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

AECT Sponsored by the Research and Theory Division
And
The Division of Instructional Design
Jacksonville, FL

Editors
Michael Simonson, Ph.D.
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Davie, FL

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Oxford, MS

2017 Annual Proceedings – Jacksonville: Volumes 1 & 2

Volume 1: Selected Research and Development Papers
And
Volume 2: Selected Papers
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For the thirty-ninth time, the Research and Theory Division of 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 Jacksonville. FL. 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.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately sixty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

Michael R. Simonson
Deborah J. Seepersaud
Editors

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

Technology in Support of Diverse Assessment

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Abstract

This paper presents the case of a small rural school that implemented an assessment system designed around three different measures, each designed to answer a different question about the secondary students enrolled in the school. Technological solutions were used to captured both qualitative and quantitative evidence of students' learning; those solutions are described and other findings are discussed.

Keywords: assessment, K-12, portfolios, educational technology

Technology in Support of Diverse Assessment

Compared to previous generations, today's educators gather more and more types of information regarding students' learning and they use it to make more decisions (Rajagopalan & Gordon, 2016). Data gathered during instruction are used formative purposes and data gathered in summative assessments are used for evaluation (Harlen & James, 1997). Both types of assessments are used to improve curriculum, to evaluate programs, to justify accreditation decisions, and for other institutional purposes (Walvoord, 2010). Despite the long tradition of relying on the results of tests to measure students' learning, there is increasing recognition that diverse assessment data are necessary to completely describe students' learning, understand the value of instruction and curriculum, and identify aspects of schooling that need to be improved (Andrews & Wulfeck, 2014; Dede, 2010).

As data and its purposes have become more sophisticated, information and computer technology (ICT) has been applied to many assessment problems, and a range of ICT tools have been deployed to facilitate assessment. Nearing the third decade of the 21st century, educational practitioners use ICT to collect easily quantifiable data such as scores on tests that are administered given to large populations (Bennett, 2002) and content questions that can graded by computers in online and blended classes (Black, Beck, Dawson, Jinks, & DiPietro, 2007). ICT has also been used to document and assess learning in classrooms where teachers seek to promote and document complex learning (Webb & Gibson, 2015). Further, ICT tools are used to manage vast collections of assessment data as well as to manipulate, analyze, and report those data.

In this paper, the author presents the case of a public school in which ICT was adopted and adapted to facilitate several assessment practices. There are two purposes of this paper. First, to describe the assessment system and the roles of technology in the system. Second, to articulate and support conclusions regarding the design of effective technology systems in secondary schools.

The Setting and the Data Collection

The project described in this paper occurred in a comprehensive public school in a rural area of the northeast United States; it enrolls approximately 300 students in grades 7-12. The guidance counselor at the school described it as "similar to other schools in the state. We have slightly more students in poverty and receiving special education services than others, but we are closer to the middle than the extreme," and the school "sends its share of students to Ivy League schools, but we also have many students who go to work right out of school."

In the summer 2015, several groups of educators in the school were working on different initiatives; those groups included a committee working to increase the use of project-based learning (Krajcik & Shin, 2014) in all courses; a dyad preparing reports for an upcoming accreditation review; and a group of four working to upgrade the information technology hardware, software, and web services for instruction. As the principal was preparing for the beginning of the school year, he convened a meeting of individuals representing those groups for the purpose of "designing assessments that bring together the curriculum, technology, and accreditation work so it all fits together." In introducing the project to the group, the principal noted, "we have our students' SBAC, PSAT, SAT, and other test scores, but our students do so much more. By capturing a more complete view of our students, we can improve our curriculum and reporting to the accreditors." The members of this group agreed to assume a leadership role in defining a new assessment system. For the purposes of this paper, this group is called the Consolidated Committee.

The author was involved as an internal consultant to the Consolidated Committee. He was primarily involved in designing and configuring the technology solutions, and revising them as they were deployed. He was present at most meetings of the Consolidated Committee to provide input specific to the technology infrastructure and to understand what actions the committee recommended so that the technology accurately reflected the intent.

This case is described with data from three sources. First, the agendas used to plan and the minutes used to record the meetings of the Consolidated Committee were reviewed. The primary purpose of this data was to accurately describe the work including design decisions and the rationale that supported each decision. Second, the author conducted a focus group interview (Fey & Fontanta, 1991) of the Consolidated Committee. Finally, the author conducted a second focus group interview with a group of teachers who had contributed to and made use of the assessment system. Both focus group interviews were conducted about 18 months after the project began and at a time when the systems were fully functional and active development had stopped (although the Consolidate Committee reconvened soon after the interviews were completed to continue development of the system).

The transcripts of the focus group interviews were coded using the constant comparative method (Glaser, 1965). The author along with a second researcher read and coded the transcripts of the interviews; themes that were identified by both researchers are elucidated in the findings.

The Assessment System

The Consolidated Committee adopted a planning method grounded in educational design research (McKenny & Reeves, 2012); this method is intended to facilitate the use of theory to create interventions that improve educational practice, and it comprises three phases (see Figure 1). McKenny and Reeves (2014) described educational design research as "the iterative development of solutions… to practical and complex educational problems" which leads to "new knowledge that can inform the work of others" (p. 133). Key aspects of educational design research include an iterative approach to understanding the local instantiation of a problem and continuous planning actions that reconcile theory with the local circumstances. Further, educational design researchers seek to

both evaluate the degree to which the interventions produced the desired results and they seek to articulate and support generalizations that can inform similar efforts in different settings.

The principal described the vision for the assessment system that emerged during conversations with the faculty over the course of several months prior to the formation of the Consolidated Committee. These became the analysis/ exploration phase of the process. The principal observed,

> We seem to agree that a rich and varied curriculum leads to good test scores, but we know those scores do not show the true extent of our students' work. Plus, our local learning expectations [upon which] we spend so much time on don't show up in any tests. Everything students do is important to us, so we need to capture the data in whatever way [the students] exhibit their learning.

Analysis
"What does the research tell us?"

Exploration
"How is the problem instantiated in our community?"

Design
"What systems address similar problems?"

Construction
"What will our community do?"

Reflection
"What can we generalize?"

Evaluation
""Did it meet our needs?"
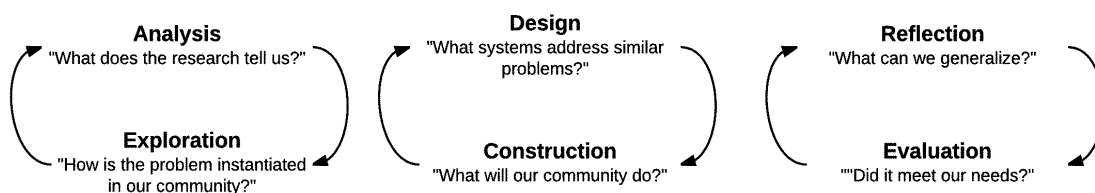
Figure 1. Educational design research adapted from McKenny & Reeves (2012)

In this vision, the principal and his faculty sought to broaden their definition of assessment data to more closely align with high-quality and valid assessments (Pellegrino, 2014) than is possible relying on standard test scores, which "had been the focus of assessment efforts previously." The Consolidated Committee recognized the need for diverse data that documents creativity, problem-solving, communication, and collaboration to be included in the formal assessment system, as those skills have taken on new importance in organizations and cultures in which digital electronic information technology dominates (Black & William, 1998; Cumming & Maxwell, 1999; Cumming, Maxwell, & Wyatt-Smith, 2016; van Laar, van Deursen, van Dijk, & de Haan, 2017).

Dimensions of Learning

Three sources of data became the focus of the assessment system (see figure 2), and IT systems were designed to collect and use all three types of data. While the Consolidated Committee used the terms "Course Grades," "Standard Tests," and "Performances" to identify the types of information they were collecting, they suggested the assessment system was designed to answer three questions: a) Does the student have the habits of effective learners and workers? b) How does each student compare to students in other populations? c) Can the student create polished work that is valued outside the context of school? and the three sources of evidence in the assessment were interpreted as answering those questions.
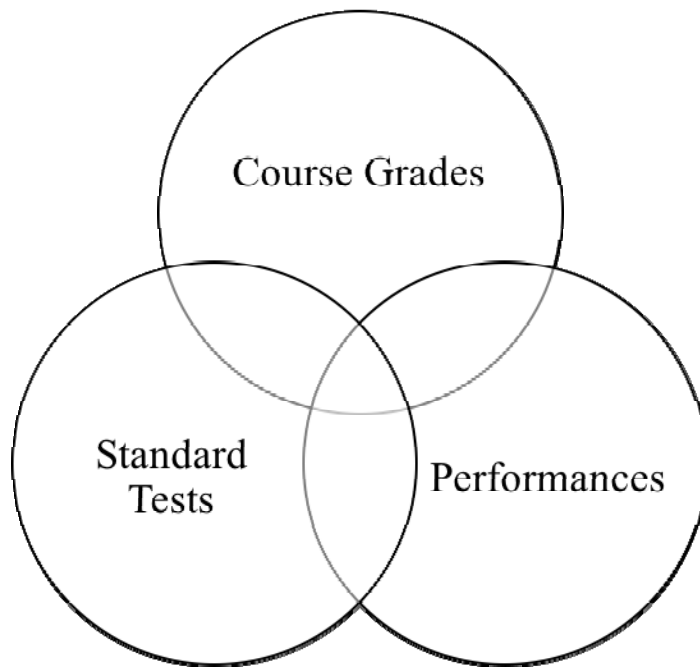

Figure 2. The three sources of evidence in the assessment system

The students in the school participate in a range of standards-based and standardized tests. These include tests associated with college admissions, as well as the tests associated with the Common Core State Standards (CCSS) (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Because he led a public school, the principal was obligated to ensure these test scores were shared with the public, so it was decided the school would continue its participation in the tests. Students would be encouraged to fully engage in the tests and the scores would be presented to students, parents, and the community as "one small part of what we know students can do, and the only chance to see how they compare to students in the wider population." Following this rationale, students' scores on these tests became part of the assessment system.

While many schools appear to be abandoning traditional course grades in favor of reporting on students' progress towards standards (Stump & Silvernail, 2014), the Consolidated Committee reasoned learning in that dimension was already being documented in the Smarter Balanced Assessment Consortium (SBAC) tests administered to comply with CCSS, thus a standards-based course grade was redundant. Traditional course grades, on the other hand, are positively associated with several aspects of each student's skills and knowledge; including content knowledge, ability to complete tasks in a timely manner, compliance, and attitude and participation which appear to be necessary for many workplace settings (Manpower Report, 2015). The committee recorded agreement with the teacher who suggested, "these are all things that matter when students leave the school, no matter where they go, shouldn't we somehow record their ability to succeed in similar ways in school?" They further reasoned the subjective assessment of students by different professionals in different courses was a predictor of students' success, thus they decided to continue collecting traditional course grades.

The final dimension of learning that needed to be captured in the assessment system was students' participation in project-based learning (Krajcik & Shin, 2014) and other authentic learning environments (Herrington, Reeves, & Oliver, 2006) in which the products they created resembled the work done by professionals

working in their field of study. The Consolidated Committee recommended an electronic portfolio platform with which students could collect and cull artifacts (mostly images and video) of the projects they created along with their reflections on the importance of that work be included to complete the assessment system

Technologies for Assessment

Once the three dimensions of learning had been defined, the Consolidated Committee turned its attention to designing ICT systems that would allow teachers and others to easily record data documenting learning in each dimension and that would allow school leaders, teachers, and others to manipulate and present the data that documented each dimension of learning. Specifically, the committee decided to adopt three systems.

In the summer when the Consolidated Committee began designing the new assessment system, the student information system (SIS) was upgraded as part of a long-established technology plan. The Consolidated Committee also recognized the school had been using the SIS for several years and that "teachers, parents, and the administration along with the technology staff were familiar with and satisfied with the method of recording course grades," so that system would remain in place and be used to document course grades.
A spreadsheet file would be created to track students' scores on standards-based and standardized tests that are administered to high school populations throughout the state, region, and country; this was known as the "Dashboard Spreadsheet" following the convention of displaying quantitative assessment data on dashboards.
A new electronic portfolio system to capture artifacts of students' performances and products on authentic projects was to be installed and configured.

The first design of the Dashboard Spreadsheet compiled students' SBAC, SAT, PSAT scores. Upon reviewing that draft, the Consolidated Committee concluded there was too little data, so it was immediately redesigned; this is consistent with the design/ construction phase of educational design research (McKenny & Reeves, 2012). Changes included adding grade point averages and categorical data such as foreign language courses passed, participation in athletics, arts, and other activities. Included in this first design/ construction iteration was defining procedures for exporting relevant data from the SIS and importing it into the Dashboard Spreadsheet. Further, formulas were added to the spreadsheet to automate the calculation of descriptive statistics.

Once that second design was completed, the Consolidate Committee reviewed it and found it more complete and satisfactory given the anticipated uses of the data to recommend student choices for courses, respond to leaders' requests for information, and otherwise improve the school curriculum. The Consolidate Committee also sought input from the professionals who managed the SIS to confirm the work of exporting data from the SIS did not significantly increase that person's duties. One additional design iteration was undertaken so that correlations between data sets contained in the Dashboard Spreadsheet could be displayed graphically and numerically.

At the end of the initial design/ construction session and the two following iterations, the Consolidated Committee reported, "the dashboard is ready for use, and it should be populated with real data." A final design/ construction iteration followed during which two individuals from the Consolidated Committee, along with the author met to improve the appearance of the data, lock cells on the spreadsheet to prevent accidental editing of data, anonymize data as appropriate to maintain privacy, and otherwise finalize the file.

The second new ICT tool designed for the assessment system was an installation of Mahara (n.d.), an open source platform for creating, curating, and presenting electronic portfolios. In adopting this platform, the Consolidated Committee sought to resolve the problem of attempting to use the SIS to capture authentic student work. They observed, "not only are the comments we have been using difficult to manage, they don't seem well-understood by parents, and it is impossible to record students' reflections." This system also underwent several design/ construction iterations.

The first design established "'proof-of-concept' as no one on the committee has any experience using Mahara, so we want to see it and determine of it is an improvement over [the previous platform]." Two additional design/ construction iterations followed. During the first, Mahara was reconfigured to be integrated with the learning management system that had been adopted by the school. The LMS had been adopted under an earlier initiative to deploy a one-to-one computing initiative, but it had not been widely used. Once two LMS and Mahara were integrated, the second design iteration added rubrics to the LMS and configured the systems so Mahara portfolios could be submitted to the LMS. The Consolidated Committee recommended, "all assessment and reporting of projects and authentic learning be migrated to the LMS and Mahara. This will allow for full documentation of learning and reporting of qualitative data exclusively through this system."

With the three technology-based assessment tools, the system was completed. The SIS was used to display traditional course grades, and also as a source of data for the Dashboard Spreadsheet. After several drafts, the dashboard displayed both individual student data and data summarizing entire cohorts of students. Finally, the electronic portfolio platform was integrated with the LMS and configured to capture ad display artifacts of works created by students and associated qualitative data.

Designs of Technology-Rich Assessment

The final phase of educational design research (McKenny & Reeves, 2012) is evaluation/ reflection during which the researcher-practitioner both determines the degree to which the interventions solved the problem as it was locally instantiated and articulates generalizations that can be used to solve similar problems in different settings. In this case, there appears to be support for three observations regarding the design of technology-rich systems to support assessment in schools; the system is evaluated in the Discussion.

Efficiency.

One advantage of using ICT to manage the vast assessment data is the efficiency with which sophisticated analyses can be deployed. When initially designing the Dashboard Spreadsheet, the Consolidated Committee sought to minimize the amount of data that would need to be input. During design/ construction, they discovered the data was received in the school or existed in the SIS in formats that could be imported with minimal effort. Batch uploading and simply copying and pasting allowed "us to enter data far more quickly than expected." The Consolidated Committee reported, "in the time we apologized for asking [the SIS manager] to get us the data we wanted, he had it into the dashboard." Further, the formulas used to generate the descriptive statistics could be written into a single spreadsheet file which was saved as a template, so creating the dashboard for new students and for new cohorts was "the matter of unlocking the file and making a few clicks."

Because Mahara was a new tool for all faculty and because the faculty expressed some reluctance to adopt it because previous platforms had proven ineffective and were abandoned, the Consolidate Committee deployed the system in steps. For example, as faculty gained experience with Mahara, they used paper copies of rubrics to assess students' work. As they become more familiar with the platform and realized digital rubrics in the LMS could be used to reduce the time needed to provide and review feedback, the faculty asked for the design/ construction iteration during which rubrics were added to the integrated LMS and Mahara system.

Ease of Use.

For several years, the school had been attempting to increase the use of online classrooms as well as consistently develop electronic portfolios; those efforts had largely been unsuccessful because "the systems all required a separate log on." With the single step of allowing single sign-on so that the LMS and Mahara used the same credentials as students and teachers used to access email and other web-based services, this assessment system was found to be easier to use. Teachers reported, "it seemed a simple barrier, but having even one or two students fighting to remember how to log on made us avoid them. Now that the systems are integrated, my department uses both [LMS and portfolios] more than we did."

