, JavaScript and other technology to achieve the college students' time management based on the theory of the fourth generation time management system. The system is simple in operation and suitable for college students to arrange and plan their time in a scientific and reasonable way. The system can not only provide prior time setting, adjust the time plan in time, but also carry out executive

feedback and follow up afterwards.

B. Rprospect

The preliminary application shows that the system can have certain positive effects on promoting the formation of good behavior habits of college students and establishing scientific concept of time management. The research can also be expanded from the following aspects:

Firstly, the influence of social, family, personal preference and other factors are also included in the formulation and implementation of the plan. The following research can continue to go deep in the aspects of college students undefined behavior trend, personality characteristics, learning style and so on, and gain more user application feedback.

Secondly, the convenience of operation is an important factor affecting the user experience. The development of the system can introduce more graphics drag-and-drop operations, create a more harmonious interface, make the software more easily accepted by college students, and further improve the efficiency of management time.

Thirdly, this system focuses on the design and implementation of time management function. With the popularization of intelligent mobile devices in college students, the next research can be combined with the development of mobile platform.

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An Institution's Training Program on Blended Learning: Development, Innovation, and Impact

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Two descriptors: blended learning, faculty development

Abstract

Blended learning, drawing from best practices in both online and face-to-face learning, is on the rise in higher education. Research shows that faculty needs professional development and support to get prepared for successfully developing and teaching blended courses. This article will share how an institution has re-developed a training program on blended learning based on learning theories and faculty feedback, along with its innovation for an effective process and greater learning impact.

Introduction

Blended learning, drawing from best practices in both online and face-to-face learning, is on the rise at colleges and universities. *Campus Technology* conducted its first "Teaching with Technology" survey in 2016, and 71% of faculty respondents reported using a mix of online and face-to-face environments to teach. The New Media Consortium Horizon Report (2017) has identified blended learning design as a top trend to drive technology adoption in higher education.

Northern Virginia Community College is the largest public educational institution in Virginia and the second-largest community college in the United States. Because of the heavy traffic issue due to its location in the nation's capital metro area with six campuses, the institution has an increasing need for blended courses. To meet this special need and prepare faculty to teach blended courses, NOVA Online has re-developed a training program on blended learning offered for all the college faculty. The mission of NOVA Online is to design and implement excellent and innovative instruction and student support services for online learners. It also supports instructional technology initiatives college-wide through certification programs, courses, workshops, small group consultation, and individualized training.

The re-developed training program is a three-week online course offered at Blackboard as Blackboard has been the learning management system that is used in the college. Since the online course needs extensive knowledge and skills in Blackboard, Blackboard proficiency is required as a prerequisite for the workshop on blended teaching and learning.

Literature Review

Blended learning is the "thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004). Blended learning describes "learning activities that involve a systematic combination of co-present (face-to-face) interactions and technologically mediated interactions between students, teachers and learning resources" (Bliuc, Goodyear, & Ellis, 2007, p. 234). Blended learning also denotes a reduction in face-to-face contact or seat time (Vaughan, 2007; Picciano, 2009; Mayadass & Picciano, 2007). For example, Picciano (2009) included "a portion" (institutionally defined) of face-to-face time [be] replaced by online activity" (p. 10). Allen and Seaman (2016) categorized traditional teaching as having 0% of content delivered online and blended teaching as having 30-79% of content delivered online, but the definition appears to be broad and vague. However, researchers recognized benefits of a broadly structured definition of blended learning since it allows institutions to adapt and use the term as they see fit and develop ownership of it (Sharpe, Benefield, Roberts, & Francis, 2006, p. 17). Dziuban, Hartman, and Moskal (2004) argued that "blended learning should be viewed as a

pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities” (p. 3). Heckman, Osterlund, and Saltz (2015) pointed out blended learning frameworks are often anchored by the dimensions of time and place, describing interaction modes as either same time or different time and either same place or different place. They stated that “both such a focus on delivery mode could sometimes run the risk of being instructor-centered or content-centered, rather than student-centered” (p. 4).

Blended learning has many benefits from the perspectives of instructors, students, and institutions. Graham, Allen, and Ure (2005) described three general benefits of blended learning: 1) enhanced pedagogy and learning effectiveness, 2) increased access and flexibility, and 3) improved cost-effectiveness and resource use. Blended courses make instructors explore new and different ways to teach by integrating activities from both face-to-face and online learning environments. Blended learning may provide pedagogical benefits such as increased learning effectiveness, satisfaction and efficacy (Garrison & Kanuka, 2004; Graham, 2013; Means, Toyama, Murphy, Bakia, & Jones, 2009). Blended learning provides students increased access to higher education offerings because of its convenience, less seat time, and a flexible schedule (Vaughan, 2007). Blended learning also save institutional resources such as classroom space and parking space, and thus make teaching and learning more cost-effective (Graham, 2013; Moskal, Dziuban, & Hartman, 2013).

Lloyd-Smith (2010) claimed that blended learning has emerged as a potential solution to address the diverse learning needs of community college students. Community college students tend to have multiple responsibilities outside of school, making flexible education an important determinant. Blended courses offer the convenience and flexibility of fully online courses without the loss of faculty and student personal interaction (Sitter et al., 2009). Xu and Jaggars (2011) found that students from blended courses were similar to those from face-to-face classes and they equally tended to complete their courses. Blended learning provides students social connections that enhance communication, thereby supporting student retention and success (Hijazi, Crowley, Smith, & Shaffer, 2006). Studies indicate that blended courses can be effective in promoting student success, but only if they are designed and delivered with care.

For faculty who have never taught online, blended courses can be challenging to design and teach as they need to develop new technological and pedagogical skills for this teaching modality. Research shows that professional development is crucial to prepare and support faculty to teach blended courses (Owens, 2012). Whether they take a low-impact blend or a medium-impact blend or a high-impact blend design approach (Alammary, Sheard, & Carbone, 2014), faculty must have the technological skills to design and maintain the online portions of blended courses. They also must have pedagogical skills needed for instructional methods unique to blended learning. Dziuban, Hartman, and Moskal (2004) concluded that maximizing success in blended learning requires a planned and well-supported approach that includes a high-quality faculty development.

Re-development and Impact

Constructivists believe that learning is an active process in which learners construct new ideas or concepts based upon their current and prior knowledge. Vygostky’s zone of proximal development indicates that learning is a social process in which people can develop more skills through peer interaction or collaboration than learning alone. Since adult learners are self-directed learners and instruction for adult learners should be task-oriented and related to the real world, adult learning programs should be developed to capitalize on the experience of all participants.

Constructivism and adult learning theories guided the re-development of the training program from its face-to-face format into a three-week online format offered on Blackboard. The initial training program required faculty to attend a series of face-to-face workshops on blended learning and then develop a blended course for review to earn a certificate of completion. The training program would often take faculty more than one semester to complete. The training process was long and the workload was very high for both faculty participants and professional training staff in terms of teaching and learning, course development, course review, and training data record management. Feedback from faculty and professional staff showed an ineffective training program. To enhance the training program and increase the learning impact, the training program has been redeveloped into a three-week online course that integrates active learning, social learning, project-based learning, and authentic learning into a new program to better meet the institutional need.

In addition to active learning supported by constructivism and social learning supported by Vygostky’s zone of proximal development, the online course also addresses authentic learning and project-based learning to make up for the initial course development and course review components in the previous face-to-face training program. Authentic learning is often referred to as real-life learning that is associated with a real-world problem or situation. It encourages learners to create a tangible and useful product, and provides learners with opportunities to

connect directly with the real world beyond the classroom. Project-based learning is an instructional approach that is centered on learners. It is defined as “an instructional approach that contextualizes learning by presenting learners with problems to solve or products to develop” (Moss & Van Duzer, 1998, p. 1). Project-based learning is different from traditional teaching as it emphasizes learning through learner-centered, interdisciplinary, and integrated activities in real world situations (Blumenfeld et al., 1991; Solomon, 2003).

Besides constructivism, project-based learning is also theoretically anchored in situated cognition (Brown, Collins, and Duguid, 1989). Brown, Collins, and Duguid (1989) think that learning is maximized if the context for learning resembles the real-life context in which learning materials will be used. Learning is minimized if the context for learning is not similar to the context in which the learning will be used. Project-based learning integrates experiences, knowledge, real-world contexts and situations into an active learning process for the creation of a tangible artifact, which produces meaningful learning.

The three-week online course covers all the basics about blended learning that the initial face-to-face workshops offered, and it also provides faculty an opportunity for active learning, social learning, project-based learning, and authentic learning without an additional course review. Three weeks of online learning makes faculty commit a certain amount of time to finish all the learning activities and assignments during the three weeks. Two out of three weeks provide faculty with opportunities to discuss and share topics such as understanding of blended learning, benefits and challenges of blended learning, examples of blended learning activities, and issues faced while designing a blended course. Taking a project-based learning and authentic learning approach, the online course requires faculty to develop and create artifacts such as a blended learning syllabus, a blended learning course design blueprint, and three modules of blended learning for a real-world course faculty have taught in a face-to-face format or a new course faculty are going to teach as a blended course. Furthermore, all the learning materials are accessible to all learners with captions available for all the videos in the course. After the three weeks of online learning, faculty will gain basics about blended learning as well as course design and hybrid pedagogy through hands-on learning at Blackboard.