Ease of use was also identified as an obstacle to using the dashboard to the extent it was intended. Specifically, teachers found it difficult to customize the graphs so they displayed the correlations between scores and other data in which they were interested. While most agreed the steps were not difficult, they were unfamiliar, so many avoided the need to learn by finding a colleague who was willing to create the graphs he or she needed.

Understanding Learning.

The final observation that was consistently reported by both the Consolidated Committee and the faculty who used the assessment system was that it had increased their understanding of the degree to which students were learning. Their understanding appeared to be for both individuals and for cohorts.

The addition of qualitative data regarding students' projects and authentic work in the electronic portfolios "gave [teachers] insight into how students were applying what we studied in class." Teachers also reported the technology was one factor that contributed to their ability to gain this insight. "Because the system was always available and easy to use, it was used by more teachers than the other portfolios and they added more work so we had more to look at," observed on teacher, and that was followed almost immediately be another who added,

"having the rubrics there also made it more clear to us what we thought we should be seeing, so I could focus on what the [student] did and what we thought they should be doing." The qualitative data that was consistently gathers and easily assessed led to deeper understanding of individual students.

The Dashboard was found to be particularly useful for understanding students as a cohort. The fact that data was compiled for all of the students in a grade in a single place made data available in a manner that it was not previously. "Especially for the students in the middle quartiles, the dashboard seemed to given of information we did not have previously," reported the teachers. "We could see differences between what they had taken for courses, for example, and see that those who had taken certain classes appeared to have higher tests scores. This is useful for making recommendations," added the principal.

Discussion

There two purposes of this paper. First, to describe the design of the assessment system. In this case, the technology-based assessment system appeared to provide educators with information that they did not have prior to the deployment of the system. The additional data appeared to be both the result of the system being easier to use than other systems and the system being designed to gather data that was previously lost or not collected. Because the system was designed through iterative processes with changes being recommended by users of the system, it appears to have more closely reflected their needs and their capacity to use it.

Second, to articulate generalizations regarding the design of ICT systems in school. These data appear to support the conclusion that the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) accurately describes the factors that predict the use of ICT in educational populations. Specifically, UTAUT posits effort expectancy is positively associated with the intention to use technology. In this case; case of use and efficiency, both factors associated with effort expectancy, were reasons teachers cited for using the assessment system. Also, performance expectancy, which is grounded in job fit is posited to positively affect technology use. In this case, teachers claimed the system helped them understand their students learning, thus they were abler to perform essential job function.

While this project does appear to have resulted in an assessment system judged to be an improvement over those used previously, and this improvement is recognized as an aspect of user-based research (Bereiter, 2002), it is unknown the degree to which this improvement was recognized by all stakeholders. Because the assessment system was an initiative begun by the principal who had supervisory authority over all of the faculty, and the faculty is fewer than 30, it was difficult to identify potentially dissenting voices. Further, it is unknown the degree to which this specific effort and the iterative nature of it was responsible for the observations. Given the authority of the principal, any new assessment system could have produced these results.

Conclusion

Despite the limitations for the research, there does appear to be support in these data that an assessment system that used ICT configured to provide both quantitative and qualitative data regarding students' performance in three dimensions of learning contributed to teachers understanding of their students. Both the data they already gathered were more easily manipulated and displayed and they were able together data the was previously lost because it was not consistently collected.

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Changing with the Times: How Do We Lead Technology Integration, Including Mobile Devices, in Schools?

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Abstract

Because of the availability and growing use of mobile technologies and communication models, "Enthusiasts argue that the presence of such technologies would push schools in the direction of embracing the liberating possibilities of new media rather than limiting their use through acceptable use policies" (Collins & Halverson, 2009, p. 26). Unfortunately, some schools are not enthusiastic about the presence of mobile technologies and restrict use through policies. Regarding such policies, schools vary widely in their approach and acceptance of integrating these technologies, especially mobile devices. Some schools limit access and exercise control of the use mobile devices through restrictive or outdated policies and procedures governing both employees and students, while other schools have more welcoming "bring your own device" (BYOD) policies.

Introduction

"For it is inescapable that every culture must negotiate with technology, whether it does so intelligently or not" (Postman, 1992, p. 5). Historically, new technologies are viewed with wonder and/or suspicion, especially in educational institutions. Some challenges to technology integration are due to caution, change resistance, existing infrastructure, and resistance to disruption. Some technologies prove unable to meet the needs of the customer (institutions, systems, teachers, and students) better than traditional methods or established technologies; therefore, it is naturally difficult and unlikely for those technologies to form a disruption. On the other hand, the prevalence of technologies, such as mobile devices, is responsible for new customer demands.

Previously, many technologies available within the school environment required an institutional purchase and were not readily available to the end-users because the school determined both if and when the technology would be available. The prevalence of mobile devices that are owned and supplied by the user changes this dynamic. The shift of availability and control has changed. "Hence the imperative of technology is toward more learner control, and schools are fighting a losing battle to control what students learn" (Collins & Halverson, 2009, p. 18). The result means that customers (students) and members of educational institutions have the potential to drive integration, if not disruption.

Similar to the negative stance the American Federation of Teachers once took regarding video use, some institutions feel that the opportunity for misuse is too great. The National Education Association (NEA) and many other institutions approach device use as something they can control, asking students and employees to only access the Internet via school networks that are governed by such policies. Since many users not only have their own device, but have independent access to the Internet through personal data plans, is it realistic to expect that schools can exercise complete control over these technologies? Are schools refusing to change with a technological change that they don't own?

Decreasing the digital divide, or the access to technology, has long been a concern. More recently, the concern has evolved to a second-level digital divide, the ability to use technology. Literature in the early 2000's through the present reflects the second-level digital divide, "the difference, or "divide," in how technology is used" (Reinhart, Thomas, & Toriskie, 2011). Wei, Teo, Tan, & Chan (2011) refer to the second-level digital divide as a "digital capability divide." The confounding issue regarding mobile technologies is that access is available, but institutions are limiting students' use that can increase proficiency beyond purely social applications.

Mobile technologies provide an opportunity for students to learn and use technology skills for applications are common in the workplace and outside of a school environment. Furthermore, using available technologies increases students' 21st Century Learner skills. The Framework for 21st Century Learning is a set of standards meant to prepare students "to thrive in today's digitally and globally interconnected world" (Partnership for 21st Century

Learning, n.d.). These standards are intended to prepare students to respond to and be adaptable to rapidly changing technologies. In addition, it is equally important to realize that today's students will use technology in their everyday lives. Access and proficiency in technology is directly related to access to information, education, healthcare, and employment opportunities.

A discussion within a community of practice addressed some historical experiences with "new" technologies in schools, such as the belief that radio, then television, would revolutionize education and seek to compare past technology changes to modern technologies. Based on experiences in learning communities and organizations, policy reviews, and surveys; existing policies were presented, and the educational technology practitioners shared their own experiences with policies and procedures in a variety of educational settings as both professionals and as students.

Participants engaged in the following discussion points:

Do schools spend more time fighting the technology instead of embracing it?
How much control is feasible?
What are the policies and procedures that allow the best chance of technology integration?
Should schools look at the technologies as a possible disruption if the customers can meet their needs and still use a device that they aren't willing to allow the schools to govern?
Does the wide range of policies add to the digital divide?
What is the role of educational technology professionals in leading change?

Conclusion

Schools are traditionally change resistant and slow to embrace change. Generally, change and "successful implementation depends on the commitment of top management" (Januszewski & Molenda, 2008, p. 183). As professionals and educators, it is time to recognize that these technologies do not fit the mold of some current policies or the needs of students. Schools no longer can ensure control by not purchasing, not using, and condemning new technologies. The users have some control and the playing field has changed. Schools will not be able to control all tablets, phones, watches, and other mobile technologies. Perhaps it is time to lead the change to implementation and embrace the learning potential for users rather than focusing on restriction. If "the end purpose of educational technology is *using"* as suggested by Januszewski and Molenda (2008, p. 168), then leaders should encourage institutions to transform policies and views regarding technology and mobile devices into ones which demonstrate appropriate use and usefulness in learning and communication.

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A Systems Solution for Engaging Learners in STEM Learning

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Abstract

STEM Education is a critical component of high quality 21st-century education, but increasing demands are placed on teachers to prepare students for state and federal exams. This paper will detail three model public school districts that are currently using individualized digital tutors as a tool to reduce the classroom time that test preparation takes, allowing teachers to engage their students in real-world, problem-based STEM learning activities.

The Importance of STEM Learning

Science Technology Engineering and Mathematics, or STEM, along with its many variations (STEAM, eSTEM, STEMM, etc), represents a movement in the United States to expose students to 21st century learning environments (White House, 2016). In our evolving technological world, students need to acquire STEM skills to be college and workforce ready, even if they are not going to be an engineer or scientist. These resources come in different forms, such as programmable robots, sandbox style video games, building tools, and virtual and augmented reality devices. These learning materials give students a chance to problem solve and to be creative in ways that traditional textbooks and testing can not measure. Unfortunately, there currently exists a tension between preparing for high-stakes end-of-year testing, and allowing time for exploration of relevant 21st century skills for students. This paper outlines the aggregate experiences of three public schools that have managed, with only a small amount of outside help and a lot of creativity, to square this circle, ensuring high performance on end-of-year tests, as well as allowing the freedom for teachers to engage their students in problem-based STEM learning.

Common Core and State Testing

While there are currently over 20 schools participating in the NEF STEM+ Academy program, the three schools we are focussing on are Canton Central School District in Canton, NY; Steubenville City Schools in Steubenville, OH; and Martins Ferry City School District in Martins Ferry, OH. All three are small-to-moderate sized school districts with relatively limited resources. Schools around the country continue to focus on student testing, and recently on teacher evaluations (Educational Leadership, 2016). Finding their teacher evaluations tied to student performance, the teachers in these districts found themselves in an untenable situation: they felt that while previously there may have been time to explore new and relevant topics not directed by the state testing requirements, preparing students now took up virtually all of their classroom time. Intentional or not, the cultural shift to double-down on high-stakes testing and teacher evaluations has in many ways hurt the public school system, in many cases reducing teaching to a lowest common denominator: "The Test."

People and Organizations Willing to Help

Rather than giving in to the status quo, the teachers at these three schools sought outside help and received funding from local businesses, nonprofits, and other sources to provide individualized digital tutors and STEM learning for students at different grade levels in each of the districts (Batt, 2016). A local private foundation provided partial funding for Canton, while Steubenville and Martins Ferry used funds from their own district budgets. The remainder of funding came from a mix of grants, donations, and nonprofit partnerships. The graduate program in Educational Technology at The State University of New York at Potsdam partnered with one of these nonprofits, and worked with these districts to provide professional development and logistical support in managing the implementation of the individualized learning system. The program the teachers from these districts have implemented represents some of the best ideas from the sixteen STEM+ academies in ten states around the country (Canning, 2016).

A "Systems Solution"

Our approach acknowledges and works with the idea of a school district as an integrated system of students, teachers, parents, administration, and community members, and provides tools for all of these groups: the parents and community are provided with professional development software, allowing them to build their skills in IT, Business, and Desktop Applications; the administration is provided with additional funding and teacher development; the teachers are given access to 21st century learning tools; and the students are provided personalized learning software that is customized to their own particular strengths and weaknesses. Students are also provided with motivational incentives, including Olympic Style Leaderboards, individual rewards, and group-based rewards, all based on their performance. Because performance is measured by their gain over their initial benchmark, students of all abilities are competing on a relatively level playing field.

Conclusions

In the three years since we have begun working with these districts we have seen a strong positive correlation between the students' performance in the individualized learning software and their state test scores in both Math and Reading. For instance, at Canton, 100% of the students who were at or above grade level in Math and Reading in the learning system at the time of their state test passed that test. Similar results were found at the other two schools as well. When armed with some clarity and assurance of their students' state test scores, the teachers felt less obligated to "teach to the test" and started introducing more and more STEM learning activities in the newly created free time, such as K'Nex building tools, Snap Circuits, Minecraft software, and programmable robots into their classrooms.The students, as might be expected, were thrilled, so much so that many asked their parents for these tools and kits as Christmas gifts.

The system quickly became self-reinforcing, as access to STEM learning was predicated on student performance in the individualized digital tutoring system. As students succeeded in the tutoring system, they gained access to STEM learning activities; the more they engaged in those activities, the more they wanted to continue with them, which spurred them to continue to strive to do well in the tutoring system to secure this access. Because the individualized tutoring software is scaffolded to state standards, their performance on the state tests increased. Regardless of which is more important - the state test scores of the engaged student learners - what was previously seen as an issue of either-or was transformed into a yes-and.

Because the systems at these schools communicate with each other through their University and nonprofit partners, the change seen in these schools is spreading to other school districts and states. New partner schools are already learning and replicating their success, and while the fundamentals of the system are the same, each school has a unique way of putting the pieces together. Changing the systems in three local systems is but a start: a proof-of-concept showing that performance on state tests and 21st century STEM learning can coexist and complement each other. The next step is to share these results with other stakeholders, and to continue on the mission that President Barack Obama set forth for universities and schools, that is to make students "...more excited than ever about pursuing their passions for STEM." (Ransom, 2016).

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Game-for-Social-Change: A Way Home
A Game to Teach Players about a Serious Topic While
Driving Civic Engagement

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Index Descriptors: Children's Rights, Games and Simulations

Abstract

Grounded upon the Diffusion of Innovations theory (Rogers, 2010), a prototype of a game for social improvement was developed to begin the process of systemic change. The purpose of the game is to disseminate knowledge, the first step in a systematic process to affect changing mindsets. The content's focus is on the United Nations (U.N.) Convention on the Rights of the Child (CRC) Treaty of 1989, precisely Article 12: The Right to be Heard and Article 13: Freedom of Expression (The U.N. International Children's Emergency Fund [UNICEF], 2009). The Treaty was created to be a beacon of light for all children. Quite simply, it is a compilation of basic human rights children should be afforded. All U.N. nations have ratified the CRC Treaty but one. Despite American presidents taking an active role in initiating and supporting this call to action, the United States still abstains from ratifying it since its inception in 1989 (UNICEF, 2009). An endogenous game was selected as the vehicle to immerse the players in real-world scenarios with additional elements of fantasy to motivate engagement (Gunter et al., 2008). Through simulated experiences, the game was designed to provide education about the given topic while the pathos was intended to evoke emotion and change attitudes (Gee, 2008; Jones, 2008). It was hypothesized that this knowledge and change in attitudes could potentially induce action leading to real-world improvement. "Knowledge is power" (Bacon, 2001) and the first step to begin change.

Introduction

Clearly the U.S. provides many protective services for child welfare and, in fact, has a constitutional amendment which affords freedom of speech for all its citizens. Is there a need for instruction to teach about rights for children with so many provisions already in place? For the children who directly encounter the inequitable unwritten practices in our constitution and judicial system, these provisions are not enough to protect their human rights. Akhil Reed Amar proposes:

> The eight thousand words of America's written Constitution only begins to map out the basic ground rules that actually govern our land, while the unwritten perceptions guide all other judgment (2012, p.ix).

Historically, the practice has been that adults know what is best for children and make those determinations regardless of conflicting opinions from the children (Rodham, 1973; Taylor, 2009). Examine the disparity within the court system. Criminal cases have acknowledged that children are capable of expressing their views such as in the Gault Case of 1967 (Federal Judiciary, 2015). The Juvenile Detention division may deem children "fit to be heard" yet these same children may be considered "unfit" in the Family Law division (Taylor, 2009). Likewise, children's rights vary by state and county. Forty states provide children a voice in their own dependency cases forming an inequality for the children in the other states (Breger, 2010; Rodham, 1973). These rulings do not stem from research reflecting the children's ability to express themselves better in one court of law over another but from legislative traditions.

What is the significance of raising awareness about a treaty of human rights designed to protect these citizens who go under the radar? Studies reflect that over half of the marriages in the U.S. end in divorce (Centers for Disease Control and Prevention, 2014). If just half of those marriages have the average number of two children per household, over a million children may be in legal proceedings affecting them. Unlike the rights of the adults, however, these children's fates are decided for them as they are often divided like the assets in the household. The decision of whether their words are considered is left up to a judicial system often not trained in mental health issues needed to make these determinations (Lemon, 1999). Even when the children are heard, their words are often

discounted based upon engrained practices (Collins, 2012). The numbers of unheard voices rise considering the almost two million children born out of wedlock and the divorced couples with multiple children (Centers for Disease Control and Prevention, 2014). Add in the element of domestic violence (DV) which in many cases is not even considered relevant in custody cases and the need for change becomes alarming. In fact, data reflects that more domestic violence victims die at the hand of someone they were in a relationship with than someone unknown to them (Haddix, 1996). A study of survivors in DV shelters reflects that majority of their children witnessed the abuse (Haddix, 1996). Evidence reflects that children are, in fact, an integral part of these cases and have the capacity to express their views (Holt, Buckley, & Whelan, 2008). These views are often not even taken into consideration in the extreme cases. The children in cases: James M. of California and Bartasavich v. Mitchell in Pennsylvania witnessed one of their parents kill the other parent. The assailants still had custody rights to the children upon their release of incarceration regardless of the children's words (Haddix, 1996).

This game-for-social-change was designed to educate and advocate for the equal rights of all children. Overall, the CRC Treaty contains fifty-four articles and four themes: Survival, Development, Protection and Participation. The latter was the focus of the initial instruction for this first prototype, specifically Article Twelve: The Right to be Heard, and Article Thirteen: The Freedom of Expression. The ultimate goal of the instruction was designed to teach digital natives about the need to support the ratification of the CRC Treaty in the U.S., with the ultimate goal of empowering the learners to take action. This digital native population was selected as they are most accustomed to learning with digital-game-based learning, systematic thinking and processing with simulations, (Prensky, 2001).

The Background

The idea for a game to teach originated from this researcher's experience of witnessing game based learning motivate digital natives to play and learn core subject matter. Reasoning and critical thinking became by products of this problem-solving instruction (Gordon, 1970). Research supported the advancement of the idea. In fact, studies reflect Digital Game-Based Learning (DGBL) is a motivational means to learn (Justice & Ritzhaupt, 2015), demonstrates improved focus, learning cognition (Eichenbaum, Bavelier, & Green, 2014) and retention (Brent & Felder, 2009; Gee, 2008; Gordon, 1970). Gee posits that brain function is based upon the embodiment of sensory involvement (2008). Video games, therefore, serve as a logical platform for learning based upon how the brain actually works. Gamers are provided with a problem and select avenues of advancement based upon the information they have. Through game stimuli players advance or retreat, learning through each phase of the experience (Gee, 2008). In fact, these are the same critical-thinking and logic skills required as a basis for Science, Technology, Engineering and Math (STEM) careers (Roberts, 2002).

In a diverse and troubled world, gaming could provide an equal playing field for all students to learn while promoting choice and self-expression. Failed choices lead to learning the content rather than failing the lesson (Jones & Chang, 2014; Justice & Ritzhaupt, 2015). Gaming brings Bloom's taxonomies to education in a fail-safe environment including: facts and information, comprehension opportunities, skills to master analysis and synthesis, leading into the cognitive domain where player-learners are challenged to review the process of how to excel from one level to the next (Moriarty, 1974).

To assure sound pedagogy in meeting the goals of this instruction, the design principles stemmed from the First Principles of Instruction (Merrill, 2002a, 2002b, 2007, 2009) and focus on e3 Instruction: effective, efficient, and engaging (Merrill, 2007, 2009). Activation begins with an introduction of the CRC Treaty and the basic list of rights it provides to children. A CRC icon (envisioned to be a scroll in the game) is noted in the prototype to be accessible in each scene for the player to use as a resource to see all the articles as well as which countries have ratified the CRC. Players demonstrate understanding of content by selecting the accurate answer based upon whether the CRC Treaty was ratified for that country. According to selections made, the next path provided reflects the consequences of decisions. Branches of support resources and next game level of adaptive instruction empowers players to build self-efficacy and take action as they proceed.

Aligning to the Elaboration Theory which suggests curricula should be built from the simple to the complex (Reigeluth, Merrill, Wilson, & Spiller, 1980), this instruction sequences and builds upon the foundational knowledge achieved from decisions made during each scenario. Thus, the scenarios advance from simple desires children may express to more important human rights issues. The tone is intended to be serious although the game begins with some humor to capture the attention of the player. Topics range from requests to be heard regarding breakfast choices to life-altering pleas to sleep in a safe home. Advanced layers include application activities for players to learn more about the topic and take action; travel through more scenes; and explore avenues intended to empower players with confidence building tips such as opportunities to select appropriate communication responses.

As the storyline unfolds, real-world scenes are presented in which player-learners make decisions which in turn teach them about the purpose of the CRC Treaty. Emerging branches support the player-learners in coping with feelings of sadness and empower them with feelings of hope as they learn about self-efficacy tips and actions they may take to survive the scenarios because affective domain can affect learning (Dormann, Whitson, & Neuvians, 2013).

Furthermore, DGBL was selected as the best viable option to disseminate knowledge, globalize and transforms education (Pellegrino & Scott, 2004) as DGBL is a platform players are already familiar with engaging in for hours at a time. Access is available to most users through mobile devices, computers and game consoles. Data reflects that the age range expands beyond simply the digital native and has generated in surplus of sixty billion dollars (Jones, 2008). The value of this DGBL, however, extends beyond dollars as its purpose focuses on changing attitudes, perceptions and potential social change for improvement. This game-for-social-change instruction elevates to the level of serious-games (Chen & Michael, 2006; Cody, Ritterfeld, & Vorderer, 2009; Heeter, Lee, & Peng, 2010; Ratan & Ritterfeld, 2009). Downloaded over two million times, *Darfur is Dying* is one such example of the extent to how serious games can spread a message (Jones, 2008). Furthermore, gaming in education has far greater capabilities of influencing player-learners than traditional methods of instruction as evidenced in the article *Can a Video Game Make Someone Nice?* (Kapp, 2012). This study examined participants engaging in socially positive and negative games. The scenario ranged from docile activities like picking up spilled pencils to stressful situations such as stopping an abusive lover. In both cases, player-learners who played the game persuaded others to make positive choices and were more likely to come to the aid of another (Kapp, 2012).

Gaming has also been used as a platform to educate about other treaties the U.N. has created. For example, the U.N. called for the decade from 2005 to 2015 to focus on education promoting sustainable energy. Answering the call, Ball State University in Indiana planned the development of the Second Chance Game: Local Partnerships (University-Community) for Global Awareness and Responsibility. The results of the DGBL initiative proved that imparting social knowledge and getting buy-in from key players to develop innovative strategies to educate goes beyond governments creating treaties or passing laws. (Pacheco, Motloch, & Vann, 2006).-Likewise, Europa games developed by the European Commission teach about the CRC to children in countries which had adopted the Treaty (EUROPA, 2011). These are exogenous games, based upon a behaviorism approach and reinforcement theory.

Justice Sandra Day O'Connor spearheaded the use of games to teach about civics and US Government (Toppo, 2015). Since 2009, over three million users have played the free iCivics games to learn about the process of government and civics, such as how judges make rulings on landmark cases to protect rights (Toppo, 2015). Lastly, the European Union Commission, EUROPA, created web-based free games specifically designed to inform children in countries about their rights in countries which had ratified the CRC (Europa, 2011).

Lastly, this prototype was modeled after games promoted by the Games for Change Organization (http://www.gamesforchange.org/), adding pathos through the real-world scenarios to deliberately evoke empathy and transfer of knowledge (Edele, Dziobek, & Keller, 2013; Gunter, Kenny, & Vick, 2008; Huang, & Tettegah, 2010).

The question is this: Can a game designed to educate about the U.N. CRC Treaty persuade the digital natives to ratify it in the U.S. in order to begin the movement for change to ultimately achieve equal rights for children? It is hypothesized that there is evidence to support that a game would be an effective means to advocate and profoundly impact invaluable social change to better the lives of children in need. It was time to create this game to teach the U.S. children about the CRC Treaty.

> *"Never believe that a few caring people can't change the world… indeed, that's all who ever have,"* Margaret Mead.

The Game-for-Social-Change Prototype was the first step in this endeavor. Artifact URL: www.purpose2day.com/site/ChildrenAroundtheWorldGame-Prototype.html

The Conclusion

The researcher designed this prototype based upon a *Choose Your Own Adventure* architect (Packard, 1979). Crowdsourcing returned real-world scenes which changed the persona of the characters and depicted scenes better suited outside of the classroom walls targeting the teen and adult population. Trends and themes which evolved were embedded into the game to reflect the repetitive needs expressed by children falling on deaf ears. For example, the name of the game changed to *A Way Home* as cases gathered continued to reflect the same underlying cry to be able to return to the home where they felt safe.
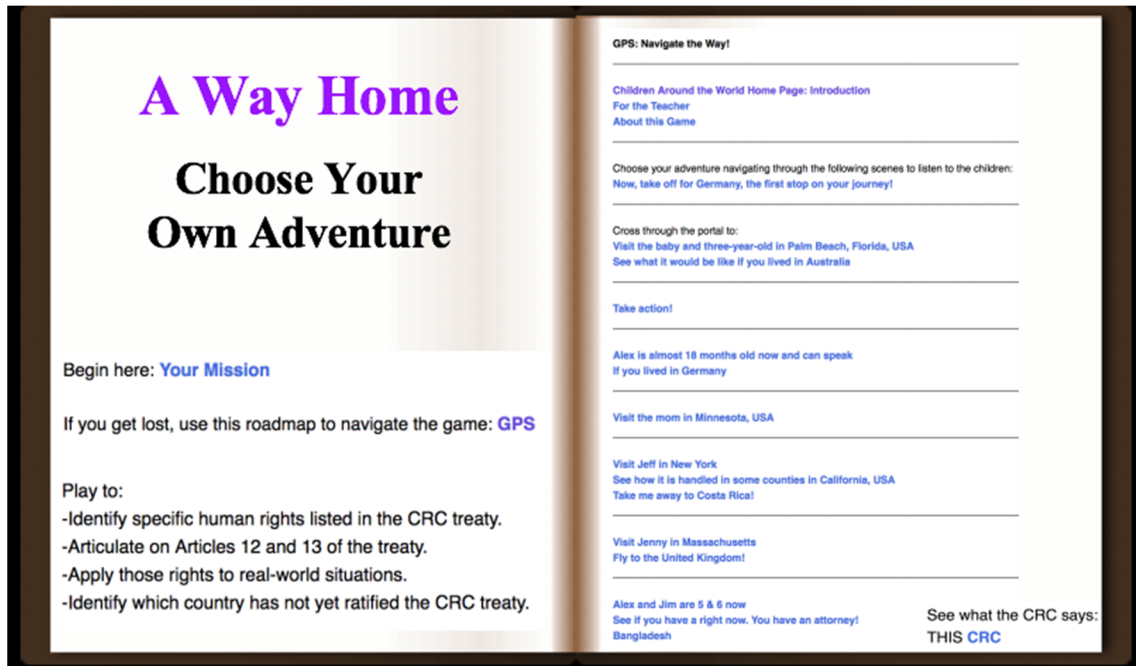
Figure 1. A Way Home: Introduction. Ensmann, 2017

The game-for-social-change was designed to meet the gaps of the games upon which it was modeled. For example:

> iCivics teaches about the national rights of the US citizens per the national amendments. A Way Home teaches about the rights of children per the global CRC Treaty.
>
> Europa, uses exogenous games to teach children about the CRC in countries who have already adopted the Treaty. A Way Home was designed as an endogenous game, which means players would literally immerse themselves in scenes to experience the benefits of adopting the CRC in the US.

Supportive tools are offered in every scene to provide guidance and feedback to players. For example, there is a CRC icon which lists the articles of the treaty, a GPS icon to help players navigate, and always the escape tunnel to offer players an outlet take control of the scenarios with access to real-world application inviting them to take action. Twinery, a web-based software was used, to design the storyline and create the intersections of the game. It started as a simple linear view and quickly blossomed to an impermeable web filled with numerous scenes from real-world cases. The prototype encompasses nine main characters, travelling and aging throughout the game, all eventually imploring the same need to be heard.

The First level is a simple fictitious scene to introduce the player to the differences between rights and responsibilities, choices and consequences and tips to respectfully communicate with adults. The next level of the game, reflects real-world cases, such as the one which portrays the life of a Boy who hides his restraining order in his sock, or the story of the children who begged their mother for help. That family escaped and sought protection outside of the country. In the real-world case, they were awarded political asylum by another country (Collins, 2012).

It's game over when players make decisions which end in incarceration or injury. One-hundred, forty-five children died last year just in Florida due to abuse or neglect (TCPalm, 2016). These are real endings in which real children lose. Players win the game when the children Win their Day to be heard.

Figure 2. A Way Home: You Win Scene. Ensmann, 2017.

A way Home is a Game for Social Change. The purpose of this game is to

- Introduces players to the CRC
- Raise awareness of the need for adopting this treaty in the US and
- Motivate players with actionable items

Leading Learning for Change is not a solo affair, however. This game has been developed to the prototype stage. This researcher seeks out developers to take it to the next phase of development. Doctors Todres and. Diaz wrote in the Global Health journal just last month explaining *why* children's right to be heard matters:

Participation can contribute to positive child and adolescent development. Studies show that allowing children to play a meaningful role in, and have some sense of control over, their lives have potentially significant intrinsic value (2017).
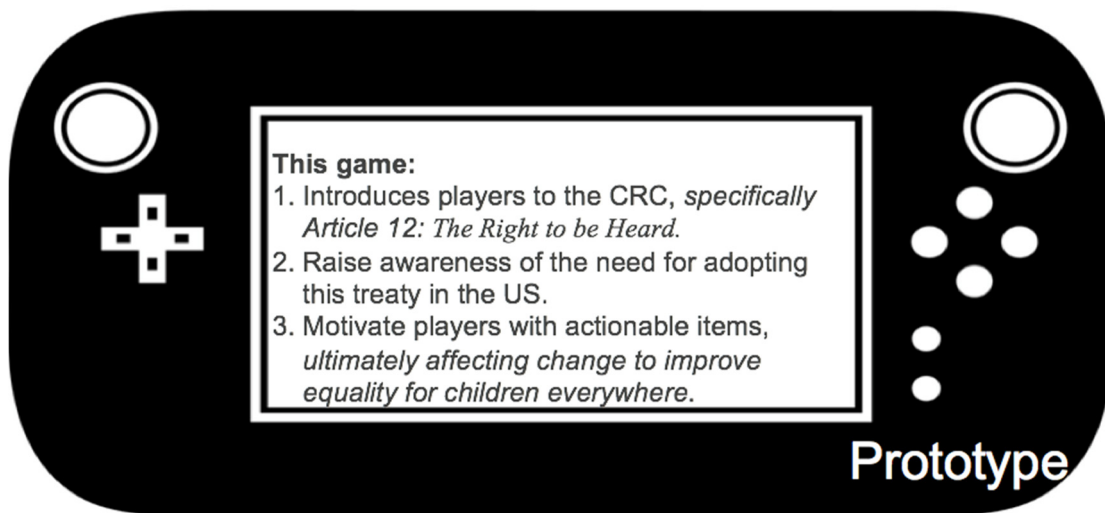

Figure 3. A Way Home: Purpose. Ensmann, 2017.

Your contribution matters. Pass this information on or join the collaborative effort in pursuit of change to improve lives for children.

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STEAM Powered Tools For Art Education

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Abstract

This paper seeks to highlight an effort by Computer Science and Visual Arts faculty to create opportunities for students from both departments to work with interactive technology in cross-disciplinary creative teams. The focus of the paper is a group project assigned within a STEAM course co-taught by faculty from both disciplines. The project, which challenges students in the course to build interactive educational tools for use in K-12 art education, will be presented in terms of its pedagogical role as a "bridging" assignment unifying the disciplines, and also tying together the skill acquisition and the skill application portion of the course.

Introduction

Course creation in the field of Interactive Digital Art can present challenges for both designers and instructors, since it draws skills from the very different disciplines of Visual Art and Computer Science. It is particularly challenging to bring together students with experience limited to one discipline or the other and effectively engage and teach both groups simultaneously; particularly if the goal is to leave them empowered to continue exploring the subject beyond the end of the semester. To address the issue, the course creators developed a project that tasks the students with working collaboratively to create educational tools for K-12 art classes. This project was created so that students would learn elements from both disciplines while creating an attainable result that is also useful and fun.

Foundations

The highlighted project is situated within a course designed and co-taught as a collaborative effort between faculty in computer science and visual arts. The intention of the course is to have students explore topics in Emerging Media and Interactive and Generative Art, topics that require a range of skills not commonly found in students from either of the academic disciplines. An additional goal of the course is for students to gain insight and experience regarding how to work collaboratively with individuals from outside their own discipline in creative teams. The fact that the course is co-taught by both computer science and visual arts faculty means that variations in perspective, logic, and creative approach can be continually addressed and discussed. As such, the teaching process also models the cross-disciplinary collaborative process the faculty found necessary in order to communicate ideas, provide instruction, and create sample projects.

Throughout the course, students work individually and in small groups to explore programming, animation, electrical circuits, input/output devices, and interface construction. Processing, a Java based framework designed to make it easy to programmatically create animation and many other results, is the primary visual creation tool used in the course. That programming language was chosen because it provides an easy entry to programming for artists and a means for the computer scientists to learn more about artistic concepts. The Arduino microcontroller board, and devices such as buttons, motors, lights, and dials, are used to teach students the basics of electrical circuits for the purpose of building unique interfaces to control visuals, animation, audio, and other results.

Problem

Part of the struggle for the instructors in the previous iterations of the course has been balancing the approaches and content being presented. The course brings together students from different disciplines which poses interesting obstacles for course creators. These obstacles go beyond a difference in skill sets and include issues related to general temperament, expectations of course assignment, timing, and grading, as well as the context within which learning should occur. In general, the art students enrolling in the class tended to adopt a more flexible and open approach to tasks and tended to have some misgivings about technology. These students brought a

willingness to see activities as continual processes and to be a bit wary of structure. They were used to three hour long classes twice a week, more subjective evaluation, and varied workspaces. The computer science students on the other hand favored structure and clearly defined processes and goals. They tended to struggle with tasks that lacked a defined functional end and were used to a traditional computer lab as the space in which learning occurred. Furthermore, they were used to classes that were half as long as those experienced by art students and expected a more objective approach to evaluation. They had the expectation that If they adhered to the constraints of the assignment, then that should result in a perfect score on any assignment.