After faculty complete the online course, they will receive a certificate of completion through the online registration system. At the end of the online course, anonymous survey is conducted with all the faculty participants to collect feedback about the online course and their learning experience. Below is a brief summary of course evaluation surveys conducted with 304 faculty participants from Spring 2016 through Fall 2017:

Survey Items	Mean (n=304)
Requirements for successfully completing the workshop were clearly stated.	4.7
The workload was appropriate.	4.5
I was able to regularly share ideas with others.	4.4
I feel prepared to develop a blended course now.	4.6
The workshop increased my confidence in my ability to teach a hybrid course.	4.5
I would like to recommend this workshop to a friend or colleague.	5.0
I'm satisfied with the workshop.	4.7

The survey is composed of questions with a Likert scale from 5 points for “Strongly Agree” to 1 point for “Strongly Disagree” and open-ended questions for faculty to share comments and thoughts about the online course. During the two years from Spring 2016 through Fall 2017, 304 faculty have completed the online course and 184 faculty have completed the survey, which yields a response rate of 61%. The survey data shows a very positive result about clear requirements of the workshop communicated to faculty, appropriate workload, peer learning through regular sharing with other fellow faculty members, feeling prepared to develop a blended course, and increased confidence to teach a blended course. All faculty respondents were very satisfied with the workshop and all of them would like to recommend the workshop to a friend or a colleague. Some qualitative data from the open-ended questions in the survey are listed below to show faculty’s positive experience about the online format of training, timely response from the facilitator, peer learning opportunity, project-based learning, and the online course itself.

Samples of positive comments on the online training format:

What I liked most was the simply ability to participate at any point and at any hour. That makes a huge difference to me in being able to complete the workshop. I think the course is fine as is, likewise the technology.

I really like the online format. That's the only way it can make me complete the hybrid training course while teaching my own students.

Samples of positive comments on the facilitator of the online course:

I appreciated the instructor's readiness in dealing with questions the class had and the regular communication.

I was and am very satisfied with the course. Professor Wang was and is a great Instructor. She is very warm, lovely, and friendly. She works very well with everybody. She is patient, understanding, and understands human problems. She is highly educated, very competent, and very good at what she does. A great Instructor, and a great asset to NOVA.

I really liked the quick, detailed feedback from the instructor. I enjoyed the discussion boards and collaboration with fellow faculty. I cannot think of anything specific to improve the course.

Excellent course. The optional materials are extremely helpful, and applicable. Anyone not well versed in hybrid pedagogy would benefit from the course. The instructor is extremely helpful and provides very timely and appropriate feedback. I especially appreciate the quick responses to emails (same day, usually within a short period of time).

Samples of positive comments on peer learning opportunities:

What I like most was the ability to share with others and get a wider view of the difference between hybrid and online courses.

I like the fact that this workshop used discussion boards and required its students to reply to another students thread, I think that is an excellent idea. I like the outlines explaining what is going to happen in class and online.

With regards to what I liked most, I thought the implementation of the discussion boards was particularly nice because it allowed me to get a sense of how other disciplines are implementing the hybrid format into their classrooms.

Samples of positive feedback on the course:

When I see that a course is well organized and easy to navigate, I know that it's going to be a good course. Then when I reviewed the content for each module, I knew that it would help me as I design the online component of my courses.

I liked everything about the course. The videos and readings were interesting and to the point. Hong communicated with us often and was very approachable. The technology was not over my head which was a major relief. I also appreciated that Hong said to start out using what we know and add to it later down the line.

I love the way the instructor gives us detailed instructions and it made it easier for us to understand what was expected from us for each assignment. I am very happy to learn about the resources available to us via this course. Thank you.

I liked the assignments that help to frame the shape of an actual course that we would create.

The course was informative and Hong's instructions were very clear and easy to follow.

In addition to re-developing the face-to-face workshops into an online course, the training registration system has also been improved to make the registration process and data management easier. The initial registration was through emails and then an online system. Training staff had to spend lots of time to trouble shoot technical issues for registration and manage the training data in spreadsheets. After the online system is changed into a home-grown system for registration and data record management, more time is saved from technical support for registration and more effective data record management is achieved.

Conclusion

Innovation takes many forms in both theory and practice, and its core value lies in problem solving and evolving (Magna & Buhana, 2018). Examples of this type of innovation for evolving include researching new and better ways to enhance teaching, changing education delivery to appeal to a new target population, and implementing new ideas to bring about better outcomes. Sustaining innovation refers to a process, system or modification that improves an existing product or system. It makes the process better and more efficient as well as more beneficial to the end users. Our sustaining innovation is achieved through both course re-development and new registration system development. By redeveloping the face-to-face workshops into a three-week online course with a focus on authentic learning, peer learning and project-based learning, data showed increased learning access, learning effectiveness, and faculty satisfaction and thus better support them to teach blended courses. By developing a new registration system to manage enrollment roster, course evaluation survey and certificates of completion, operation process showed reduced time in technical support for course registration, training data management, and certificates management. Our intention to improve training and solve a problem faced in the training program resulted in a greater impact in both faculty learning and training process management.

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A Community of Practice: Promoting Effective Practices in Teaching Blended Courses

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Two descriptors: blended learning, community of practice

Abstract

Blended learning continues to be on the rise in higher education. Research shows that faculty needs professional development and support to successfully develop and teach blended courses. This article will share how a community of practice supported faculty for effective practices in blended courses and what lessons learned for future implementation. All colleagues passionate for student success in blended learning can learn and enlighten their own practice.

Introduction

Blended learning, drawing from best practices in both online and face-to-face learning, is on the rise at colleges and universities. *Campus Technology* conducted its first “Teaching with Technology” survey in 2016, and 71% of faculty respondents reported using a mix of online and face-to-face environments to teach. The New Media Consortium Horizon Report (2017) has identified blended learning design as a top trend to drive technology adoption in higher education.

Northern Virginia Community College (NOVA) is the largest public educational institution in Virginia and the second-largest community college in the United States. Because of the busy traffic issue due to its location in the nation’s capital metro area with six campuses, the institution has an increasing need for blended courses. While the college offers a three-week online course multiple times per semester to prepare faculty for teaching blended courses, there are no other continuing programs to support faculty when they are teaching blended courses in the real world. After each session of the online course is offered in the college, feedback is collected from faculty participants regarding their learning experience and suggestions for future improvement of this training program.

Although the feedback is generally very positive, a number of faculty indicated that some continued support after the online course is necessary if possible. The authors of this article, guided by the blending with purpose model (Picciano, 2009), developed a series of face-to-face seminars to continue support for faculty on one of NOVA’s six campuses in collaboration with NOVA Online that offers the online course college wide and Woodbridge Campus on which the onsite seminars were offered. This collaborative initiative in Spring 2018 intended to promote effective practices in teaching blended courses through a community of practice.

Literature Review

Blended learning is the “thoughtful integration of classroom face-to-face learning experiences with online learning experiences” (Garrison & Kanuka, 2004). The Online Learning Consortium defines blended courses as courses that integrate online with traditional face-to-face class activities in a planned, pedagogically valuable manner, where a portion of face-to-face time is replaced by online activity. Allen and Seaman (2016) categorized traditional teaching as having 0% of content delivered online and blended teaching as having 30-79% of content delivered online, but the definition appears to be broad and vague. Researchers recognized benefits of a broadly structured definition of blended learning since it allows institutions to adapt and use the term as they see fit and develop ownership of it (Sharpe, et al., 2006, p. 17). Dziuban, Hartman, and Moskal (2004) argued that “blended

learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities” (p. 3).

Blended learning provides students increased access to higher education because of its convenience, less seat time, and flexible schedule. Researches have also shown that blended learning can enhance student engagement and learning outcomes (Dziuban, Hartman, Cavanagh, & Moskal, 2011) as well as students’ satisfactions (Martinez-Caro & Campuzano-Bolarin, 2011). For faculty who have never taught online, blended courses can be challenging to design and teach as they need to develop new technological and pedagogical skills for this teaching modality. Research shows that professional development is crucial to prepare and support faculty to teach blended courses (Owens, 2012). Faculty must have the technological skills to design and maintain the online portions of blended courses. They also must have pedagogical skills needed for instructional methods unique to blended learning (Korr, Derwin, Greene, & Sokoloff, 2012).

Picciano (2009) identifies a blending with purpose model composed of six components: content, social /emotional, dialectic/questioning, collaboration/student generated content, reflection, and synthesis/ evaluation. Content is the primary driver of teaching and there are many ways in which content can be delivered and presented in a blended course. The model also indicates that teaching is not always just about learning content or a skill but is also about supporting students socially and emotionally. Dialectic /questioning is an important activity allowing faculty to probe what students know and help them construct their own knowledge. Collaborative learning, incorporating reflection, can be a powerful pedagogical strategy. The last element is synthesizing, evaluating and assessing learning. Although not every course needs to require students for group work and not every course should rely entirely on reflective activities, Picciano (2009) stated that the six components of the model should blend together in an integrated manner that appears as seamless as possible for students in a blended course. The learning objectives of a course should drive the activities and approaches of the model.

Picciano’s blending with purpose model guided the design and development of four conversational seminars on effective practices in blended courses, with a focus on an overview of blended learning and the seminars, developing and blending content, developing and blending interaction and collaboration, and developing and blending assignments and assessment for each session respectively. The sessions are open to all faculty on Woodbridge Campus, with a preference to faculty who have completed the college’s online training program and who have already taught blended courses in the real world.

A Community of Practice

The initial concept of community of practice originated from “Situated learning: Legitimate peripheral participation” (Wenger & Lave, 1991). Wenger and Lave think learning is “increasing participation in communities of practice” (Lave & Wenger, 1991, p. 49). In his groundbreaking book, “Communities of practice: Learning, meaning, and identity,” Wenger (1998) expanded the idea of community of practice, articulating how social resources shape people’s learning trajectories and their professional identity. Wenger thinks a community of practice is formed by people who engage in a process of collective learning in a shared domain of human endeavor. It refers to a group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly with each other. The practice of a community is dynamic and involves learning from everyone.

Henri and Pudelko (2008) classified four levels of communities considering the strength of a group’s social bonds and the extent of its intentionality: communities of interest, goal oriented communities, a learner’s community, and communities of practice. Communities of interest generate knowledge solely for individual use. Goal-oriented communities, driven by external forces, carry out particular tasks within a specific timeframe. A learner’s community relies on the instructor for guidance and it generates both individual and shared products. Communities of practice are organized around professionals. The community members perform similar activities and use strong social bonds and high levels of intentionality to extend and improve their practices by generating and building a shared knowledge.

Wenger, Trayner, and de Laat (2011) presented the concept of value creation as a way to describe and assess social learning in a community of practice. The value is created as a result of community members’ activities and interactions with others. They defined five different cycles of value creation generated within a community of practice: immediate value, potential value, applied value, realized value, and reframed value. Immediate value refers to learning that is put to use immediately to solve a problem. Potential value refers to benefits related to shared knowledge and skills that can be realized at some time in the future. Applied value refers to application of shared knowledge and skills to new contexts. Realized value refers to knowledge and skills gained through a community of

practice made a difference in their ability to achieve important goals. Reframed value refers to the identification and definition of new criteria for success.

Data Collection and Analysis

The seminars were offered during the spring semester in 2018. Unfortunately, one of the buildings had flood emergency at the beginning of the semester. The campus was closed for one week, and almost 800 courses were moved and re-scheduled for the rest of the semester. While everyone was dealing with emergency, the seminar attendance rate was dropped. With all the efforts put into the initiative, three seminars were offered to cover all the planned content.

A total of ten faculty attended the three different seminars. Since each time had different faculty participants, we interviewed four faculty members who have participated in all the sessions. They are all female faculty, but they teach four different subjects and all of them have teaching experiences in blended courses. The interviews were scheduled right after the end of the spring semester in 2018. Each interview lasted for one hour in a quiet study room and a set of same questions were given to each of the four faculty members to answer. Further questions and comments occurred during the interview conversation. Four interviews were recorded with Speechy App for later transcription. It took about four hours to transcribe each recorded interview.

A brief summary of interview data is presented in the following table:

Themes	Faculty A	Faculty B	Faculty C	Faculty D
Faculty background	<ul style="list-style-type: none"> • She teaches art history courses. • She has been teaching blended courses since the college started offering. 	<ul style="list-style-type: none"> • She teaches English courses as an adjunct faculty. • She has been teaching blended courses since 2011. 	<ul style="list-style-type: none"> • She teaches math courses. • She has been teaching blended courses since 2012. 	<ul style="list-style-type: none"> • She teaches chemistry courses. • She has been teaching blended courses since 2004. • She is the first faculty to start teaching chemistry blended courses.
Insights about blended learning	<ul style="list-style-type: none"> • She thinks most students like blended courses. • “Obviously less time in the classroom is attractive because they would rather be there for less time.” 	<ul style="list-style-type: none"> • She likes blended learning and thinks it’s great for marine students. • She is concerned about not giving enough instruction in blended courses and feels insecure when not in the classroom engaging with students. 	<ul style="list-style-type: none"> • She thinks that blended learning is absolutely necessary but it’s not for everyone. • Blended courses increase more online components for students working on themselves. 	<ul style="list-style-type: none"> • She thinks engagement is a lot better with the required online or out-of-classroom learning component. • There is a little bit more preparation in blended courses compared with face-to-face courses.
Reasons for attending seminars	<ul style="list-style-type: none"> • Helpful to know what other professors are doing. 	<ul style="list-style-type: none"> • Drawn to the seminars because of the insecurities that she felt about her blended classes. 	<ul style="list-style-type: none"> • To find some new ideas for teaching. • To know what new emerging technology available for 	<ul style="list-style-type: none"> • To learn something new, in particular, about technology tools.

		<ul style="list-style-type: none"> To improve her class for the students to make their English experience better. 	implementing into her teaching.	
What they have learned	<ul style="list-style-type: none"> EdPuzzle Backward design approach 	<ul style="list-style-type: none"> Technology tools – the ways she can make it more interactive with students. The online lecture component Backward design approach 	<ul style="list-style-type: none"> New concepts New technologies Conversations with colleagues to discuss challenges and strategies 	<ul style="list-style-type: none"> Some really useful materials from the presentations Learning different perspectives from people in different disciplines Changed former perspective about science teaching
What not working for the seminars	<ul style="list-style-type: none"> Just a little too heavy on theory 	<ul style="list-style-type: none"> Wishing more is done with the tools Trying to tailor things working for each disciplines is very difficult. 	<ul style="list-style-type: none"> She wanted to know specific math hybrid courses. 	<ul style="list-style-type: none"> A little bit more hands-on probably needed for some sessions.
Whether seminars have met expectations	<ul style="list-style-type: none"> Positive 	<ul style="list-style-type: none"> Learned a lot Networking A lot of tools Theory part is helpful. 	<ul style="list-style-type: none"> It works through introducing new concepts and new technology as well as discussing the challenges 	<ul style="list-style-type: none"> Absolutely. It's actually way beyond that.
What else do you expect to learn or suggestions you have	<ul style="list-style-type: none"> The same kind of interchange of ideas 	<ul style="list-style-type: none"> More technology tools 	<ul style="list-style-type: none"> Published new ideas and specific courses in the discipline 	<ul style="list-style-type: none"> She is eager to set up more similar sessions more people can get involved in because it's going to help everyone grow

Discussion and Conclusion

Our observation of faculty's engagement in the conversation during the seminars and the interview data showed a very positive experience for faculty participants in general. All faculty have extensive experience in teaching blended courses, but they still think peer learning through conversational seminars is helpful. All of them want to learn what other professors are doing and what new ideas and new technology tools available to enhance their teaching. One faculty also shared her feeling of insecurity about teaching blended courses and expected to learn more through the seminars. The lessons we learned include 1) importance of community building; 2) incorporating both

design and technology components into the professional development program; and 3) balancing theory and practice with an emphasis on providing concrete examples from different disciplines.

All faculty interviewees liked the conversational seminars and the peer learning opportunity through networking with others and community building. Their learning include new pedagogical ideas such as different methods about assessment, new technology tools such as EdPuzzle, discussions on challenges and issues along with social networking with other faculty.

When asked whether the seminars have met their expectations,

Faculty D said:

“Absolutely. It’s actually way beyond that. I did not anticipate in learning much when I first came in. I didn’t anticipate but I did get more out of it.”

Faculty B said:

“I definitely learned a lot. One of my goals was definitely to network and that was 100% succeed. I definitely gained a lot of tools. The seminar was trying to tell us to do more interaction, and what it really shined was when you were showing us how to do this like the EdPuzzle tool.”

Faculty C indicated importance of peer learning and community building:

“I’m not sure why my other colleagues didn’t show on the seminars. We don’t have enough conversation with each other. Everyone is doing on our own. Nobody knows what others are doing. That’s the missing part.”

When developing the seminars, we tried to incorporate both design and technology into the sessions.

Faculty’s feedback showed the need of both components with a special favor on backward design approach and EdPuzzle as a technology tool.

Faculty A remarked:

“Hong mentioned that working backwards, like thinking about what you want them to know, develop assessment, and then build your lectures around that. I would do it in the other way so yeah that was just like something that stuck in my head ever since, that just makes sense and I never thought about it before.”

Faculty B commented:

“During the seminar, we discussed that thinking backwards, looking at the outcomes first, and then go backwards to identify content and design the activities, that’s very helpful.”

Faculty B also shared her wish for sharing more technology tools and Faculty D would prefer some hands-on work for some sessions.

Faculty C summarized her learning:

“Overview part is absolutely mandatory to help think about what components are important for hybrid, and then technology. The most important conversation with colleagues.”

While all faculty interviewees think theory is necessary, they shared a need to learn from practice through publication and concrete examples.

Faculty B remarked:

“In the beginning, theory part is helpful. It was interesting and it did make me think about things in a different way.”

Faculty A indicated a little too heavy on theory while Faculty C shared her wish to learn more through specific examples:

“I especially want to know specific math hybrid courses. Not just how people teach math hybrid in general, I would like to know something published and presented some new ideas.”

Interview data showed that it is important to make a proper balance between theory and practice with a focus on providing concrete examples from different disciplines.

In summary, the social bond among the faculty participants appeared to be strong and the extent of intentionality of the conversational seminars was high, which resulted in a community of practice (Henri & Pudenko, 2003). Although the interview data indicated that none of the faculty participants have tried the new ideas and new tools in their teaching right after the spring semester, the data showed that they are going to try the new knowledge and skills in the future semesters and the seminars also made a difference in their ability to teach blended courses. The seminars did not seem to have created immediate value and applied value, but they appeared to have created potential value and realized value through the community of practice (Dziuban, Hartman, Cavanagh, & Moskal, 2011). This collaborative initiative to promote effective practices in blended courses through a community of practice proves to be helpful and effective although faculty participation is not very high. Faculty feedback is also encouraging and constructive. The lessons we learned from our initial effort will lead to better planned sessions for our faculty through a community of practice in the future.

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International Graduate Student Perspectives & Experiences within an Instructional Design & Development Program: An Exploratory Examination

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Descriptors: International Students, Instructional Design

Abstract

This study investigated the experiences of international students in a doctoral instructional design and development program at a public university in the United States. Instructional practices differ globally, which present challenges as students become accustomed to the new concepts and applications of their host country (Zhu and Flaitz, 2005). The study addresses the effectiveness of blended online coursework for international students, the ability to acquire professional competencies, the perceptions, and realities of experiences in the academic program. Findings suggest that degree of social and academic challenges for international students in the IDD program are reflected by motivations for enrolling, specifically autonomous and non-autonomous motivations.