Course creators had intended for their to be a balance between these different outlooks, but in early iterations of the course instructors struggled to move beyond the need to teach technical abilities in a way that would help students develop projects grounded in artistic concepts. This technical focus, especially in the early weeks of the class, left the art students feeling uncomfortable with the programming heavy content and functional focus of tasks. Other assignments where students were required to apply the technical skills to communicate an artistic concept left computer science students struggling to find a functional purpose behind the project. Group projects in the early iterations of the course were purposefully designed to be open-ended in order to allow the students to apply the wide variety of hardware, software, and technical processes in any way they wished to achieve an articulated artistic concept. Unfortunately, this broad amount of opportunity left both art and computer science students overwhelmed and struggling to define a path forward in the projects.

To an extent this disconnect in student perspectives is to be expected based on the nature of the course, but the instructors sought a way to create a more integrated approach that would more effectively unify these divergent outlooks. Toward this end, a project was designed to simultaneously provide a functional focus for the computer science students to learn the artistic concepts and an artistic grounding that allowed the art students to incorporate technical elements. It was decided that this project would act as a"bridge" to address the issues in discipline expectations. Furthermore, the project would tie the early weeks of the course which were focused on small skill acquisition assignments to the later weeks of the course which were focused on larger concept focused interactive art installations. The solution they landed upon was the "Color Theory Project" described below.

Solution

The Color Theory Project was created to address the problems of contextualizing knowledge for both groups of students. The intention was to do so in a way that allowed them to teach each other by building tools for a specific need, but in a context that seems achievable despite limited experience. Students in the course were grouped into teams of three, consisting of one artist, one junior computer scientist, and one senior computer scientist. Each group was tasked with creating an interactive visual meant to help K-12 students learn a specific aspect of color theory.

Each group was given a different color theory concept as the focus of their project and then needed to design both a screen based interactive visual and a physical interface for controlling the visuals. Students were asked to include multimedia elements and to explore ways to teach the concepts to children in a manner that was fun and interesting. The expertise of Art Education specialists was sought to determine what artistic elements K-12 students struggle with at various grade levels and what content goals an instructor would want to achieve through the use of such a tool.

Four groups were created within the class and were randomly assigned the following color concepts to address in their creations:
- Color Harmony
- Color & Contrast
- Additive & Subtractive Color
- Color Context

Core requirements for the project included:
- An initial segment or screen that presents this color theory concept, and indicates a way to move on to a second screen.
- A second segment that challenges the student to apply the color theory concept (and gives feedback regarding whether they have applied it correctly).
- A clearly defined end that resets to the first screen.
- A physical interface constructed of cardboard and incorporating arcade buttons or other input devices.

Students were given time in class and were also required to work outside of class to create the project. The projects were to be completed in a two-phase process wherein the first phase focused on the creation of the visuals, content, and gameplay using the Processing language. This phase of the project covered roughly two and a half weeks and students were required to provide weekly updates both to the instructors and the rest of class on the current progress of the project including the successes and issues they had experienced during the creation process. This was done in order to allow the entire class to benefit from any solutions to specific problems other groups had come across and to allow all students to suggest solutions to existing problems in the development of the projects. This activity also allowed the instructors to offer suggestions and address any issues within the creative teams or re-focus the students on their assigned color-theory concept as needed. The first phase culminated in a class-based demonstration of the visual portion of the project and an opportunity for instructors and students to try out the current state of the project and offer suggestions on revisions. Art Education majors also attended this demonstration to give feedback on appropriateness and the overall feel of the visuals.

A gap between the first and second phase of the project occurred as students worked on small assignments related to soldering, wiring, and use of electronics as controlled by the Arduino microcontroller. During the gap between the two phases, students began the ideation process for their final group projects and began acquiring resources to complete this semester project. Before the gap in work on the Color Theory Project, students were told that they would need to be working on a physical interface for the visual element of the Color Theory Project consisting of a painted/decorated cardboard-based prototype enclosure integrating functioning arcade buttons wired to an Arduino. They also had to set up the Arduino to accept those signals and pass them along to the Processing code running on the computer. Students were informed that they would be presenting this final phase of the project to the public at a Creative Arts & Research Symposium held at the university where the course is taught. All groups would have the week before the symposium to finalize their physical interfaces but they would need to be working on this second phase of the project in the background while the class focused on other related activities concerning the Arduino.

The second phase of the project concluded with the various creative teams presenting their projects for use by the public at the symposium. A large room that normally held tables and chairs for approximately 40 individuals was the context for this public showing and tables and chairs were rearranged in the room to allow the public to move around the room where the various projects were set up. Student projects were presented in various states of functionality. The majority of projects' physical interfaces consisted of enclosures that masked the laptop computers (driving the visuals) as well as the wiring and Arduino (controlling physical input). The only parts of the project that were visible to the public In these creations were a screen, the tops of arcade buttons, and the enclosure covering. Some projects relied on constructed coverings for a traditional mouse as well as button based controls to interact with the visual elements of the project.

Results

Overall the majority of the groups were able to complete a functional version of the Color Theory Project that included a game based visual tutorial for the assigned color concept and a prototype physical interface. One group was not able to get a functioning physical interface ready for the symposium and resorted to the standard keyboard and touchpad of a laptop to control the visuals. At the symposium the projects were well received and several attendees encouraged others in different venues of the symposium to come and interact with the projects. Some attendees mentioned that they enjoyed trying out the creations and felt that the projects might work well in a classroom when advanced to a more solid physical interface of plastic or other material. Students reported feeling satisfied with the knowledge gained about the various technologies and the experience of developing prototypes. The instructors felt that the experience did advance the students' abilities to work with Processing and Arduino microcontrollers. However, the main benefit of the project within the course was to simply allow students to practice and apply skills related to the use of the technology and it did not fully meet the goals of the creators.

While some of the physical interfaces reached a generally complete state, the groups struggled to create physical interfaces beyond those which masked and mimicked the normal functions provided by a computer. The creators had hoped that the students would exercise some creativity in exploring different ways of controlling the visuals, but the interfaces generated by the students tended toward the purely functional. Many students underestimated the time necessary to create and troubleshoot the physical interfaces, and thus resorted to the easiest path to completion. This in part may be due to the functional focus of many of the computer scientists who largely maintained directive control over the projects and adopted a "meet the base requirements" approach to the project.

It was hoped that the content of the project being focused on a formal element of art would allow art students to see an avenue into the project that would allow them to direct the group creatively and generate

interesting and aesthetically appropriate projects. However, this did not happen. The art students tended to struggle to find a role for themselves in the project and some fixated on a specific artistic element regardless of its relevance to the project or ability to easily integrate into the concept or gameplay. Others simply separated themselves from the process and focused on other assignments. This disconnect may in part be due to an unconscious assumption by the creators that the art students would naturally fill the role of creative director. In hindsight, that supposition on the part of the creators failed to take into account the tendency among art students to work on their own. Furthermore, this disconnect may be the result of the project being too focused on a specific task which might be considered rudimentary from an artistic perspective. The art students may have felt that they did not see a way that they could express their own creative intentions within the context given.

Additionally, many of the created projects were vague in how they tested the color concepts they were assigned to address. Often there were contextual choices that confused or distracted from the main concept. The computer scientists often became overwhelmed with the possibilities for gameplay and struggled to achieve some of the technical requirements programmatically. They seemed to adopt a "good enough" attitude and took visual shortcuts because it was more expedient. Image choice and programmatic structure were often chosen because of easy availability rather than because of conceptual appropriateness. While the project provided a clear functional goal for the computer science students and an artistic component for the art students, the project as a whole was more utilitarian than conceptual. The technical difficulties prevented the groups from reaching a point where they could explore alternative iterations, and a lack of opportunity for creative expression seems to have resulted in diminished morale.

Discussion

Ultimately, the course creators felt that the Color Theory Project did not meet the needs it was designed to address. This is not to say that the project did not have value, but the value of the project in this course was more as an opportunity for students to learn the value of iterative development. The course creators feel that the project was ineffective in supporting the development of artistic concepts. The project offered insight into the assumed abilities of students and the need for projects based on prepared technical solutions that allow students to quickly reach a level where they can explore artistic concepts. This is not to say that the course creators seek to remove all technical difficulty from future projects, but rather they feel that the are enough inherent difficulties in implementing and adapting prepared solutions to unique situations to be sufficient for learning. In essence, the goal will be to bootstrap the students up to a point where can achieve initial success in specific applications before branching out to more self-directed interactive digital art applications for the final project and beyond the course.

Furthermore, while the Color Theory Project will probably not be included in future iterations of the Interactive Digital Art course, it has been the potential to be the basis for development of other inter-disciplinary efforts. Specifically discussions are underway to form a partnership between computer science and education that stems from the example set by the course for which the project was originally developed.   This sort of partnership provides a better context for the Color Theory Project and the opportunity for expansion and could potentially benefit from more motivation based on authentic interest from students.

Wearable Computers: Past, Present, and Future Possibilities

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Abstract

Wearable computers include a variety of body-borne sensory, communication, and computational components that may be worn on the body, under, over, or within clothing. These mechanisms have potential benefits for (a) human performance support, (b) cognitive and psychomotor learning, and (c) K-12 educational environments. This manuscript begins with a historical overview of wearable computers and then provides the readers with a current and future perspective of wearable use across a variety of educational environments with specific attention focused on K-12 environments. Examples of current research in wearables is highlighted, followed by limitations and future directions for research.

Introduction and Background

Wearable technologies have progressed over the past decade and have the potential to be used effectively in K-12 classrooms (Lee, Drake, & Williamson, 2015). Wearable computers have been around since the early 1960s (McCann & Bryson, 2009). Thorp and Shannon created a roulette wheel predictor, a wearable computer that would predict where the ball would land when playing roulette (McCann & Bryson, 2009). The device did not earn the title of the first wearable computer until 1966 when Thorp published the work (McCann & Bryson, 2009). Another contributor to wearable computers was Steve Mann. Mann developed his first wearable computer system in the early

1980s, and it was composed of a head-mounted camera and a backpack (Mann, 1997; McCann & Bryson, 2009). Over the next 20 years, Mann's (1997) wearable computer continued to evolve into a less cumbersome device.

In the late 1980s and early 1990s, further progress in the area of wearable technology made smart glasses commercially available (Havard & Podsiad, 2017). After the introduction of the World Wide Web, researchers began sharing their wearable computing studies internationally (McCann & Bryson, 2009). The sharing of information enabled technology developers to combine the ideas of multiple wearable computers to create new technologies. In 1993, Platt and Starner combined smart glasses called the Private Eye and a one-handed keyboard to develop the first context-aware system (Havard & Podsiad, 2017). Throughout the 1990s, researchers developed additional wearable computers such as the Pathfinder system, which was the first wearable GPS, as well as prototypes for augmented reality systems (Havard & Podsiad, 2017).

In the early 2000s, the Lilypad Arduino was introduced and began as an academic research project (Buechley & Hill, 2010). "The LilyPad Arduino is a system for experimenting with embedded computation that allows users to build their own soft wearables by sewing fabric-mounted microcontroller, sensor and actuator modules together with conductive thread" (Buechley, Eisenberg, Catchen, & Crockett, 2008, p. 424). The Lilypad project was commercialized in collaboration with Sparkfun Electronics and sold as an e-textile construction kit (Buechley & Hill, 2010). Students in K-12 have used the Lilypad Arduino to make a "touch-sensitive shirt; makes silly sounds when touched in certain places and a police hat that makes siren noises when a switch is pressed" (Buechley & Eisenberg, 2008, p. 14). The Lilypad Arduino serves as the electronic component of many wearable devices.

Although advances in wearable technology have progressed significantly over the past few decades, researchers and educators are continually developing wearable devices and finding new ways to incorporate them into the academic curriculum. Currently, wearable devices are being used in a variety of ways in K-12 education. Educators and researchers across the globe have infused fitness activity trackers in schools to help students achieve instructional goals. Additionally, wearable technologies have been paired with STEM instruction and educational computing, as well as a tool to engage students in collaborative learning experiences. Wearable devices are also being used with students to encourage educational gaming and free play. Though there are limitations to the use of wearable devices, these technologies have positive implications for teachers and students alike.

Wearable Fitness Activity Tracking Devices

The introduction of wearables for health-related purposes was not until the 1980s (Price & Rasmussen, 1980). Price and Rasmussen (1980) patented the invention of a wearable heart rate monitor for the wrist that detected and displayed one's pulse rate. The technology has evolved to fitness and activity trackers, smartwatches, and heart-rate monitor chest straps. More recently activity tracker wearables have been used in K-12 classrooms for educational purposes besides teaching students about health or fitness.

Statistics Instruction

High school students have used Garmin Forerunner heart rate monitors to practice interpreting visual displays of data, and fifth-grade students have used Fitbit Ultra device data to identify measures of central tendency (Lee et al., 2015). Lee, Drake, and Thayne (2016) chose to utilize Fitbit Ultra and Fitbit One devices during physical education and teach students grades 3-8 elementary statistics. Steps gathered from the students' activity trackers were used as data to create histograms and provide students with an understanding of variability (Lee et al., 2016). Fitbit is a pedometer, or step counter, that uses a "three-axis accelerometer to detect movement" (Lee et al., 2016, p. 357). The wearables were not used to teach students specifically about physical education but were used to teach students about data accuracy and statistics (Lee et al., 2015).

Project GETUP

Project GETUP (Gaming to Educate Teens to Understand Personal Health) was a study conducted to determine student engagement with tracking his/her health using Fitbit One devices (Schaefer, Ching, Breen, & German, 2016). Schaefer et al. (2016) discovered that student engagement declined over time, tried to cheat to log more steps, and there were several constraints that could have possibly affected the outcome of the data. The potential constraints included limited technology accessibility, design flaws, difficulty using the device, and device loss (Schaefer et al., 2016).

Motivational Tool

At the A. Harry Moore School at New Jersey City University, Fitbits are used to motivate students to move around during the school day (Pepe & Talalai, 2016). A. Harry Moore School is a laboratory school for "students with multiple physical, medical, and cognitive disabilities" (New Jersey City University, n.d., para. 1). The Fitbit serves as an activity tracker and steps counter display that aids in encouraging students to meet daily goals (Pepe & Talalai, 2016).

Wearables for Instructional Needs

The use of wearable technology to meet instructional goals in the K-12 environment is occurring across the globe. Instructors are incorporating e-textiles and other wearable technology into instruction to improve attitudes and interest in STEM and engineering, as well as educational computing. Building and programming wearables encourage creativity and facilitate cooperative learning among K-12 students (Ngai, Chan, Cheung, & Lau, 2009).

Science, Technology, Mathematics, Engineering (STEM) Instruction

Solving real-world problems with the use of the engineering design process is the cornerstone of STEM instruction. Learning through engineering design lessons allow students to connect content knowledge to real-world applications (Riskowski, Todd, Wee, Dark, & Harbor, 2009). Therefore, researchers have attempted to discover the impact of wearable technology and engineering design. WearTec researchers at the University of Nebraska have found evidence that intermediate students who participate in wearable technology programs have increased attitudes towards STEM, including motivation to learn, self-efficacy and learning as a whole (Barker et al., 2015). WearTec researchers also found that the use of e-textiles in instruction has been shown to increase interest and participation in female students because it makes engineering and computing personally relevant to them (Barker et al., 2015). In addition, Barker et al. (2015) stated that the instructional goals of wearable technology are closely related to the goals of the engineering design process; therefore, making the use of these technologies a natural addition to STEM education.

Collaborative Learning

Also in line with the engineering design process, the use of wearable technologies promotes collaborative learning with K-12 students (Ngai et al., 2009). Researchers using e-textiles for computing circuit design observed several students working on different aspects of one garment at the same time, recognizing the need to work simultaneously with other students to accomplish their goal (Ngai et al., 2009). Even students attending different schools have the ability to collaborate with to create and produce wearable technologies. Middle and high school students working with the Engineering Brightness project used 3D printers to develop wearable wrist watches with solar-powered lights so children in underdeveloped countries can read at night without electricity (Fogarty, Winey, Howe, Hancox, & Whyley, 2016). Using online conferencing applications, such as Skype, students worked collaboratively to learn necessary information on circuits, plan and design the wearable wrist watches, deepening their understanding of the technology, as well as its philanthropic impacts (Fogarty et al., 2016).

Educational Computing

Wearable technology gives K-12 students an opportunity to master instructional goals, as well as designing and creating projects using educational computing (Barker et al., 2015). Although wearable technology shows promise in the area of educational computing, it comes with some significant challenges that researchers are aiming to improve. Researchers created the TeeBoard in an attempt to utilize e-textiles in a way that allows students to make mistakes that are easily correctable and does not require extensive training or expensive tools (Ngai et al., 2009). The TeeBoard project is just one example of how e-textiles and other wearable technology permeate the K-12 curriculum.

Wearables for Games and Other Uses

Researchers have found that incorporating wearable technology into play time fosters creativity in young children, encourages physical activity and allows students to play independently (Rosales, Sayago, & Blat, 2015).