International Graduate Student Perspectives & Experiences within an Instructional Design & Development Program: An Exploratory Examination

The purpose of this phenomenological study was to reveal the experiences and changes in international students' values and beliefs as they engaged in a doctoral instructional design and development (IDD) program at a public university in the southeastern United States (U.S.). The research included participants from diverse backgrounds and cultures who have different motivations for selecting instructional design (ID) as their field of study.

The increasing number of books and academic articles published about the experiences of international students, as well as the appearance of the *Journal for International Students* dedicated to research on international students, is evidence of the growing academic interest in this population (Hackett, 2014). The data for this study were collected from international students currently enrolled in the program, as well as program alumni, to gain a deeper understanding of the needs and expectations of international students and will allow for the investigation of how to meet those specific needs and expectations.

Regardless of the country of origin, international students in higher educational institutions in the U.S. share similarities in the challenges they face (Geary, 2016). For example, the delivery of instruction can be quite different than what they were accustomed to in their home countries, as are the academic demands and expectations for students. A lack of awareness of support services, if such services are available, can decrease motivation or overall satisfaction in a program of study for this population (Perry, Lausch, Weatherford, Goeken, & Almendares, 2017). The language barrier tends to be one of the biggest obstacles leading to adjustment issues. The nuances of American English lead to miscommunication and misunderstandings, affecting not only friendships with peers but also academic success (Leong, 2015). American students sometimes misinterpret behaviors of international students which may lead to isolation and embarrassment, especially in the context of online learning.

There are issues associated with international students' learning experiences that were not as prevalent until the emergence of web-based courses. Technological advances have made it more accessible for individuals of diverse populations to attend graduate courses in the U.S. For example, web-based instructional content may be a major

convenience for international students. However, self-expression of the understanding of course content in an online format could cause complications for individuals when English is the second language (Lui, Lui, & Magjuka, 2010).

A new international student's level of perceived competence come from feelings of frustration or feelings of effectiveness of one's efficacy. Feedback of success or failure influence the new international student's sense of competence. Language skill and cultural adaptation are anxiety-provoking factors for many international students which can decrease the international students' sense of competence.

To help build a sense of competence for someone from another culture, there are several approaches that can be taken. Teachers can make a concentrated effort to monitor the international students' progress, strengths, and weaknesses and provide timely, informative feedback about their performances. International students should be encouraged to voluntarily participate in class and give rationales about their educational experiences, expressing their ideas freely. Also, collaborating with other students enhances the learning experience for students from other cultures as well as local students. Collaborative activities provide opportunities for international students to express their ideas, receive feedback from peers, develop global competencies for local students, and allows the international student to develop relationships necessary for cross-cultural understanding. The actions support effective-relevant feedback, allow students to grasp the meaning and worth or external goals, and provide the understanding and relevant skills conducive developing a sense of motivation.

The IDD program provides a trajectory for scholarship through online research, forming relationships with academic advisors and peers in the field, and on-the-job learning through graduate assistantships. As graduate assistants, many these students work in teaching and learning centers which provide instructional design assistance to faculty. Such assistantships allow for a deeper engagement with the content of their coursework through hands-on experience. The IDD program provides opportunities to gain knowledge of the academic culture of their host country. Yet some international students lack experience with instructional practices that, in some cases, differ greatly from what they accustomed to in their home countries. There exists a potential to impact ID practices in their home country from the experiences with technologies related to learning and teaching that the IDD programs provide. Also, for those who plan to stay in the United States, the diverse backgrounds and academic experiences that international students bring with them can lead to unique contributions to ID research and practice in this country.

The existing research on international students enrolled in American universities is vast, however, the global diversity of students in ID programs is mostly overlooked. When IDD students complete a doctoral program, a set of standard competencies are expected to be met (Koszalka, Russ-Eft, & Reiser, 2013), but does a gap exists in regard to international students? Our study addresses this gap and provides international perspectives on research in educational technology.

This phenomenological study examined the perceptions of students from different countries in a blended ID program regarding their academic experiences. Three questions were addressed in the study:

- What are the perspectives of international students related to ID research?
- How effective is the blended nature of the ID program with this special population?
- How do the expectations for the program prior to the international student's arrival to the U.S. compare to the realities faced once immersed in the IDD program?

Method

Participants

The participants for this study were graduate students in an IDD Ph.D. program at a university in the Southeastern United States and alumni. There were seven participants. Five participants were female and two were male. There were two alumni and five current IDD Ph.D. students. The participants were from South American and Asian countries.

Procedure

The appropriate approach for such exploratory research was a comparative type of collective case study. We collected data from seven current students and graduates from different cultures to reveal the similarities and differences of their experiences. The complexities of the integration of the study of ID and the international experience were revealed with the use of qualitative interviewing, observations, and journal reflection. Each case was examined in total, and then the different cases were compared in a cross-case analysis for patterns that cut across the cases as well as differences.

Results

There were five themes in the qualitative analyses: Enhanced professional development and assistantships. Enhanced pre-arrival orientation materials, motivations for why the students enrolled in the IDD program, the relationships with advisors, mentors, and peers, and academic flexibility.

Quotes from Participants

Learning Contexts

“It was difficult at first. I was not sure what was expected of me. I didn’t know the appropriate amount to write on the forums and since the classes were online, I didn’t want to offend any of my classmates. Communicating online, I was afraid to use the wrong words or my tone might come off as aggressive. Also, my instructors assumed that I knew how to use the LMS and was accustomed to learning in an online environment. Even though I was an educator in my home country, we did not have access to the internet or most other technologies that are taken for granted. I wish the university would have provided some guidance or training for new international students so that we would not have to spend the first few months catching up and feeling lost. All new students would benefit from these training, especially international students.”

-IDD program alumnus, female, China, working as an instructional designer in the United States

Pre-arrival expectations, post-arrival realities

“Before I arrived in the United States, I expected that education was so much better than my home country, simply because it was... American, which is assumed to be superior. I found the education setting to be much different than what I was used to back home, which was no surprise, but I expected much more guidance in America. There is a lot of flexibility and independence, which is great for me. However, I could see there being problems for those who cannot adapt to the openness of American education. For instance, I took it up myself to find trainings and workshops at the university’s teaching and learning center. The workshops were intended for faculty, but knew I needed to understand the LMS so I could be a more efficient student. I found the trainings on my own, and asked permission to attend as a student. If I were not persistent, I would not have had that opportunity. Mentors are of the utmost importance for success, and I’m not just talking about your advisor; just someone who cares about your academic growth and a person whom you trust. To be successful international students need these relationships but not all know where to even start.”

- Current IDD student, female, Honduras, working as a graduate assistant

Learning Content and Learning Contexts:

“The online learning experience was easy. A little too easy, actually. However, I hold an MS for a university in the States. Even though my master’s program was an entirely face-to-face program and the IDD program blended, my previous learning experiences prepared me for what to expect. I believe the online learning experience in this program is ineffective because it requires so little effort and the instructors are hardly present. I have learned a lot about instructional design but mostly from working with my advisor, as well as what I learned through my graduate assistantship”.

-Current IDD student, male, India, working as a graduate assistant

ID Research

“There is a heavy focus on theory, which is very important, but the program could use more opportunities for student research in instructional design. I am the only instructional designer at this company. They highly recognize my expertise and are aware of the needs of ID knowledge and skills. Of the knowledge and skills that I acquired in this program, I use adult learning, needs assessment processes, qualitative analysis, and evaluation.”

-IDD program alumnus, male, Thailand, currently an instructional designer in his home country

The findings aligned with Deci and Ryan's (2017) Self-Determination Theory (SDT), the theory defines autonomy as the need to self-regulate one's experiences and actions. This self-regulation satisfies the need to feel that an individual is in control of their own behavior. Autonomous behaviors are self-endorsed with an individual's authentic interests and values. The basic psychological need of autonomy is associated with volitional, congruent, and integrated feelings. This means that the need for autonomy is satisfied when an individual makes decisions of their own will and takes actions that are consistent with one's ideal or actual self.

Ryan and Deci (2017) are careful to distinguish autonomy from the closely-related concept of self-reliance. While both autonomy and self-reliance influence an individual's decisions and behavior within a social context, autonomy is one's ability to *make choices* that follow an individual's personal will, and self-reliance is *negotiating* between the point where external forces and personal drive intersect.

Self-reliance, or independence, differs from autonomy in SDT because only some intentional actions are truly autonomous. Self-reliance is the degree to which actions are influenced by external forces such as other people, rules, laws, and social environments. Autonomy is the sense that behaviors are self-endorsed, ego-centric acts, reflecting one's will. While self-reliance is the degree to which actions are not fully endorsed by the whole self and does not totally represent the preferences and values of the individual. Self-reliant behaviors are influenced by external influences which allow an individual to trust in one's capabilities, judgement, or resources. Additionally, autonomous behavior can be thwarted if the individual feels pressured or coerced by forces perceived to be outside one's self (DeHaan, Hirai, & Ryan, 2015).

For many psychologists, the concept of autonomy differs from what is defined in SDT. Cross-cultural psychologists define autonomy as independence or individualism. The SDT concept of autonomy relies on the volition and willingness of an individual as motivation for behavior; it does not refer to independence as autonomy (Chen et al., 2014). With this in mind, different cultural contexts can provide diverse world views by which the need of autonomy is influenced. For example, students from collectivist-oriented societies may feel autonomous when following the advice from others for whom they have respect. Students from individualistic-oriented cultures will feel autonomous by making their own decisions and expressing personal experiences.

It was found that the degree of social and academic challenges for international students in the IDD program are reflected by motivations for enrolling, specifically autonomous and non-autonomous motivations (see Figure 1.)

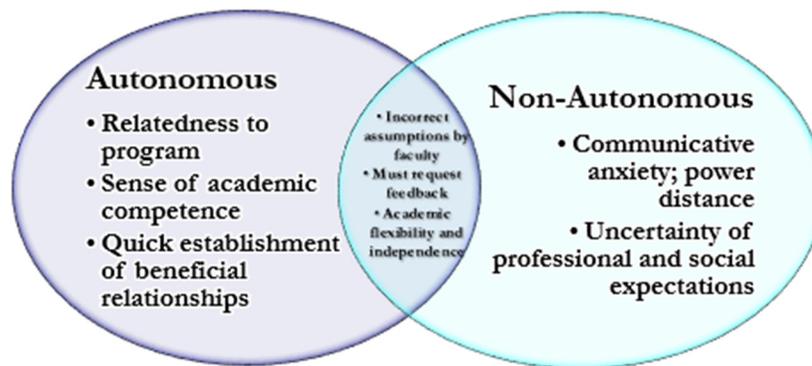


Figure 1. Motivations and Resulting Experiences of Enrollment

Discussion

To attract and maintain a talented and academically successful international student presence on campus, variability of the psychological needs across cultures must be explored. Professional development opportunities should be available to provide an understanding of underlying assumptions of SDT. These opportunities could be targeted for faculty and staff who work closely with international students so that they can be prepared to help build a sense of autonomy for international students as they adapt to their new academic environment. Development of trainings which deal with culture-specific perspectives of autonomy (e.g. the Hutsulian-Ukrainian concept of autonomy) may be too resource consuming. However, assumptions can be made about the social-cultural contexts across different cultures that can help international student support professionals facilitate internalization and satisfy the need for autonomy.

Involvement and the quality of interpersonal relationships with teachers, advisors, and peers will influence the need for affiliation and belongingness for international students in a new educational setting. Another influential factor is the cultural distance between the student's native culture and the dominant culture within the learning environment. Students from countries that are culturally similar to the United States may more quickly and easily feel more connected to their peers, academic practices, and course content in comparison to students from culturally distant countries. Also, pre-arrival expectations and post-arrival realities may also conflict, which could affect the sense of relatedness.

Teachers and advisors can help build a sense of relatedness only if they try to understand and acknowledge international students' feelings and perspectives. Building relationships that offer constructive feedback, but accept expression of negative reactions, allows the international student to feel that they are valued in the academic program. Empathizing with unpleasant feelings in a way that provides comfort can increase the quality of interpersonal relationships between international students and faculty.

Professional development and work opportunities (e.g. graduate assistantships) can increase a sense of relatedness by creating environments that facilitates affiliation, belongingness, and connection with others. This approach can integrate international students into the university system and establish formal or informal peer-to-peer mentoring. Such relationships can provide a constructive and positive connection through friendly and professional involvement, heightening the sense of affiliation and relatedness while mitigating relational exclusion and loneliness.

There were limitations to this study. More international students and alumni should be interviewed for a deeper examination of the perspectives, expectations, and the effectiveness of the IDD program. Faculty should also be interviewed and given a chance to reflect on what they are doing to improve relationships and learning experiences of international students, and data should be collected from multiple IDD programs to see if findings are similar across different universities and programs.

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The Collaborative Instructional Design System (CIDS): An Innovative Instructional Design Tool for the 21st Century Learning

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The Collaborative Instructional Design System (CIDS) is an innovative tool in instructional design that will benefit teachers as well as stakeholders for both schools and higher institutions.

The Collaborative Instructional Design System deals on the important aspect of the 21st- century instructional design with wider perspectives involving various communities in education, sharing and collaborating ideas and strategies, promotes creativity while establishing “globally competitive learners” towards the era of IR4.0 for a better future living in a new emergence of smart Society 5.0

Abstract

The transformation of the education ecosystem is critically required particularly in the era of the information technology. The main aim is to enhance the quality of educational practices whilst creating an inspiring learning environment for learners, giving them an opportunity to determine their own learning activities as far as learner-centered approach is in practice. Much effort has been spent in providing e-learning applications to the learners, tools, and strategies for teachers. However, not much effort has been done in connecting the dots - integrating elements and requirements of the current educational needs, fulfilling the nation's educational policies and aspirations into a mechanism that helps teachers to have a wider perspective in the process of designing the instructions creatively, systematically, practically and professionally.

The Collaborative Instructional Design System (CIDS) is an innovative tool in instructional design that will benefit teachers as well as stakeholders for both schools and higher institutions. It was developed as an option for educationalist in fulfilling the current educational needs especially the 21st Century education with its 4Cs learning needs (*critical thinker, communicator, collaborator, creator*), and learning opportunities developing “globally competitive learners”, regardless of their abilities. It is a new dimension at engaging teachers and other professional learning communities to be collaboratively involved in the 21st-century learning, facilitating and preparing learners to the Fourth Industrial Revolution – IR4.0, while facing the challenges of the newly emerging smart Society 5.0.

CIDS comprises The Integral ASIE Instructional Design Model (Ismail Md. Zain, Balakrishnan M. 2014, 2016). It's IHE features (integrative, hybrid, eclectic) has the capacity to collaborate with many elements related to education in producing a highly-rich, effective and creative instructional planning activities. Aspects of the model are based on the proposed 21st-Century Learning Framework (21st Century Partnership, 2002) and Four-Dimensional Education (Fadel C, Bialik. M., Trilling B. (2015). It has fundamentally encompassed the philosophical attributes of metaphysics, epistemology, axiology, ethics, and logic. These philosophical underpinnings strengthen the need for professional education player primarily classroom teachers to execute this model in their daily teaching and learning endeavors. It is classroom-based ID model that follow the theories of behaviorism, cognitivism, constructivism (Jonassen, 1991) and connectivism (Siemens, 2005; Ireland, 2007) and advanced features of the Professional Learning Community - - PLC, (Richard D.F. (2004). It enhances teachers' professionalism while enriching learners' experiences connecting virtually with other communities. It is accessible at <https://asiemodel.net>

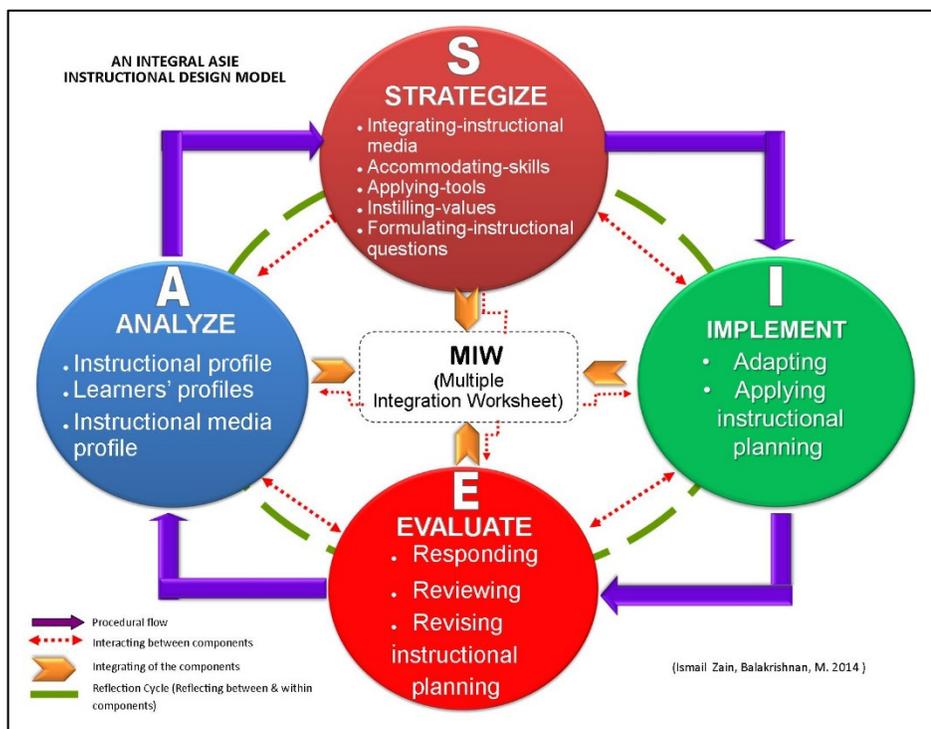
Introduction to the collaborative instructional design system - *Connecting the Dots*

The Collaborative Instructional Design System (CIDS) is a system that gives teachers an option at designing the current teaching and learning environment in connecting the dots - integrating elements and

requirements of the current educational needs, addressing the IR4.0 and Society 5.0 issues and fulfilling the nation’s educational policies and aspirations into a mechanism that helps teachers to have a wider perspective in the process of designing the instructions creatively, systematically, practically and professionally. It comprises The Integral ASIE Instructional Design Model (Exhibit 1), a transformation of instructional design model (<http://edtechreview.in/trends-insights/insights/1058-instructional-design-models-in-the-21st-century-a-review>), that provides a simple and practical planning tool fulfilling the features of current and future education needs. It allows teachers strategize approaches, methods, and activities for learners to determine their own choices that will inspire them at engaging with learning activities creatively, joyfully while preserving the characteristics of teachers' professionalism in learning and facilitating procedures. It is a constructive process in designing the instructions, which provides practitioners in education a valuable tool and perspective in enhancing the quality of instructions for all learners regardless of their capabilities as well in fulfilling the 21st-century learning requirements.