Wearable technology has also been piloted in classrooms to assist students with hearing impairments with the use of Google Glass and Quick Response (QR) codes.

Gaming and Play

Not only does wearable technology spark interest for young children, it may also serve a valuable purpose when playing games. The creators of the BeeSim game used e-textile puppets with students ages 7-8 to illustrate how complex systems operate by using honeybees as a participatory simulation (Peppler et al., 2010). Students used their computational puppets to collect honey and communicate with other students acting as bees, the beehive, and flowers. Although students attempt to win the game by bringing the most honey to the beehive, they also realize the importance of working quickly and communicating with the other bees (Peppler et al., 2010).

Researchers facilitated a workshop with middle school students that encouraged them to creatively modify existing games to include wearable controllers (Vasudevan, Kafai, & Yang, 2015). Students used computational construction kids to design and create wearable controllers that coincide with the Flappy Birds computer game. The children that participated in the workshop were encouraged to be creative; therefore, each computational glove looked slightly different and codes varied from student to student (Vasudevan et al., 2015). This workshop provided students with an opportunity to participate in the creation of the controller, as well as the activity of testing and playing with their final product.

Other technologies such as Wearable Sounds, Statue and FeetUp are wearable accessories that were created for use during free play for young children (Rosales et al., 2015). The FeetUp accessories encourage movement, as they only chirp when both feet are off the ground (Rosales et al., 2015). In a similar fashion as those listed above, these wearable accessories allow students to express themselves creatively through play, sometimes creating new and alternative games to those suggested by the researchers (Rosales et al., 2015).

Assistive Technology

Students with significant hearing impairment benefit from the development of Glass Vision 3D which uses a Google Glass application for assistance in the classroom. For this project, Google Glass was used in conjunction with QR codes, allowing students to scan the codes with their glasses which prompts an American Sign Language video to appear via augmented reality (Parton, 2017). Students are also able to gesture to access videos on the glasses, rather than use their voice because many students with hearing impairments are not comfortable with verbal language (Parton, 2017).

Limitations

Although the use of wearable technology in the K-12 environment yields positive outcomes in many occasions, researchers and educators have also determined that there are significant concerns to address in the future. Researchers noted that using Google Glass for over one hour caused the device to overheat. Therefore, the students had to wait until the glasses were cool before further use (Parton, 2017). Classroom teachers stated that although wearable technologies sparked interest for their students, instruction took significantly longer than other technologies, such as iPads, even though the outcome was similar (Parton, 2017).

Researchers have also acknowledged that not all schools can afford Fitbits or wearable technologies for students (Lee et al., 2016). Schaefer et al. (2016) noted that it was "difficult to obtain all of the necessary technological resources" (p. 13) to sync wearable fitness devices in their urban afterschool program. Researchers discovered the limitations with school firewalls when uploading Fitbit data to the online website (Lee et al., 2015). Additionally, students may have limited access to the internet at home to sync wearable device data to online locations (Schaefer et al., 2016). It is possible for school technology specialists to set up temporary accessibility to provide students with online access to their Fitbit data in an effort to combat this challenge. Other limitations included privacy and ethical concerns, data storage, and data displays (Lee et al., 2015).

As researchers conduct studies in K-12 settings, they noted small sample size as a significant barrier in generalizing their findings to a larger population. Barker et al. (2015) stated that because their sample size consisted of only 21 participants in the WearTec study, "the results cannot be generalized to the target population as a whole" (p. 74). These concerns were also echoed by Ngai et al. (2009) who indicated that the sample size of 25 was a limitation during their project. Ngai et al. (2009) stated it is "crucial that it be feasible to run larger-sized workshops" with qualified instructors (p. 56). Additionally, researchers noted that they wished to not only expand their sample size but also with participants of varying age groups. In Rosales et al. (2015) study, the authors

described their desire to test wearable devices with teenagers and adults who they thought "could also benefit from wearables that support their interest in play and social interaction through technology" (p.47). Regardless of barriers, it is evident that researchers have an overwhelming desire to continue and expand studies of wearable devices for educational purposes.

Conclusion and Future Directions

Over time, wearable technologies have continued to advance in both quality and quantity of features offered for consumers, as well as students in K-12 environments (Lindberg, Seo, & Laine, 2016). Researchers and educators alike are creating and presenting wearable computers that are user-friendly and guide students through basic computing functions (Ngai, Chan, Cheung, & Lau, 2010). With future research, wearables may be easier to incorporate into instruction, allowing both students and teachers the ability to reuse and reprogram interfaces so that they can be modified for other instruction and scaffolded for various concepts in the curriculum (Peppler et al., 2010). Creating wearables such as e-textiles enable students to participate in tactile learning that supports child development and free play (Rosales et al., 2015). Additionally, wearable technologies allow students to learn creatively through the use of STEM disciplines and the engineering design process, which encourages success in higher education (Riskowski et al., 2009).

Future studies may consider training educators in wearable technologies and their implementation to discover how wearables can be incorporated into science, technology, engineering and mathematics curriculum and instruction (Barker et al., 2015). Limited technology access in some communities may present a challenge when integrating wearables into the K-12 environment (Schaefer et al., 2016). Adapting wearables into education would require a smooth transition by incorporating these technologies a little at a time to avoid a backlash if some technologies do not work as effectively as initially anticipated (Borthwick, Anderson, Finsness, & Foulger, 2015).

It is clear through the various studies discussed above that the analysis of data "captured through wearable technologies and the Internet of Things represents an invaluable source of information" for students and instructors alike (de la Guía Cantero et al., 2016, p. 377). Since wearable technologies allow students and teachers to monitor their actions while collecting data, they have the ability to look at data from a new, more personal perspective (Lee et al., 2015). Instructional time will essentially be saved in the long run due to quick and efficient data collection using wearables, although additional time may be spent initially learning how to operate these devices (Lee et al., 2015). Based on the current research, students in the K-12 environment are not only benefiting from the use of wearable technologies in the classroom, but they are also open to their use in coordination with other learning tools and strategies (ul Amin, Inayat, & Shazad, 2015).

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Design and Development of a Tool to determine E-learning Readiness

Dr. Cathy James-Springer

Dr. Katherine Cennamo

Introduction

Why does an organization decide to use e-learning in their workforce training? What are the potential challenges ahead? As e-learning becomes more commonplace as a tool for workforce training, it is recognized there are varying reasons for using e-learning, chief among them being the fear of losing competitiveness (Comacchio & Scapolan, 2004). Adoption for the sole purpose of remaining competitive does not necessarily result in the most appropriate and timely interventions. As training expenditures on e-learning continue to grow, there are increased advantages for adoption among which are the ability to reach geographically dispersed employees; deliver just in time, standardized training; and reduce costs associated with training. Since the use of e-learning is growing it becomes increasingly important to determine the readiness of organizations for adoption before and even after using e-learning.

In this paper we will focus on the design and development process used in the creation of a tool to determine e-learning readiness. It begins with the initial considerations for tool development to the factors that influence the decisions made in the design and development process. The paper also outlines some of the limitations encountered in the research journey that determined the methodology, design and final development of the tool.

Initial consideration in designing this tool was to determine from the onset what type of analysis would be necessary to determine e-learning readiness. Tessmer (1990) recommends two areas for consideration when designing instructional systems; the instructional environment and the support factors influencing the instructional environment. In undertaking an e-learning project some sort of needs analysis should be undertaken. Tessmer (1990) emphasizes the need for conducting an environmental analysis early in the project design since an understanding of the environment could guide later decisions. The environment refers not only to the physical environment but also related culture and climate. From an instructional design perspective, a learner and context needs analysis is usually included in course design, but e-learning represents an institutional-wide learning initiative and therefore a more encompassing analysis is needed.

This research is based on the premise that a type of needs analysis is necessary before establishing e-learning within an organization. Having established the need for an upfront analysis, four (4) existing models for e-learning readiness were explored (Aydın & Tasci, 2005; Borotis & Poulymenakou, 2004; Chapnick, 2000; Psycharis, 2005) as examples of types of analysis tools. The four models included several similarities and variations in the aspects of e-learning that were important for consideration before establishing e-learning. A breakdown of each tool is seen in Table 1.

Table 1. Summary of E-learning readiness tools

Aydin & Tasci (2005)	Chapnick (2000)	Borotis and Poulymenakou (2004)	Psycharis (2005)
1. Technology - Access - Learner skills and attitudes 2. Innovation - Barriers - Adoption - Openness 3. People - Employees - HR Specialists - E-learning champion - Vendors and external parties - Skills with respect to learning with technology 4. Self-Development - Budget - Time management - Belief in self-development	1. Psychological 2. Technical Readiness 3. Environmental 4. Human resources 5. Sociological 6. Economic 7. Financial 8. Equipment 9. Content	1. Business 2. Technology 3. Content 4. Training process 5. Culture 6. Hunan Resources 7. Financial	1. Resources - Technology - Financial - Human Resources 2. Education - Content - Educational 3. Environment - Entrepreneurial - Culture - Leadership

Source: p. 16, James-Springer (2016).

Every tool referred to the need to consider: organizational readiness in the categories of organizational culture, human resources, and financial resources; learner readiness in areas such as learner characteristicsequipment readiness that covers infrastructure as well as readiness with reference to the operation of the equipment. For these tools, similarities were identified in broad headings, but there were variations in how the authors interpreted the categories within these headings; for example what Aydin and Tasci (2005) classify as self-development what can be easily categorized as learner self- efficacy and motivation, this same concept would fall under human resources in Chapnick's (2000) and Borotis's and Poulymenakou's (2004) models. These variances provided a basis for the designing and developing this new tool for e-learning readiness.

Methodology

The study uses Design and Development (D&D) research methods that cross both model development and tool development, as defined by Richey and Klien (2007). A summary of the process and their resulting outputs are shown in figure 2.
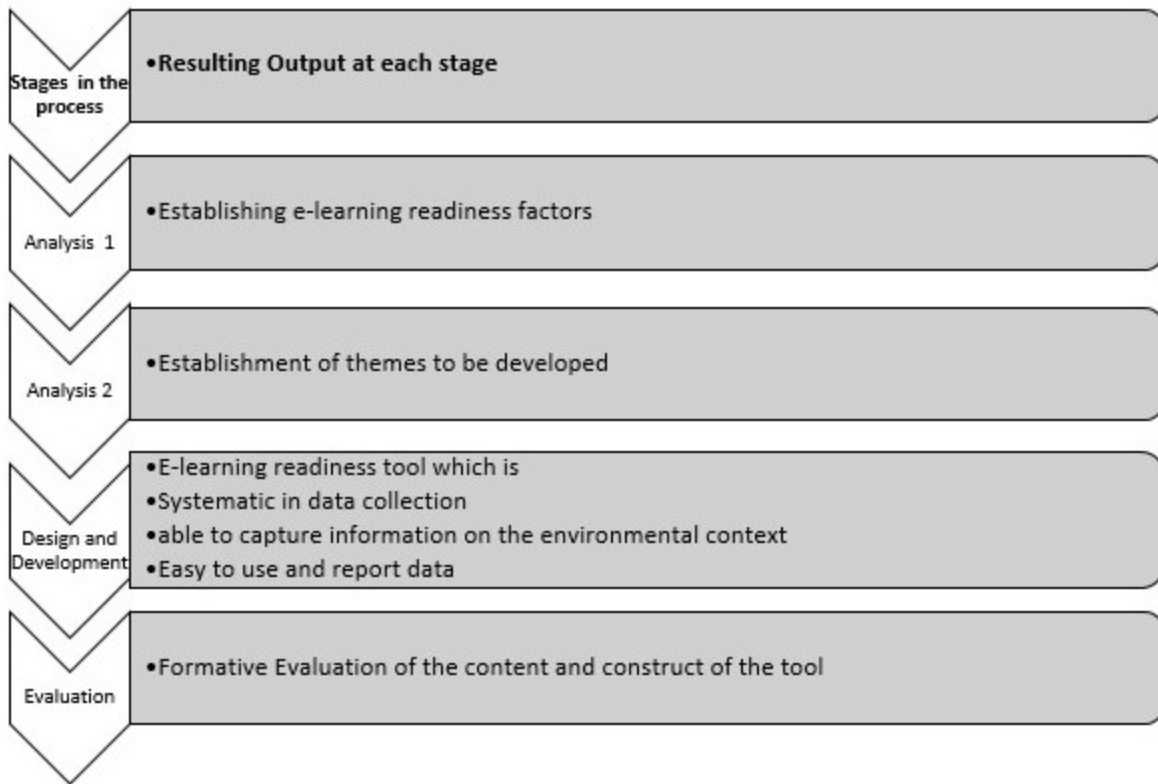
Figure 2. Stages in the design and development process and resulting outputs

In this research, two phases of analysis occurred, and the results of these analyses informed the design and development decisions.

Analysis Phase 1 involved a review of four existing e-learning readiness models, chosen on the basis of their frequency of use in e-learning literature, which resulted in a preliminary list of factors required for e-learning readiness.

Analysis Phase 2 involved a review of multidisciplinary literature to create themes. The literature used in this phase evolved as a result of questions raised during the preliminary review of the e-learning models. Nunamaker, Chen, and Purdin (1990) recommend that in information systems development, it is necessary to go beyond the discipline to obtain ideas for the design. Exploring other literature provided insight into ways of varying the tool, and facilitated application of content from fields such as learning and innovation principles within organizations, knowledge management, adult learning theory and technological support systems. These areas viewed in isolation have little in common with e-learning but the concepts proved useful in bringing the various aspects required for determining e-learning readiness.

Design and Development

The second phase involved the application and embedding of theoretical knowledge (Van den Akker et al. ,2012) in the design and development of a tool that was practical and usable in real world settings. The tool was designed and developed to capture information on:

Specific parameters for determining e-learning readiness
Systematic processes for coming to conclusions on readiness
Capturing concerns about the environmental context
Interrelatedness of the overall implementation process

Development

       The tool was developed to incorporate factors identified as important in existing e-learning literature. Seventy six (76) sources of literature were examined and coded based on the themes identified in the second analysis phase. These comprised empirical qualitative and quantitative studies, business publications, and books. From the e-learning literature, several features were found to be associated with e-learning adoption; for example the need for learning to be a part of general organizational practice; positive attitudes toward using technology for learning at all levels within the organization; and an accessible and quality system. These features reoccurred as favoring easier implementation and acceptance of e-learning. Therefore questions pertaining to these finding were included in the tool. The development process resulted in four survey instruments, each of which focused on different target groups within the organization: (A) leadership survey, (B) human resources survey, (C) learner analysis survey, and (D) technology survey.

       The leadership survey (A) has two target groups: top management and mid-level management. The basis for these targets was the acknowledgement that adoption of e-learning is a change and any change must be supported by leaders within the organization (Annansingh & Bright, 2010; Purnomo & Lee, 2013). The distinction in management was also important since mid –level managers would be able to provide more detailed information on every day running of the organization.

       The human resource survey (B) is meant to gain opinions from the individuals who are supposed to know where knowledge lies in the institution and the learning needs of the organization.

       The learner analysis survey (C) targets employees that would be presumed to actively use and interact with e-learning. The literature recognizes that several employee characteristics can contribute to e-learning success and chief among them is self-efficacy, (Womble, 2008). The survey looks to gather learner perceptions regarding various aspects of readiness including organizational support, learning culture, learner access and attitudes.

       The technology survey (D) targets the individuals who are responsible for facilitating the use and acquisition of computer technology within the organization.

       The final aspect of the tool serves to collate the information gathered from the four surveys into as succinct document that can be used for decision-making. It is in the form of a final checklist and recommendations (E). The process is outlined in figure 3.
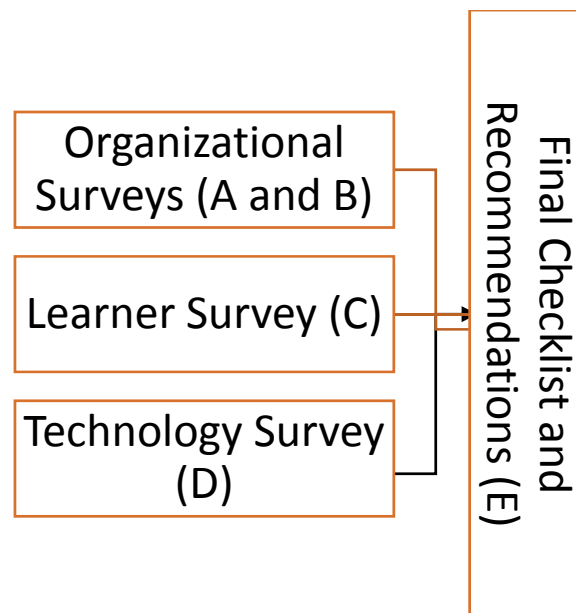

Figure 3. The process of using the e-learning analysis tool

Source: James-Springer (2016)

Evaluation

Formative evaluation was conducted throughout the development process to determine the quality, efficiency and effectiveness of the tool (Van den Akker, Branch, Gustafson & Plomp, 2012). This was done through use of two types of experts who looked at construct and content validity of the tool separately. This phase of the research study revealed both strengths and weaknesses of the tool. Feedback was consistent in terms of the tool as practical and usable, which would capture relevant information. However, suggestions were to decrease the technical nature of the questions, and tailor some of the surveys for each target audience. This included carefully considering the self-efficacy of the information technology personnel and adding questions that would capture the idea of the personal learning culture of the individuals taking the surveys. These changes were taken into consideration in the final iteration of the tool.