This model provides the procedural flow of the instructional planning which is flexible, constructive and user-friendly. It provides an option for practitioners in the educational field as a valuable tool or mechanism in planning the lesson creatively, following the needs of learners based on their characteristics or attributes. Learners are also given an equal opportunity to determine a variety of methods, activities, and recommendations proposed to be experienced in an enjoyable and exciting learning and facilitating environments. This model has a broad perspective towards improving the quality of learning, facilitating and training activities. It provides opportunities for teachers to discuss and share materials, experiences and their creativity with other colleagues throughout the country towards creating a high-tech learning approach fulfilling the requirements of the current and future education landscape. While special advanced features of the Professional Learning Community (PLC) (Exhibit 2) with its wider scope and concepts are integrated into CIDS giving more opportunities for teachers, learners, and communities to be connected and share valuable information on various aspects of education especially related to the employability issues. Individuals are invited or voluntarily participate in the program by registering as a member of PLC. They can choose to become members of a particular community group - educators, administrators, teachers, professional, student, and private communities. Users may communicate virtually with PLC members for advice, contributions, and sharing of ideas in meeting the needs of learning skills.

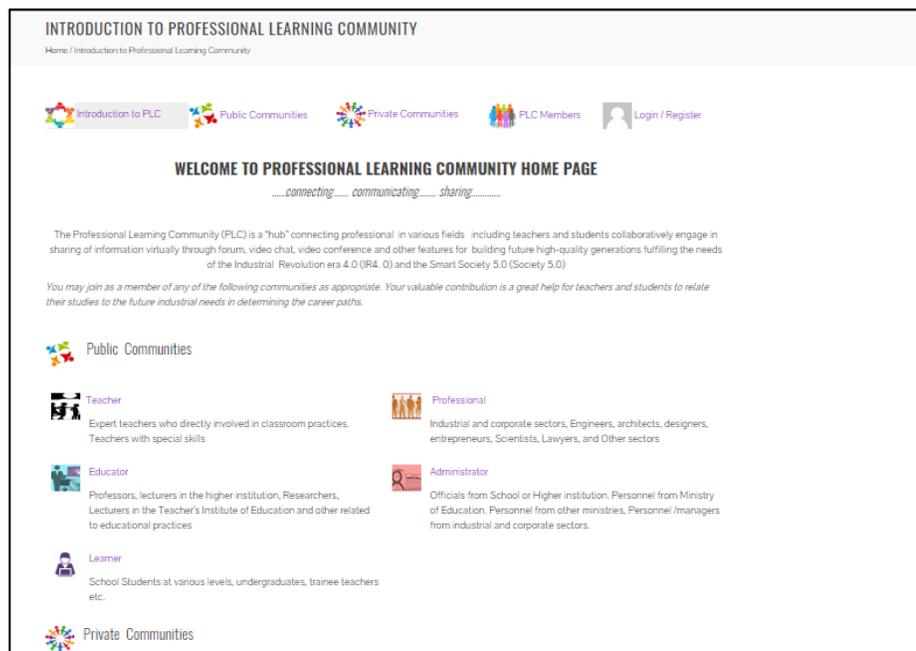
Exhibit 1: The Integral ASIE Instructional Design Model



Theoretical and conceptual framework of the collaborative instructional design system

The Integral ASIE ID Model has fundamentally encompassed the philosophical attributes of metaphysics, epistemology, axiology, ethics, and logic. This can be seen in flexible planning items that rely heavily on the creativity of teachers and students. These philosophical underpinnings strengthen the need for professional education player primarily classroom teachers to execute this model in their daily teaching and learning endeavors. It can be seen from various perspectives, concepts, and theories in the following descriptions. Theoretically, by looking at various perspectives, CIDS, as its name applied, has the capacity to collaborate with many elements in the instructional planning. The Integral ASIE Instructional Design Model encompassed in CIDS has the features of IHE (integrative, hybrid, eclectic). The items contained in this model are integral in nature because they are integrated with the various basic elements of education, which include the science of technology, pedagogy, and

Exhibit 2: The Main Professional Learning Community Page



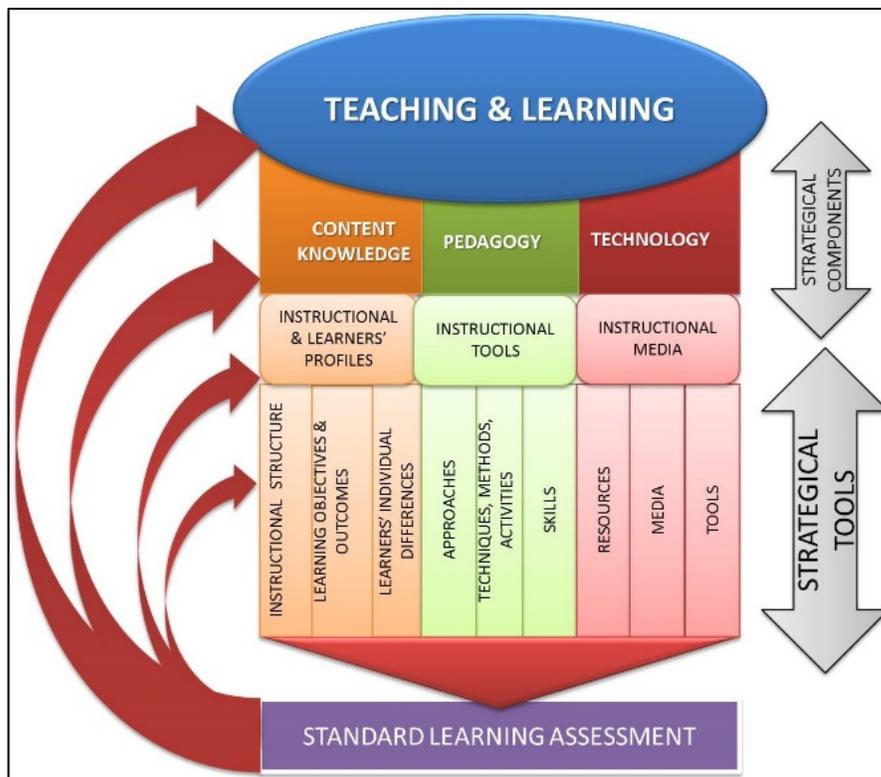
content knowledge - TPACK (Mishra, P., & Koehler, MJ (2006) comprehensively to meet the current learning needs. Looking at the features on the components and items of the model, it can also be classified into the hybrid instructional design system category though basically it is a classroom-based ID model but it has a wider scope which goes far beyond the four walls involving the virtual environments learning which give rooms to the blended type of learning as well as to make the possibility of flipped classroom being practiced. It follows an eclectic approach to the instructional design whereby a designer (user) blends ideas from multiple learning theories to construct a learning experience that works better than from only one theoretical influence. Hence, the paradigms of behaviorism, cognitivism, constructivism, and connectivism are likely being considered and applied in the various instructional planning procedures, unlike some of the conventional models that initially designed for Instructional System Development (ISD) (Seel, N. M. 1997, Gustafson K.L., Branch R.M. 2002) which make this model differs from other conventional ID models.

Theories of behaviorism, cognitivism, constructivism are the three broad learning theories most often utilized in the creation of instructional environments. These theories, however, were developed in a time when technology did not impact learning. New technology forces the 21st-century learner to process and apply information in a very different way and at a very different pace from any other time in history thus, lead to the emergence of connectivism. According to Siemens, (2005) connectivism was driven by the understanding that decisions were based on rapidly altering foundations. New information is continually acquired, and the ability to draw distinctions between important and unimportant information is vital. As a result of the above theories, various learning and teaching models were developed which introduce different methods and techniques to be applied by

teachers and students in learning situations. These methods and techniques that can be integrated into teacher's planning procedures according to their own creativity in the Integral ASIE ID Model. While adapting to the basic principles of instructional design and other instructional design models such as Dick & Reiser Model, Dick & Carey Model, ASSURE Model, ARCS Model, ADDIE Model, attention was also given to other related fields in the formation of this ID model. Basically, what distinguishes between The Integral ASIE ID Model with conventional ID models is in terms of the goal towards meeting the concept of the learner-centered approach. Most other models carry the question "What elements need to be determined by the teacher to build a learning situation for learners" - is more teacher-centered because teachers determine the planning process. While for The Integral ASIE ID Model focus "How teachers strategize the learning in developing a flexible learning situation to meet to the needs of the learners" - it is more learner-centered learning because teachers only suggest various elements that are appropriate while learners are given the opportunity to implement those activities that inspire their interest in establishing "fun-learning" environment.

A special attention has been given to learners' profiles, their readiness in following the lesson, media attributes, and learners thinking levels in establishing the "differentiated learning" situation. Moreover, the relevance between the principles and theories taught in the classroom with the working environment to be met in the era of the Revolutionary Industry 4.0 (IR4.0) and their position and role in the emergence of the smart society 5.0 (Society 5.0) in the future, is a vital factor to be analyzed, strategized and implemented. These factors are important in creating the concept of "thinking out of the box" among learners and educationalist as well, in addressing to the current education developments. Likewise, the key elements in the current learning framework such as the 21st Century Learning Framework, (2002), Four-Dimensional Learning, (2015) and Framework for 21st Century Learning, Ministry of Education, Malaysia (2017), that have a close correlation between each other are also part of the planning items in this model to ensure its relevant to current learning situations. Practically based on the theoretical description, teachers require skill in pedagogical knowledge, technological knowledge, and content knowledge – TPACK (Mishra, P., & Koehler, MJ 2006) integrated into their learning and facilitating activities. A Strategic Learning Structure Framework (Ismail Md Zain, 2016), (Exhibit 3) was developed to clarify how the components of instructional planning in The Integral ASIE ID Model were formed and displayed in a Multiple Integration Worksheet (MIW) based on the areas in the TPACK Model (Exhibit 4).