Findings

The findings from this design and development study showed that it was difficult to separate this developmental research into the distinct categories of model or tool research. Tool research is context specific while model research is general (Richey & Klien, 2007), yet, this research resulted in a tool which is generalizable to various contexts. The deviation form tool design research also included a move from using case studies, as suggested by Richey and Klien (2007), and focused on gathering information from various contexts within the e-learning literature. This review of the literature resulted in a more generalizable final tool.

In the absence of clear guidelines for tool research in Richey amd Klien (2007), it was necessary to look beyond IDT for guidelines in tool design. This procedure was informed by other disciplines. The methodology for this research drew on the works of Ellis and Levy (2010) and Nunamker et al. (1990) which featured information systems design approaches to tool development. Thus, the resulting methodology was an amalgamation of methods from IDT and computer systems design (Ellis & Levy, 2010).

Design and development research allows for flexibility of procedure (Van den Akker et al. 2010; Richey & Klein, 2007). At any time during this design and development, there was a focus on more than one variable. Early on in the research process, it was recognized that separation of the variables would have been difficult due to the interrelated nature of the factors affecting e-learning. Several themes were identified in the literature, these themes were related in many areas. For example, learning organizational culture is an aspect which affects every individual in an organization, whether it is creating the environment for learning or benefiting from this environment. The learning culture also affects the processes used in supporting learning within the organization. The idea of learning culture is interrelated with organizational readiness, learner readiness and technology readiness.

The artifact created in this D&D research is specifically designed to collect data within organizations from multiple perspectives. Much of the literature represented views of individual groups within organizations on the readiness of the organization; for example, Annansingh and Bright (2010) interviewed leaders within an organization and their perspectives and assumptions were used to determine e-leaning readiness. The limitations of this approach resulted in the idea of targeting several groupings within an organization. Additional findings of the literature review were that that the existing tools did not have an efficient way of collating data. Survey E serves this function and provides an efficient and succinct way of presenting information in the tool designed.

Conclusions

The artifact created looks at e-learning readiness in a systematic and interrelated way. The end product produced a tool intended to capture the content necessary for making decisions on e-learning readiness while at the same time being practical in application and use. Organizations show unique characteristics, and therefore, developing a general tool to determine e-learning readiness posed some challenges. Questions had to be carefully selected so that they can apply to most settings. There was also difficulty in keeping the design and the development process separate at some points in the research, since many decisions overlapped and influenced each other. The process used to come to the final product resulted in the amalgamation of various methodologies for tool development, these consisted of both IDT processes as well as Information systems processes.

Design and development research speaks to inclusion of several variables at once (Van den Akker *et al*., 2012; Richey & Klien, 2007) and this research was no exception. The design of the tool itself reflects the interrelatedness of the variables and should help influence e-learning adoption decisions. Overall the tools should collect data from various sources within and organization in order to give a comprehensive view of the degree of

readiness within the organization. As much as possible it was designed to be easily used to collate and compare information gathered.

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Peer-Led Team Learning in a Problem-Solving Course: Lessons Learned

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Descriptors: Peer learning, Problem solving, Computer education

Introduction

Despite the projected future demand of Computer Science related jobs in the US, there are not enough students choosing to major in this field (Bureau of Labor Statistics, 2014; NCLS, 2012). This issue is particularly evident with underrepresented minority (URM) students: among 22,273 high school students who took the Advanced Placement (AP) computer science test, 4% were African American and 9% were Hispanic Latino (College Board, 2013). URM students are significantly less likely to persevere in Science, Technology, Engineering and Math (STEM) majors (Chang, Sharkness Hurtado & Newman, 2014).

Biggers, Brauer, and Yilmaz (2008) identify "*the perception of asocial community with low levels of human interaction including student-faculty and peer-peer*" as one of the reasons students decide to leave their CS major (p. 406). A way to potentially improve the persistence of URM students in these majors is increasing the likelihood of students to engage in academic experiences, such as studying frequently with others (Chang, Sharkness Hurtado & Newman, 2014).

Peer-to-Peer Interaction and Learning

There are several instructional strategies aimed at promoting peer-to-peer interaction as part of classroom activities in STEM courses such as Peer Instruction (Mazur, 2017), Team-Based Learning (Michaelsen & Sweet, 2008) and Pair Programming, which is mainly intended for Computer Science related courses (Williams & Kessler, 2002). These strategies are based on Social Constructivism, a learning theory that suggests that knowledge is constructed through interaction with others (Vygotsky, 1978).

Peer-Led Team Learning (PLTL) is an instructional strategy that is not conducted as part of the classroom activities, as the aforementioned strategies, but as separate sessions that are lead by student mentors (called Peer Leaders). The instructor is still heavily involved in the design of the sessions (called workshops) but is not physically present in them.

PLTL was developed by Gosser et al. (2001) in the early 1990s to support students in Chemistry courses, however, it has been successfully implemented in several other areas, such as Biology (Batz, 2014), Information and Communications Technology (Sheard et al., 2011), Mathematics (Hockings, DeAngelis, & Frey, 2008), and Computer Science (Horwitz et al., 2009; Huss-Lederman, Chinn, & Skrentny, 2008; Murphy, Powell, Parton, & Cannon, 2011; Stewart-Gardiner, 2010).

Peer-Led Team Learning Characteristics

Gosser et al. (2001) identify the following characteristics: PLTL consists of a weekly workshop, which involves a peer leader and a group of six to eight students. The course instructors are closely involved with the workshops by holding weekly sessions with the peer leaders and developing challenging materials that are integrated with the course content.

The peer leaders are recruited from students who completed the course successfully. They are trained in leadership skills and teaching and learning strategies. Their role is more as facilitators and not as teaching assistants or mentors. Some of the peer leaders' tasks involve:

    clarify the purpose and goal of each workshop
    ensure full participation of the students
    create special opportunities for students
    build students' commitment and self-confidence
    practice listening skills and questioning techniques

strengthen students' skills and problem solving approaches
reflect continuously upon their process for leading the workshops

Our First PLTL Implementation

Encouraged by several studies highlighting the implementation of PLTL as a potential instructional strategy to reduce attrition for URM students (Horwitz et al., 2009, Stewart-Gardiner, 2010) and also for female students (Murphy, Powell, Parton, & Cannon, 2011), we decided to implement PLTL in CST231 Problem Solving and Programming in fall 2016. Our main research questions about the implementation of the PLTL program were:

1. What are the effects of PLTL on retention rates and grades?
2. What is the students' perception of PLTL?
3. In what ways could the PLTL program be improved?

CST231 is the first programming course that freshman students take as part of the undergraduate program in Computer Science. The class size is about 35 on average, and about 35% of them are URM students. As part of this course, students are able to edit, run, debug, and document computer programs written in C++. The course introduces basic programming skills such as conditional statements, logical expressions, loop structures, arrays, data files, and an introduction to object-oriented programming.

Following Gosser et al.'s (2001) recommendations to implement the PLTL program, we recruited students who successfully completed the course the previous semester as peer leaders; we trained them in leadership skills and teaching and learning strategies; two-hour workshops were offered every week; instructors were closely involved with the workshops, holding weekly sessions with the peer leaders and developing challenging materials that were integrated with the course content.

There were three sections of CST231 Problem Solving and Programming in fall 2016. An instructor taught two and a second instructor taught the third section. The weekly content was exactly the same across all sections. By the end of the previous semester, we had identified and recruited four students who had completed the course successfully and were willing to be Peer Leaders. Two of them had been tutors in previous semesters. We organized a two-hour training session in which we trained them to be Peer Leaders. They learned how to use several instructional strategies to facilitate the workshops, including peer problem solving and round robin techniques (Gosser et al., 2001).

The workshops were initially offered three days a week, Monday, Tuesday, and Friday. Each workshop lasted about 2 hours and the same content was covered in the three weekly workshops. In this way, students could attend a workshop on the day that was most convenient to them. Workshop attendance was not compulsory but strongly encouraged. Each weekly course assignment consisted of five questions/problems, two of which were ill-defined problems that were addressed as part of the PLTL workshop. Consequently, students attending the workshops would then benefit by working on their homework assignment under the guidance of the peer leaders.

The emphasis of the workshops was to focus on the problem solving process. Students worked in groups of four to six, depending on attendance. It was decided that computers shouldn't be used during the sessions for several reasons: a) promoting peer-to-peer interaction by preventing students from working individually in a computer, b) preventing students from looking for answers to the problems presented, and c) forcing students to memorize and recall the syntax of programming in C++.

Unfortunately, student attendance was a major issue: out of the 108 total students in the three sections, only about 50 students (46.29%) attended at least one workshop during the semester. Only two weeks had over 20 students attending the weekly workshops but on average, there were only about 10 students attending the workshops each week.

Both instructors were adamant about not assigning extra points for attendance, fearing that students would only attend to earn the extra credit. However, we did implement several other strategies to increase student attendance, such as:

1) Instructors increased the difficulty level of one of the ill-defined problems and encouraged students to attend the PLTL sessions to work on it.
2) A survey was conducted by the end of the first month of classes to identify a better day and time that would work for more students. Based on the students' feedback, the Monday workshop was moved to a different time on Fridays.
3) PLTL leaders came to class to give a short presentation about the benefits of attending the PLTL sessions and to answer any questions or concerns that students had.

Low attendance to PLTL workshops seems to be a common issue (Gafney & Varma-Nelson, 2008). Stewart-Gardiner (2010) reports that for several semesters almost no students participated voluntarily in the workshops. Even with extra credit, just two students out of 80 attended the workshops regularly.

We conducted a survey to analyze the students' perception about the PLTL program and identify areas of improvement. In total, 67 students from the three sections submitted the survey and 14 of them indicated that they had not attended any workshop. Nine of the students who did not attend any workshop reported that they were expecting to get an A as their final grade, and the remaining five were expecting to get a grade of B. The most common reason for not attending any PLTL workshop was that students felt they did not need them because they were able to solve the assignment problems by themselves.

The number of students that dropped, failed or withdrew the class was similar to previous semesters, between 25 and 30% per section. However, due to the low workshop attendance, it was not really possible to judge the effectiveness of the PLTL program.

Revised PLTL Implementation

In Spring 2017 the PLTL program was implemented for a second semester but attendance was made compulsory. Indeed, some PLTL programs at different universities require attendance and participation (Gafney & Varma-Nelson, 2008). At Columbia University, students taking CS1 can get one unit of research credit for their participation in the PLTL workshops, with two unexcused absences resulting in a failing grade (Murphy et al., 2011).

When the class was made available for registration, students were notified that they were required to attend three days per week during the semester, and that the third day would be for a lab session (PLTL). Attendance was made mandatory, with four unexcused absences resulting in a failing grade.

There were three sections of the class, each with about 32 students; each section attended a PLTL workshop separately. There were three peer leaders attending each workshop. One of the instructors met on weekly basis with the peer leaders for around 30 minutes to discuss the problems to be covered during the following workshop.

Other than making the attendance required, everything else remained the same: students were grouped randomly in groups of six to seven; two ill-defined problems were assigned as part of the class and students worked on them in the workshops; no computers were allowed. After identifying a potential solution to a problem, one of the students in a group would write it down in a whiteboard for everybody else to see it and provide comments and suggestions.

In spite of the required attendance and the joined efforts of the instructors and peer leaders, by the end of the semester, the percentage of students who failed, dropped, or withdrew from the class was still similar to previous semesters (25% to 30% per section). These results were somehow similar as those reported by Merkel and Brania (2015), who implemented a PLTL program for a Calculus I class but did not observe any gains in students' learning or retention.

We did not conduct a survey about the perception of students towards the required PLTL workshops. However, based on the opinion and observations from some of the peer leaders, the ill-defined problems used as part of the workshops might have been problematic for two reasons: 1) the problems might have been too advanced and might have tended to just benefit stronger students, and not those students who were still struggling with conceptual understanding, and 2) some of the problems were too difficult to be broken in smaller parts for analysis and to promote collaborative learning, as suggested by the PLTL literature (Gosser et al., 2001).

Conclusion

We implemented a PLTL program during two consecutive semesters with the goal to increase students' performance in programming and problem solving, as well as to decrease the number of students who drop, withdraw, or fail from the Programming and Problems Solving class. Even though there was no significant differences in the percentage of students failing or withdrawing the class, it doesn't necessarily means that a PLTL program is not effective.

Given that PLTL participation was voluntary during the first semester, only very few students actually attended the workshops. The lesson we learned was to either apply more active recruitment or to make participation mandatory. During the second semester implementing PLTL, we learned that it is important to use the right kind of problems as part of the workshops (problems with the right level of complexity that can be broken into smaller sub-problems).

As part of our analysis, we should have also considered other factors that might influence students' decision to drop or withdraw the class: CST231 is the first class in the Computer Science program and it is possible that some freshmen students might still be undecided about their career goals. Perhaps the PLTL program might be more helpful in sophomore or junior years, in which more students are committed to pursuing a career in Computer Science.

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Non-traditional Students – Leading the Charge to Change the Respect of Student Time in the Online Classroom

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Index Descriptors: Distance Learning, Nontraditional Students

Nontraditional students are multi-taskers. They work, they go to school, and they have family responsibilities. Sometimes they are successful with balancing their responsibilities. However, in many cases nontraditional students have little success. As Shapiro et al. (2015) reports, college cohorts who started in 2009 had graduation rates of 39.20% for students above the age of 24, compared to 58.6% for those who started their program under the age of 24. For online students, Patterson and McFadden (2009) drew a close correlation between being an older online student and student attrition. As a result, universities face two nontraditional student persistence impactors: nontraditional student external stressors and the intrinsic motivation needed to be a successful online nontraditional student (McClain-Smith, 2017). These impactors are areas that university's do not have control over and can provide little help…or perhaps they can?

While matriculating, online nontraditional students raise their children, deal with family crises, handle work duties and deadlines, while managing assignments, readings, and other learning activities within their courses. When external stressors become too much, nontraditional students are forced to prioritize their attention amongst family, work, and school. In turn, they face difficult choices. If stressors within college courses compete with stressors of life, students may choose to remove the easiest of all stressors, school. However, if instructional actions and course design reduce course stressors, students may be inclined to continue their courses and in turn complete their degree program.

One way to address these issues is by providing online instruction with respect of the nontraditional student's time. Student support services, along with course relevancy are often in the forefront of university online strategies. However, actual consideration of how course instruction and design affects student time constraints is an area in need of further exploration. Although instructors may allow some individual flexibility, in many cases course structure and learning activities may cause conflicts with nontraditional students' time constraints.

There are strategies available, in the area of respecting the time of online nontraditional college students, without reducing quality or instructional rigor. Key constituents such as college faculty, administrators, and instructional designers, have the ability to implement these strategies. As leaders within their universities, courses, and course design, these professional educators are the change agents needed when nontraditional students take online college courses. During phenomenological research data collection, the researcher interviewed online nontraditional students about their experiences within their online courses and the implementation of autonomy supportive actions by instructors or through course design. Autonomy supportive actions for the online classroom include (a) providing choices where students may select assignments based on preference, (b) providing rationale of the importance of the course, content, assignments, and (c) providing opportunities for personalization by allowing flexibility (Lee, Pate, & Cozart, 2015). Study results reflect that through the aforementioned actions, time, support, and relevancy are themes that reoccurred within participant statements. The Time theme had the most significant number of participant statements, accounting for 48%. The Support theme came in second with 39%, while the Personal Relevance theme had 13% of identified personal statements (McClain-Smith, 2017). As a result, time and the respect of time in particular, significantly influences students' ability to be intrinsically motivated to persist.

Of course, there are variants of online delivery across universities, with some courses being synchronous, asynchronous or blended. However, within various delivery methods there are course design and instructor delivery practices that negatively affect the matriculation of nontraditional students. Below are shared samples of participant statements (primary resources), reflecting nontraditional student thoughts and experiences while taking online courses. In some cases, students faced online courses that demand lengthy or excessive amounts of synchronous sessions. During participant interviews, when asked about synchronous lectures Participant 2 stated the following:

> It can already be boring to sit through a lecture, but to sit through a lecture at your own computer with a lot of distractions at a time that might not be ideal to you can be very frustrating. I think I didn't gain a lot from those experiences. It was frustrating with the timing. I was one of the few people on a different time

zone. So that made it even more difficult because the timings of the sessions were based on the university. For most people that worked out well, but for me it did not work out well. Sometimes it felt like wasted time. It was frustrating. Part of the reason for choosing an online program is because you want to be able to get things done at a time that's good for you (McClain-Smith, 2017).

An additional practice experienced by study participants was the restriction of viewable course content. This practice limits the nontraditional online student from moving ahead as needed based on personal circumstances. When asked about course flexibility and the availability of content, Participant 27 stated the following:

I would have liked him to [put learning activities up all at once] because if I was off on the weekend I was working on schoolwork. I would have liked to see everything up front so I could work down the list. I don't know why he didn't post it. I requested it, but I don't know why everything wasn't posted at one time. Different professors are different. Some will post it all and some won't. In the back of my mind, I was a little worried, because I didn't know when I would find the time to do them (McClain-Smith, 2017).

Within the same flexibility topic, when asked about course structure, Participant 2 stated the following:

"Three weeks in there's going to be a project and then a paper and then a big project. If I knew that in the beginning, regardless of if I was able to start on these things it gave me the ability to plan out my time and know if I needed to start something early. I'm going to start on this project weeks before it's due and I will start on another at another time. Because of the fact that they planned it out so well with a clear structure, they made it very well organized for us. Some even provided the rubrics at the beginning of the course, even if we couldn't complete it; it gave us the ability to plan our time" (McClain-Smith, 2017).

Depending on the action, abating or implementing such actions may influence a nontraditional student's time and subsequently impact the student's intrinsic motivation to persist. Nevertheless, there are actions to implement within online courses to counteract students' demotivation to persist. There are derived strategies that respect the time of nontraditional students based on perspectives of student's struggles and successes experienced in online college courses. To help with the time crunch of nontraditional online students, these actions include providing structure, timing, and communications (See Figure 1).
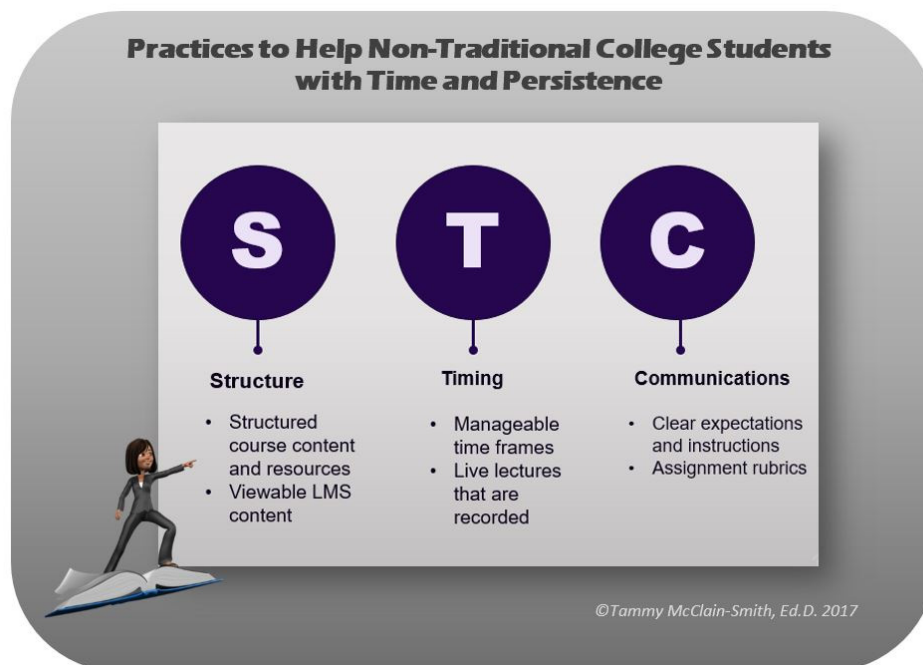
Figure 1. Recommended instructor and course design actions to assist online nontraditional students with time.

When examining course structure, well organized course layouts help eliminate confusion for the nontraditional student. Additionally, make learning management system (LMS) content viewable so that the nontraditional student can plan based on their time. In the area of timing, develop well-paced online courses, with learning activities provided within manageable timeframes. When using live lectures through a web conferencing tool, take into account lecture length and student access to lectures outside of live lecture timeframes. Recorded lectures are not only useful for nontraditional students, but also beneficial to traditional students. Finally, implement good communication by providing thorough instructions for learning activities. Additionally, rubrics are helpful in

communicating grading criteria. By using them, there will be no question of what level a student must perform to earn a particular grade. Most modern learning management systems provide the ability to embed rubrics within course assignment pages. Equally as important is providing the same rubric on assignment instructional documents for quick reference. The aforementioned actions are a sampling and considered as "low hanging fruit" that can be implemented easily within a course design or at a university policy level.

Autonomy supportive efforts that respect the nontraditional student's time can increase intrinsic motivation within online courses. Hence, better management of student external stressors result in the reduction of course stressors. Actions are easily implemented and can assist in providing further support for the nontraditional student; whether actions are in an individual course or college-wide. These recommendations may lead towards the support of autonomy of nontraditional students. While continual research will drill down the exact impact of each action, the recommended actions are a direct result of student reactions and recommendations. As a result, the implementation of these actions could possibly lead to higher student course and program persistence.

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TILC: An Innovative Learning Community Leading Educational Change

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Abstract

Say goodbye to working in isolation and hello to technology integration through innovative learning communities, both online and face-to-face. This presentation described and reflected on the organic and innovative processes that evolved during the creation and formative growth of an online professional learning community (PLC) in the context of higher education; the TILC (Technology Integration Learning Community). The TILC emerged and thrived in the context of budgetary constraints that limited the number of face-to-face faculty retreats and funds for professional development and conference attendance.

The goals of our TILC are to promote change, foster collaboration, and lead the way for integrating technology among a group of faculty.

Introduction

In the context of institutional budgetary constraints that limited formal professional development opportunities, the Technology Integration Learning Community (TILC) emerged to link geographically dispersed faculty with the purpose of integrating technology to engage online students. This presentation traced the development and evolution of the TILC, described its achievements, and shared lessons learned. Presenters offered strategies to foster success and promote transfer in the online learning environment.

Leading Educational Change

This self-initiated and independently coordinated learning community critically adapted the main foundations of theory crafted by experts in PLCs (see Dufour, Dufour, & Eaker, 2008; Easton, 2011; Martin-Kniep, 2004) and the foundations of andragogy (see Knowles, 1990; Linderman, 1961), to become a forum for professional development, technology integration and collaborative reflection to promote change in teaching and learning. Definitions of Professional Learning communities agree on PLCs as teams of educators who meet regularly to collaborate, learn, and improve teaching and learning. PLCs adopt a culture of collaboration that promotes data analysis, risk taking, and reflection. As a model of professional development, PLCs meet the qualities of effective professional development (Fogarty and Pete, 2007): they are job embedded, sustained, collegial, results-oriented, and practical. As a consequence, the work of PLCs can have real impact on students learning and on the institutions where they work. Because the context of the TILC is a College of Education in which most of the courses are teaching online, this PLC developed online. Its work is ongoing and it has been evolved for years in a collegial manner, based on the needs for collegial interaction, camaraderie, and professional development. The desired results that this learning community focus on are the improvement of learning through members and students' engagement. The members of the TILC reflect on the concepts and theories that support our practice. However, what we learn during our meetings is practical and is transferred into our courses.

Based on Knowles' findings of andragogy or adult learning theory (Knowles, 1973), the TILC offers its members control on their learning, immediate utility of the knowledge and skills learned, a focus on issues that interest us, opportunities to anticipate and discuss the use of what is learned, expectations to improve faculty members' performance as instructors and as designers, the ability to maximize the access to resources, opportunities to collaborate in a respectful and informal environment, and access to information that is appropriately paced.

Members of the PLC control the content addressed during the meetings by proposing and selecting what they want to learn and how they want to do it. Usually, one of the members of the PLC gives a brief presentation on a learning tool or strategy and leads a workshop for everyone to learn how to use it. In addition, the team discusses strategies for immediate integration. Every term faculty members share their experiences implementing one of the tools or strategies learned during the previous term.

Change for this team involves promoting engagement through integration of newer technologies that foster an environment of innovation and productivity for the students in our courses. Members of the TILC lead change by teaching each other how to use innovative tools and technologies, and discussing how to integrate these tools and technologies into our courses. Change is analyzed to evaluate our own learning and progression within our learning community.

History of our PLC

Our TILC emerged as a result of a Blue Sky focus group to brainstorm how to enhance student engagement at the Abraham S. Fischler College of Education (FCE) at Nova Southeastern University (NSU). We decided to pilot an iPad initiative with full support from administration, with the goal of integrating more technology into our courses. In 2012, we piloted the initiative with a small Master's in Athletic Administration program, taught the program faculty how to use the iPads, recommended a number of helpful apps, and challenged them to integrate mobile learning into their curriculum. Upon completion of the pilot, we evaluated our efforts to determine what worked (i.e., collaboration, administrative support) and what did not work (i.e., lack of accountability, limited training; Lacey, Gunter, & Reeves, 2014).

The need for additional training evolved into the development of an online learning community of eight NSU faculty members to promote technology integration during the Fall of 2013. At first our learning community focused on mobile learning, where each faculty member was responsible for learning about and teaching the rest of the learning community about certain mobile learning applications. We posted app reviews on a Wiki, but instead of just reviewing the app, we went a step beyond to discuss how we could integrate them into our courses. It was the integration ideas that really made our learning community unique. During the next couple of years, we evolved into a true technology integration learning community based on a collaborative training approach, where everyone was responsible for their own learning. We meet monthly to learn about new tools or technologies and always end the training with a discussion of how to integrate our newfound knowledge into our courses. To hold each other accountable we challenge each member of the TILC to integrate at least one new tool/technology into their courses each semester.

To guide our trainings, we developed the TILC Instructional Framework incorporating the social, collaborative, and evaluative components of our learning community (Please see Reeves et al., 2015 for a discussion on the framework).
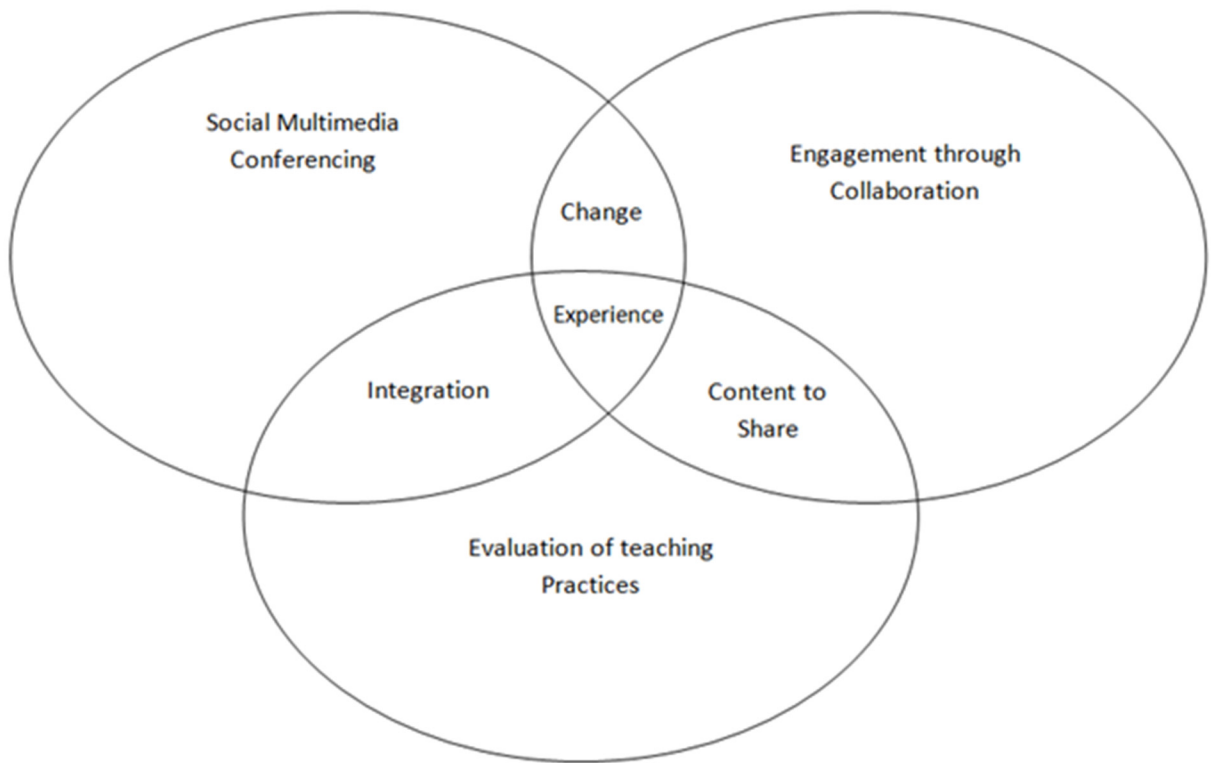
Figure 1. TILC Instructional Framework

Best Practices

Best practices for our TILC include defining clear and common goals, using a common communication platform, leading change by teaching each other, promoting transfer by discussing integration ideas, and holding each other accountable by challenging each member to integrate one new tool or technique into our courses each semester.

The goals of our TILC are to increase student and faculty engagement and promote integration of technology into our courses. We use a common video communication platform so that every member of the learning community feels a sense of connection. Although the members of our TILC are geographically dispersed, we do not feel as if we are working in isolation. Activities and training sessions are developed as a collaborative group, rather than thrust upon the community by the administration. This sense of community and collaboration is a key pillar to our learning community's effectiveness.

We hold monthly meetings where one member of our TILC leads change by teaching the other members about a new innovative tool and technique. Giving members the opportunity to teach each other creates a sense of engagement, responsibility, and accountability that benefits the community. In addition, offering the choice to teach or discuss a specific tool addresses two of the characteristics of the adult learner: the need to (a) control our learning and (b) focus on issues that concern us (Knowles, 1990). At the end of each meeting we promote transfer by discussing how to integrate these ideas into our classes. Regardless of skill level, group members help each other in an authentic way to move the group forward as a social community. Finally, we hold each other accountable by challenging each member to integrate one new tool or technique into our courses each semester.

The members of our TILC share, implement, and reflect on user-friendly and free technology tools that are easy to access not only for us, but also for our students. This is fundamental to our learning community: keeping it simple and practical. The members of our TILC have employed leadership skills by coaching colleagues during faculty retreats; at meetings; and local, state, and international conferences.

The presentation targeted K-12 educators and higher education professors and administrators who want to lead change by engaging students through the integration of technology. This presentation offered recommendations to establish a successful learning community related to any content area or interest. Modeling the ways in which this learning community interacts, we had traditional presenters (in the assigned conference location) and presenters at a

distance via video. This presentation reflected on best practices for design, recruitment, and sustainability of a learning community. We also shared with the audience lessons learned, our instructional framework, and tips for promoting transfer in the online learning environment.

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OMG! Leading and Learning to Create Faculty and Student Engagement Opportunities

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Abstract

This roundtable shared best practices and tools for leading and learning to foster engagement. This presentation showcased how to develop a learning community that integrates technological tools and strategies to promote collaboration, communication, and personal growth. In the context of institutional budgetary constraints that limited formal professional development opportunities, the Technology Integration Learning Community (TILC) emerged to link geographically dispersed faculty with the purpose of integrating technology to engage online students.

Introduction

Our Online Motivational Group (OMG) shared and discussed with the audience their ideas for creating faculty and student engagement opportunities. In this presentation, our Technology Integration Learning Community (TILC) discussed our journey and presented a brief outline about some of the tools we use to increase engagement in our courses, including tools for communication, collaboration, and productivity.

We provided participants with effective practices to promote collaboration and problem solving within a learning community and led a discussion on enhancing engagement in the classroom by discussing the technology tools, experiences, and outcomes from our TILC. By sharing the lessons we have learned, participants learned about our successes and roadblocks to implementing technology enriched learning environments to create engagement opportunities.

Creating Faculty and Student Engagement Opportunities

Many educators and learners are technologically competent using multiple digital and media devices and applications simultaneously. The connection between theory and application is bridged simply by sharing with colleagues, and reflecting about our own practices while referencing what the literature stated in a very real-life fashion. The goals of our TILC are to promote change, foster collaboration, and lead the way for integrating technology among a group of faculty.

Tools and Strategies for Enhancing Engagement

The following technological tools and strategies were briefly introduced to create engagement opportunities. These were organized under three main categories: communication, collaboration, and productivity.

Various communication tools were introduced including some for communicating more effectively (Remind and Google Voice), sharing information freely through the use of Blogs (e.g., Blogger) and microblogs (e.g., Twitter), staying in touch with family and friends via social media (e.g., Facebook), and streaming live video (e.g., Periscope and Facebook). We briefly described each of these tools below. Remind is a website that provides users a way to text message or email students and parents "where they are." This application divides courses into separate sections and can be utilized to send specific messages as needed to specific groups. Students and parents join the class using a code. Neither teachers nor student see other users' phone number. Google Voice is a free

communication tool that allows communication using all of your electronic resources including: telephones, mobile devices and a computer. This allows the users to gain access to needed information using any tool that is available at the time. Blogs and Microblogs are online diaries of thoughts published by an individual or a company. Blogs and microblogs have many educational applications and can be used to foster discussion in lieu of a traditional discussion forum. Blogger and Twitter seem to be the standard or most utilized blog and microblog; however, there are numerous social media blogs available to users from a variety of website or application. Acquiring good information quickly and easily seems to be everyone's goal today, and these tools respond to this perceived need.