Exhibit 3: A Strategic Learning Structure Framework



The 21st century education

So much attention has been given on the characteristics and features of the 21st Century Learning framework in the development of the Integral ASIE ID Model (Exhibit 5) because it is kind of current requirements in learning that support the era of IR4.0 as well as the emergence of the smart Society 5.0. While in 2015, The Four-Dimensional Education (Fadel C., Bialik. M., Trilling B. (2015) has been released which focused on the transformation of education systems in relation to the competencies and aspirations needed by our learners in the 21st-century learning environment. Being closely related to the 21st Century Partnership framework, the component has been restructured to portray the qualities of human learning dimensions namely the knowledge, skills, and character that involved the metacognition processes.

Exhibit 4: Components of TPACK Model in The Multiple Integration Worksheet

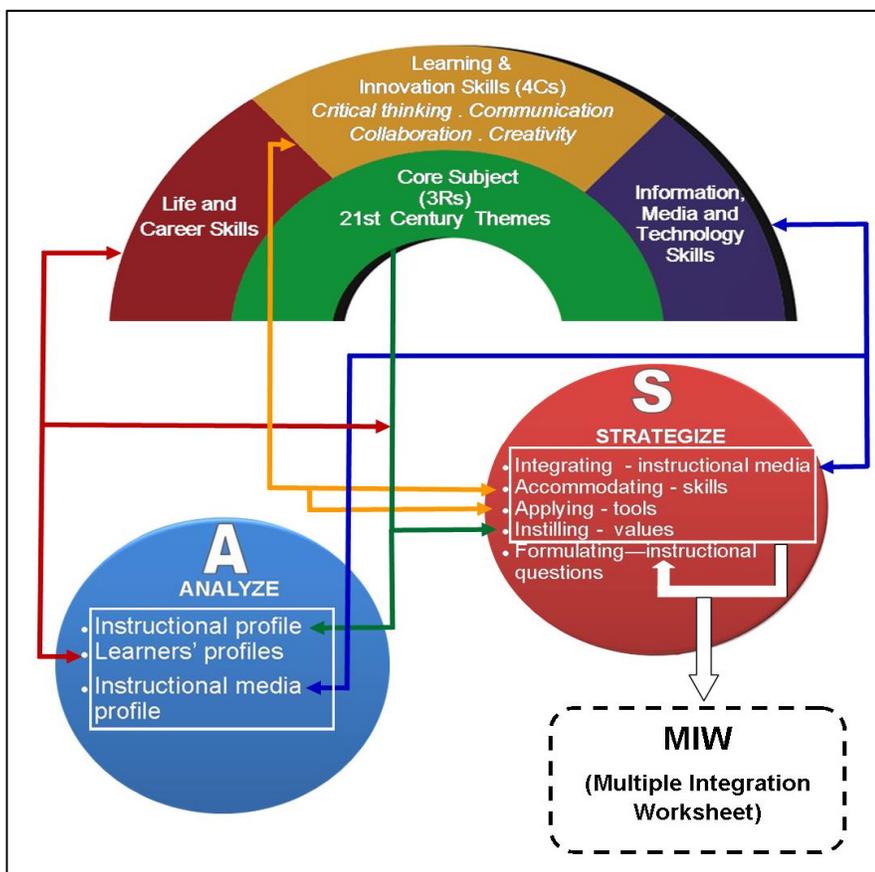
ANALYZE		STRATEGIZE					
(a) Instructional Profile	(b) Learners' Profiles	(c) Instructional Media Profile	(d) Integrating - Instructional Media	(e) Accommodating - Skills	(f) Applying - Tools	(g) Instilling - Values	(h) Formulating - Instructional Questions
<p>Topic Unit 4 - Be Safe</p> <p>Learning Topic 1 Grammar 2 Reading 3 Writing 4 Language Arts</p> <p>Content Standard 2.2 By the end of the 6-year primary schooling, pupils will be able to demonstrate understanding of a variety of linear and non-linear texts in the form of print and non-print materials using a range of strategies to construct meaning. 2.3 By the end of the 6-year primary schooling, pupils will be able to read independently for information and enjoyment. 3.3 By the end of the 6-year primary schooling, pupils will be able to write and present ideas through a variety of media using appropriate language, form and style.</p> <p>Learning Standard 2.2.1 Able to apply word attack skills by identifying: (a) homograph (b) homophone 2.2.2 Able to read and understand phrases and sentences from: (a) linear texts</p>	<p>Please click here to enter information</p>	<p>Types of Media Whiteboard and marker pens Fiction and Non-Fiction books Images Printed materials Textbook Elements Text Composition Environment Importance</p>	<p>Instructional media Images are used to show examples. Printed materials are used as worksheet. Textbook is used as the main reference. Whiteboard and marker pens are used by pupils to complete the activities. Fiction and Non-Fiction books are used for NILAM EAC Aspect of invention is used in the learning.</p>	<p>21st Century Interdisciplinary Themes Theme Civic Literacy Learning and Innovation Skills (4C) Critical Thinking Communication Collaboration Life and Career Skills Flexibility and Adaptability Initiative and Self-Direction Information, Media</p>	<p>Thinking Tools Consider All Factors (CAF) Double bubble map Method, Technique, Approach Outcomes based learning Simulation Contextual learning Role play/ Dramatization</p>	<p>Values Hardwork Persistence Safety Be cautious Team work Creativity</p>	<p>The main instructional questions or statements based on LOTS What is a neighbourhood watch? The main instructional questions or statements based on HOTS Why should we turn down the volume on the home telephone before we leave?</p>
↑		↑		↑			
Content Knowledge		Technological Knowledge		Pedagogical Knowledge			

The Integral ASIE Instructional Design Model – the procedural application

The Integral ASIE Instructional Design Model is an integrated strategical approach to the designing of the instruction in fulfilling the learners' needs in today's learning environment. ASIE refers to the components of **Analyze, Strategize, Implement, and Evaluate** (Exhibit 1). Each component has several aspects and items accordingly (Exhibit 6). This "learner-centered approach" interactive online ID model in designing instruction, engaged learners of different abilities exploring and unleashing their potentials in generating and creating ideas through Higher Order Thinking Skills (HOTS) activities, (Ismail Md Zain, 2013). The model is **interactive** - a user-friendly interactive features which provide options to interact with the content of the items, **integrative** in planning the content - provide options for teachers to integrate planning items provided or add new items as needed in the planning process, **prescriptive** - provide a fast accessing of preset information that assists users in understanding the features of the model, and **constructive** in the organization of the components - a complete, comprehensive and well organized strategical planning procedures. The model begins with the individual teacher or a group of teachers in the same subject area collaboratively analyzed the suggested aspects in the first component of the model that include the instructional profiles such as subject, theme, learning areas, topic, learning objectives and outcomes or other profiles for the particular subject. In the second component of the model, features of the 21st-century learning skills analyzed, various instructional tools (techniques, methods, and activities) selected, appropriate thinking tools especially dealing with the principle of higher order thinking skills (Ismail Md. Zain, M. Balakrishnan, 2014), and

aspect of moral values identified. This leads to the formation of instructional questions. They are essential questions for the topic which formed instructional strategies in the instructional planning. Teachers will select the strategies prepared in the third component for their best practices in the classroom to ensure its appropriateness and effectiveness for the learners. The final component is the evaluation stage whereby responses from feedback are gathered to review and revise the instructional planning strategies in the respective component and aspect of the model. It is a reflection process for future instructional redesigning opportunities. However, evaluation is not only taking place at the end of the planning but at every component of the model as indicated by dotted lines. The Reflection Cycle is another form of evaluation/reflection for teachers in their instructional planning process as indicated by the green circle. There are other advanced features that benefit teachers in their instructional planning as well as instructional leaders (principle, headmasters, evaluators) in monitoring, supervising, evaluating and accessing the teachers' professional competencies. There are options allowing teachers to create daily lesson plans (DLPs) according to their respective needs creatively and professionally and creating a Professional Learning Community (PLC) to build character and unleash learners' creativity.

Exhibit 5: The relationship of the 21st-century learning features integrated into the components of The Integral ASIE ID Model



Multiple Integration Worksheet (MIW)

An Integral ASIE ID Model has its own displayed planning worksheet known as Multiple Integration Worksheet (MIW) (Exhibit 4 & Exhibit 7). It gathers a wide instructional planning information by users through the customized aspects and items in the components of the model. These unique features guide teachers in the process of formulating & integrating the best possible practices for learners with different abilities in the instructional planning strategies at the macro level (overall planning for a specific topic) and at micro levels (creation of daily lesson plan – DLP). Since teachers are encouraged to plan their instruction collaboratively with their colleges, thus, MIW helps teachers in the lesson study session (features of Professional Learning Community – PLC) to determine the best

possible item that fit well in their classroom practices. It is editable and savable in the pdf file format to the user while providing options in requesting it to be shareable among others across the nation. Information selected or written in the 1st & 2nd component of the model (*Analyze & Strategize*) is compiled or inserted in the MIW. It will be displayed when the user clicks on any aspects of the 3rd and 4th component of the model (*Implement & Evaluate*).

Exhibit 6: Components, Aspects, and Items of The Integral ASIE ID Model

COMPONENT		ASPECT	ITEM	MIW
A	ANALYZE	Instructional profile	<ul style="list-style-type: none"> ○ subject, theme, learning areas, topic, etc. ○ learning outcomes/ learning objectives etc. 	Multiple Integration Worksheet (MIW) is an overall planning mechanism or framework based upon the four components, used to guide instructors/ teachers in formulating & integrating the best possible practices in the instructional planning strategies to meet the current and future learning needs and requirements of the learners.
		learners' profiles	<ul style="list-style-type: none"> ○ multiple intelligences, ○ learning styles ○ other psychological profiles 	
		instructional media profile	<ul style="list-style-type: none"> ○ types of media chosen ○ elements ○ compositions 	
S	STRATEGIZE	integrating - instructional media	<ul style="list-style-type: none"> ○ instructional media were chosen for the lesson in relation to the above profiles 	
		accommodating - skills	<ul style="list-style-type: none"> ○ Various learning skills including the 21st. Century learning skills and features 	
		applying - tools	<ul style="list-style-type: none"> ○ applying various thinking tools - Higher Order Thinking Skills (HOTS) ○ instructional tools - technique, methods, activities, etc. 	
		instilling – values	<ul style="list-style-type: none"> ○ the element of moral values & others 	
		formulating	<ul style="list-style-type: none"> ○ instructional questions ○ assessment 	
I	IMPLEMENT	adapting	<ul style="list-style-type: none"> ○ adapting for lesson/course development 	
		applying	<ul style="list-style-type: none"> ○ applying in the learning & teaching process based upon lesson/course plan developed 	
E	EVALUATE	responding	<ul style="list-style-type: none"> ○ responding to the feedback 	
		reviewing	<ul style="list-style-type: none"> ○ reviewing the instructional planning strategies for improvement 	
		revising	<ul style="list-style-type: none"> ○ revising the instructional planning strategies for future redesigning 	

Exhibit 7: Multiple Integration Worksheet (MIW)

Teachers may select information in each column to create a daily lesson plan (DLP)

Blue text is editable



NAME: ARNI ASREENA BT AZIZ
CLASS LEVEL: YEAR 5
CLASS:
SUBJECT: ENGLISH
DATE: 04-06-2018 TO 08-06-2018
WEEK : 23



SEKOLAH KEBANGSAAN LUKUT
MULTIPLE INTEGRATION WORKSHEET (MIW)

ANALYZE			STRATEGIZE				
(a) Instructional Profile	(b) Learners' Profiles	(c) Instructional Media Profile	(d) Integrating - Instructional Media	(e) Accommodating - Skills	(f) Applying - Tools	(g) Instilling - Values	(h) Formulating - Instructional Questions
<p>Learning Topic 4 Language Arts 5 Grammar 1 Listening and Speaking 2 Reading 3 Writing</p> <p>Content Standard 3.1 By the end of the 6-year primary schooling, pupils will be able to form letters and words in neat legible print including cursive writing 3.2 By the end of the 6-year primary schooling, pupils will be able to write using appropriate language, form and style for a range of purposes. 3.3 By the end of the 6-year primary schooling, pupils will be able to write and present ideas through a variety of media using appropriate language, form and style</p>	<p>Learners' Readiness Pupils have learned about Gunung Mulu Pupils knew the traditional costumes in Malaysia. Pupils have learnt simple future tense.</p>	<p>Types of Media Images Printed materials Elements Text</p>	<p>Instructional media Images Printed materials.</p>	<p>21st Century Interdisciplinary Themes World of Knowledge Learning and Innovation Skills (4C) Critical Thinking Communication Collaboration Creativity Life and Career</p>	<p>Thinking Tools Consider All Factors Alternatives, Possibilities, Choices (APC) First Important Priorities (FIP) Recognize.</p>	<p>Values Helpfulness Gracious Resilience Godly Have principles Politeness Responsible Tolerant Empathy Integrity Thrifty Sensitive Team work</p>	<p>The main instructional questions or statements based on LOTS Describe the pictures to construct simple sentences. The main instructional questions or</p>

Endorsement				
Name	Position	Remark	Date	Endorsement
 SABIDAH BINTI MADON	Headmaster SEKOLAH KEBANGSAAN LUKUT		11-06-2018 8:41 AM	Verified 
 DR ISMAIL MD ZAIN	Observer PUSAT BANTUAN	Overall remarks: Congratulation and keep it up	18-06-2018 1:00 PM	Verified 

Upload Shared Material

Create Daily Lesson Plan

Save as PDF

Print

Open Record

Back to Model

Upload sharing material

Create DLPs

Save in PDF file format

Print MIW

Confirmation/ verification from administrators

List of DLPs that have been created

Daily Lesson Plan (DLP) – Planning at Micro Level

The content of DLP is in 2 parts following the model's component (Exhibit 8). The first part is the information of the selected items from the MIW- 1st & 2nd component of the model (*Analyze & Strategize*). The second part is the information of the teaching and learning activities (facilitating activities, learners' engagement activities) as indicated in the 3rd component of the model (*Implement*) as well as impact, reflection, and remark as indicated in the 4th component of the model (*Evaluate*).

Summary - The Impact of CIDS on teachers, learners and administrators - Strength and Capabilities

Generally, it is time effective, reduce teachers' burden in preparing the lesson, provide sharing of ideas, establishing unlearn, learned and relearn society - to learn different approaches in educational designing, relearn of new

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Exhibit 8: Daily Lesson Plan (DLP)

Planning items that has been selected by users from MIW

<p>NAME: NABILAH BINTI JAMIL CLASS LEVEL: YEAR 5 CLASS: 5 ARIF SUBJECT: ENGLISH WEEK: 18 DATE: 30-04-2018 TIME: 11:00 AM TO 12:00 PM</p>	<p>SK SERTING HILIR 2 FELDA DAILY LESSON PLAN</p>					
ANALYZE			STRATEGIZE			
(a) Instructional Profile	(b) Learners' Profiles	(c) Instructional Media Profile	(d) Integrating - Instructional Media	(e) Accommodating - Skills	(f) Applying - Tools	(g) Instilling - Values
Learning Objectives write at least three out of five sentences using Learning Topic 5 Grammar Content Standard 5.1 Use different word classes correctly and appropriately Learning Standard 5.1.4 Able to use conjunctions correctly and appropriately: (a) although (b) since Performance Standard write sentences Objectives Success Criteria write at least three out of five sentences using	Learners' Readiness Pupils have been exposed to the topic in their previous lesson.	Types of Media Printed materials Elements Text Composition Expectation	Instructional media Printed materials are displayed to pupils EAC Language	21st Century Interdisciplinary Themes Theme Civic Literacy Learning and Innovation Skills (4C) Critical Thinking Life and Career Skills Productivity and Accountability Information, Media and Technology Skills Information Literacy Lower Order Thinking Skills Apply High Order Thinking Skills Reflective skills	Thinking Tools Alternatives, Possibilities, Choices (APC) Method, Technique, Approach Outcomes based learning	Values Responsible

IMPLEMENT						
LEARNING & FACILITATING ACTIVITIES						
Instructional Questions The main instructional questions or statements based on LOTS identify the use of The main instructional questions or statements based on HOTS write sentences using						(f) Additional Activities (Optional) Information for the learners' enrichment activities
(a) Instructional Events	(b) Facilitating Procedures	(c) Planning Items	(d) Learners' Engagement	(e) Remarks		
	<i>(Activities in this facilitating procedures should be based on the main instructional questions or the main statements of LOTS and HOTS formulas)</i>	<i>(The selected planning items listed below should be integrated in the instructional planning)</i>	<i>(Involvement of learners in the learning activities)</i>			
Set Induction 5 Minutes	Pupils recall how to use 'although' and 'since' by using examples of sentences.	Types of Media Printed materials Elements Text Composition Expectation	Pupils respond to the teacher's questions.			
Step 1 15 Minutes	Pupils do fill in the blanks activity using 'although' and 'since' orally through classroom discussion.	Instructional media Printed materials are displayed to pupils EAC Language	Pupils do fill in the blanks activity orally.			
Step 2 0	In small groups, pupils create sentences using 'although' and 'since' and then discuss their answers in classroom discussion.	21st Century Interdisciplinary Themes Theme Civic Literacy Learning and Innovation Skills (4C)	Pupils do a group discussion.			

Instructional events

Facilitation activities for learners.

Selected items displayed

Expected learners' engagement activities

Information gathered to enrich learners' activities

EVALUATE				
Learning Impact / Self Reflection				
				<div style="border: 1px solid black; padding: 5px; display: inline-block;">Self-reflection</div>
Supervisors' Remark				
Endorsement				
Name	Position	Remark	Date	Endorsement
 DR ISMAIL MD ZAIN	Observer PUSAT BANTUAN	Remarks for this DLP: (Select or leave blank if not required) Congratulation and keep it up	03-05-2018 8:51 AM	Verify
Description				

strategies formulated in response to the changes in the educational landscape, and unlearn the past experiences through the transformation process in creating awareness of the importance and impact of current innovation in ID towards

lifelong learning as required by The Sustainable Development Goal 4 –Education 2030 Agenda – UNESCO, (UNESCO, 2014). Learners have equal opportunities for gaining knowledge & skills regardless of their differences in capabilities resulting from the high-quality systematic design of teachers’ instructions. Unleash their potentials through learners centered approached, established globally competitive learners – following the 21-century learning needs, Inspiring learners – learning are not just gaining knowledge and skills but responding to the industrial needs for future employability. School administrators are accessible for verification, monitoring, evaluating and identifying teachers’ competences (strength and weaknesses), assist in identifying the relevant CPD courses for teachers while establishing a complete network and database of teachers’ instructional planning.

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