Keeping in close contact with today's learners, colleagues, or stakeholders is paramount and simple with a variety of asynchronous or synchronous social media websites. Options with this tool include public and private websites. In emergency situations, social media is already the first communication method utilized to notify people of event cancellations, changes in plans, or simply an update about any topic. We provided examples of how to integrate social media into our courses, including live streaming, which enables you to transmit live video and audio coverage of any event over the Internet. Various software application such as Facebook or Periscope make this activity easy and simple to complete. These can be used for courses where an activity must be documented or for spontaneous instruction from the classroom, home, or relevant locations. These tools can provide a level of interest to a lecture that might otherwise lack quality interaction.

Collaborating in today's digital world is essential. Google products lead the way for collaboration. Google docs allows users to work together to complete activities online in real-time creating a true collaboration experience with other users. Other Google products were introduced, as well various collaboration tools from the roundtable members. Google slides was a favorite tool to create presentations collaboratively, Google forms allows colleagues to create together surveys, quizzes, and questionnaires. Google sheets is the Google collaborative version of Excel.

Finally, productivity tools are at the top of any educator's list. One of our favorites is Pinterest, which is an online repository for storing information. We shared a number of great and innovative ways to integrate Pinterest into the curriculum to enhance engagement.

Another must have in any educator's toolbox is Flipped Learning. A Flipped Classroom is a model of blended learning in which students learn content usually at home, and work is done in class with teachers and students discussing questions and solving problems applying the knowledge they acquired at home. There are a variety of tools and applications that enable this process to flow smoothly and effectively. Video Multimedia Tools are paramount to the flipped classroom. Leading the pack is YouTube which is a video sharing service that allows people to watch videos posted by other people and upload videos of their own. Students whose professors embedded YouTube links reported the "videos were exceptionally helpful" in increasing their understanding of the course material, allowing them "to grasp an understanding of many issues that were abstract or complicated."

In conclusion, this presentation targeted K-12 educators and higher education professors and administrators who want to create faculty and student engagement opportunities. The discussion highlighted various tools and applications used to engage students and colleagues. The members of our TILC reflected on best practices for evaluating, integrating, and sharing technology tools to enhance engagement in teaching and learning. We shared lessons learned from integration and briefly showcased various tools and strategies that had been used by our TILC and have been compiled in several products, including an online user manual, a social media blog, and a website. Finally, we were excited to learn that other educators in the US and abroad use similar tools to enhance engagement in their classrooms.

Future Ready Librarians and OERs Lead Learning for Change

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Descriptors: OER, Future Ready Librarians

Abstract

This session will introduce attendees to the Future Ready Schools (FRS) movement and specifically the librarian's role within the movement. Frequently serving as the technology leader within the school, the librarian will play a key role in leading learning for change. In a FRS, students and teachers will need access not only to quality digital tools and resources but also to a certified librarian who can locate, evaluate, and curate Open Educational Resources (OERs).

Leading from the Library

Librarianship no longer looks like card catalogs, dusty stacks, checkout slips, library cards, and overdues. Today's librarians teach digital citizenship skills and how to differentiate between real news and fake news, provide professional development sessions for teachers, teach technology skills for students, help students and teachers find and evaluate digital resources, help students hone their MakerSpace skills, provide technology classes for parents, teach coding, manage the school's social media and online presence, and maintain a digital and print collection along with all the other tasks of traditional librarianship.

The landscape of most libraries is changing. Today, it is not enough simply to circulate books and offer a reading incentive program. In a time when funding for libraries continuously sits on the chopping block, librarians have had to redefine their role within the learning community. This is why the Future Ready Schools (FRS) initiative is so important.

The FRS initiative calls librarians to step into a strong position of leadership. In looking at the layout of the FRS framework, librarians can clearly lead learning for change. The FRS framework is illustrated in Figure 1 as a wheel with eight pieces defining the role of a Future Ready Librarian (FRL). Of the eight sections of the graphic, three of them support the librarian as leader in a learning community: Collaborative Leadership; Curriculum, Instruction, and Assessment; and Personalized Professional Development. The FRS initiative defines tasks for each of those eight sections (Figure 2). Collaborative Leadership calls for the FRL to lead beyond the library reaching out to teachers to identify opportunities to co-teach and plan. Personalized Professional Learning is best provided by the librarian who already knows the school's faculty, the school's technology and infrastructure, and the school's goals and objectives for improvement. The Curriculum, Instruction, and Assessment section places the librarian in a powerful instructional support role through instructional partnerships, empowerment, and curating resources. But how best can librarians lead beyond the library? The answer: Open Educational Resources (OER).
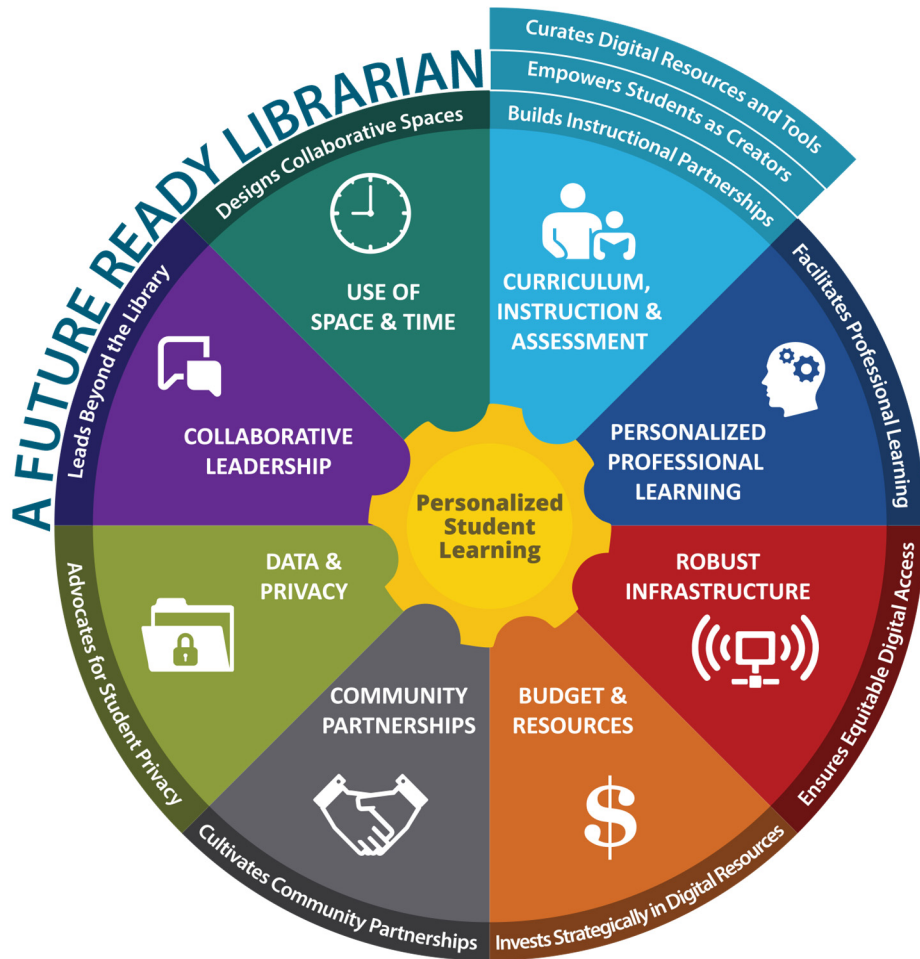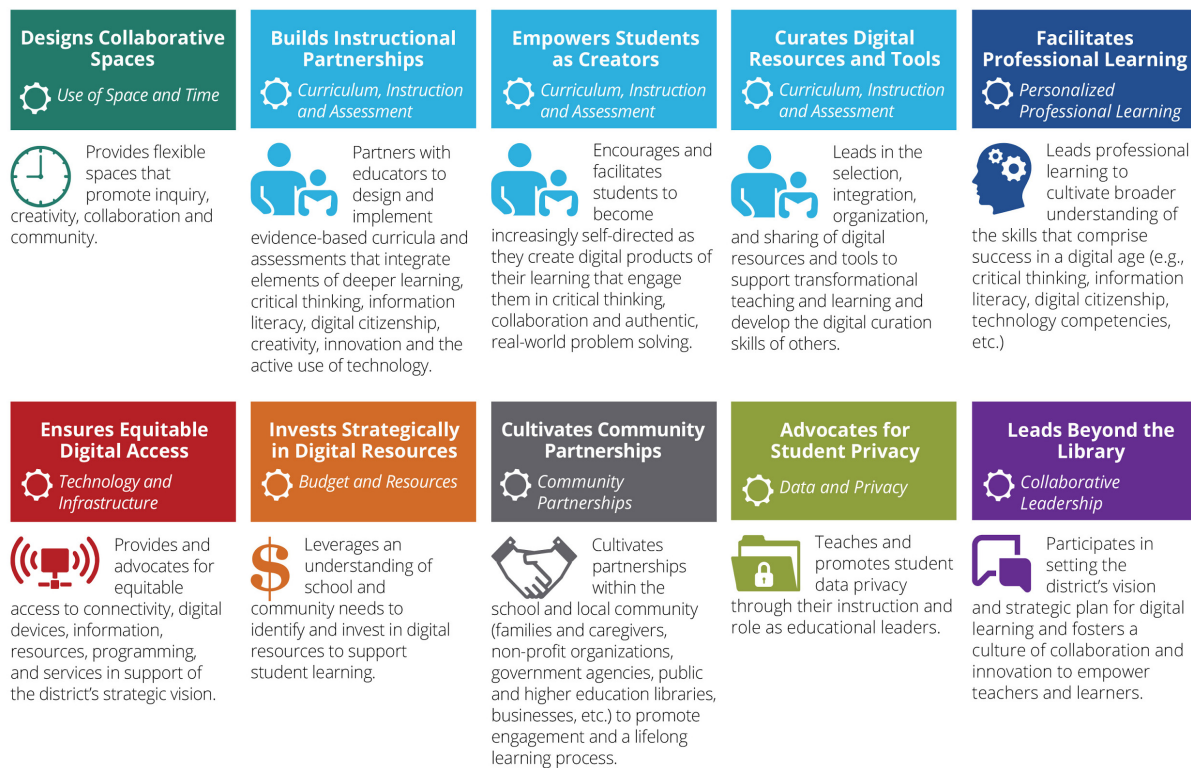
Figure 1: Alliance for Excellent Education

FUTURE READY LIBRARIANS

Designs Collaborative Spaces	Builds Instructional Partnerships	Empowers Students as Creators	Curates Digital Resources and Tools	Facilitates Professional Learning
Use of Space and Time	*Curriculum, Instruction and Assessment*	*Curriculum, Instruction and Assessment*	*Curriculum, Instruction and Assessment*	*Personalized Professional Learning*
Provides flexible spaces that promote inquiry, creativity, collaboration and community.	Partners with educators to design and implement evidence-based curricula and assessments that integrate elements of deeper learning, critical thinking, information literacy, digital citizenship, creativity, innovation and the active use of technology.	Encourages and facilitates students to become increasingly self-directed as they create digital products of their learning that engage them in critical thinking, collaboration and authentic, real-world problem solving.	Leads in the selection, integration, organization, and sharing of digital resources and tools to support transformational teaching and learning and develop the digital curation skills of others.	Leads professional learning to cultivate broader understanding of the skills that comprise success in a digital age (e.g., critical thinking, information literacy, digital citizenship, technology competencies, etc.)

Ensures Equitable Digital Access	Invests Strategically in Digital Resources	Cultivates Community Partnerships	Advocates for Student Privacy	Leads Beyond the Library
Technology and Infrastructure	*Budget and Resources*	*Community Partnerships*	*Data and Privacy*	*Collaborative Leadership*
Provides and advocates for equitable access to connectivity, digital devices, information, resources, programming, and services in support of the district's strategic vision.	Leverages an understanding of school and community needs to identify and invest in digital resources to support student learning.	Cultivates partnerships within the school and local community (families and caregivers, non-profit organizations, government agencies, public and higher education libraries, businesses, etc.) to promote engagement and a lifelong learning process.	Teaches and promotes student data privacy through their instruction and role as educational leaders.	Participates in setting the district's vision and strategic plan for digital learning and fosters a culture of collaboration and innovation to empower teachers and learners.

www.FutureReady.org/Librariar

Figure 2: Alliance for Excellent Education

What Are Open Educational Resources?

OER are those resources that afford users specific rights: reuse, redistribute, revise, and remix. The term Open Educational Resources was first used at the 2002 conference of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). UNESCO defined an OER as "teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" ("Open educational resources," 2017). The Four R's of Openness establish the principles that must include the ability to reuse, revise, remix, and redistribute with copyright licensed by Creative Commons (Hilton, Johnson, Stein, & Wiley, 2010). Although there are several licensing options available through Creative Commons, creators can choose Attribution Only to facilitate the highest levels of openness, allowing users to reuse, revise, remix, and redistribute as needed.

The mindset of sharing and generosity coupled with the ability to customize the resource and personalize learning for the students are among the greatest benefits of OER integration. "Education is sharing. Education is about being open" (Wiley, 2010).

Why Open Educational Resources?

OER integration has really begun to take off among college professors seeking to do their part to make higher education more accessible and more affordable. However, with ever-shrinking budgets, it is difficult for public school districts to justify purchasing new textbooks for every student on an adequate replacement schedule. For instance, in the library, guidelines suggest weeding the collection and discarding books more than five years old and in some cases such as computer science, every three years. It seems excessive, but students are done a great

disservice when provided with access to out-of-date information. Many librarians live by the mantra that "no information is better than misinformation" and connecting students with digital information sources can be the best solution for meeting the information needs of patrons.

Personalized learning is another benefit of OER usage. A survey of 600 K-12 teachers who integrate OER in their classes indicated their preference for OER simply in the ability to adapt resources (de los Arcos, Farrow, Pitt, Weller, & McAndrew, 2016). Picture a lesson on meteorology. In a classroom using a print, copyright-restricted textbook, the teacher is locked into the textbook's examples. In an OER classroom, that same unit on meteorology can become more meaningful when the open data collected through the school's WeatherSTEM unit is pulled into the scenarios presented to the students. Picture analyzing sentence structure where the sentences feature scenarios and people that are familiar to students. Solving math problems that are connected to current community issues makes learning real. OER and the ease with which they can be adapted make personalized learning possible and easier than ever because truly open resources enable the user to easily edit the content of the resource without the need for additional software or equipment.

Another benefit is in the ability to guide students in evaluating sources. There is great value in students seeing that information sources are found in other locations besides textbooks. Today's students are "digital natives," having never lived in a time without Internet (Prensky, 2001). Most learned to use a tablet efficiently before they learned to use a fork. By incorporating digital resources, the focus of classroom instruction shifts away from the teacher as the center to a more student-focused approach. A classroom can easily take an inquiry-based approach where the digital resources help students answer questions on the fly and can often lead to greater depth of knowledge.

As classrooms become more inquiry-based and student-focused, there are greater opportunities for collaboration among students. Students in Canada can collaborate with students in Georgia and Maryland via Google Hangout to compare each area's native plants and animals. Students interested in similar issues can work together to solve those problems even when working together happens across the country. Collaboration can happen easily within the classroom and around the world through the use of OER and the mindset they bring. Students can network with other individuals within the school or with students from a school across the country to solve problems. Students can share their data from experiments and compare results with students anywhere. Collaboration and problem solving are prime skills for students to develop, and OER integration offers a wealth of opportunities to do so when they learn to think outside the textbook.

How Can Librarians Support OER Integration?

In considering "the 'whole school' view, the librarian is in a key position to contribute to the development of strong professional learning communities through professional development and technology integration" (Dees, Mayer, Morin, & Willis, 2010, p. 10). Many librarians already serve in leadership positions within the school, but there are specific roles they can play to better facilitate the integration of OER. In fact, when carefully examining the Future Ready Librarians infographic, there are a number of sections that tie directly to librarians leading learning for change specifically through OER. A Future Ready Librarian must see his/her role beyond just the four walls of the classroom to the walls surrounding the school community. Although many of the segments support the initiative, OER integration is addressed specifically in four segments of the infographic:

1. Curriculum, Instruction & Assessment: Curates Digital Resources and Tools
2. Curriculum, Instruction & Assessment: Builds Instructional Partnerships
3. Personalized Professional Learning: Facilitates Professional Learning
4. Collaborative Leadership: Leads Beyond the Library

Curriculum, Instruction & Assessment: Curates Digital Resources and Tools

Librarians have always been curators. Traditionally they have been curators of print resources: fiction and nonfiction books, teacher resources, magazines, and newspapers. Today there is a need to curate digital resources and specifically OER in an effort to make these resources more accessible. A Future Ready Librarian "leads in the selection, integration, organization, and sharing of digital resources and tools to support transformational teaching and learning and develop the digital curation skills of others" (Future Ready Librarians, 2016).

Currently Follett, provider of the library management platform Destiny, has built in pieces to curate OER through their service. So a school whose library management system is Destiny has the ability to search for and organize OER in addition to their books and digital resources. While Destiny provides access to OER included in the Destiny databases, Follett has recently released the latest updates to Destiny including Collections. This is basically

an online file cabinet where patrons can create collections of resources to include websites, YouTube videos, OER, print books within the library, digital books, and databases. For instance, teachers in a school who developed an interdisciplinary unit on the recent eclipse might have created a Collection called Eclipse.
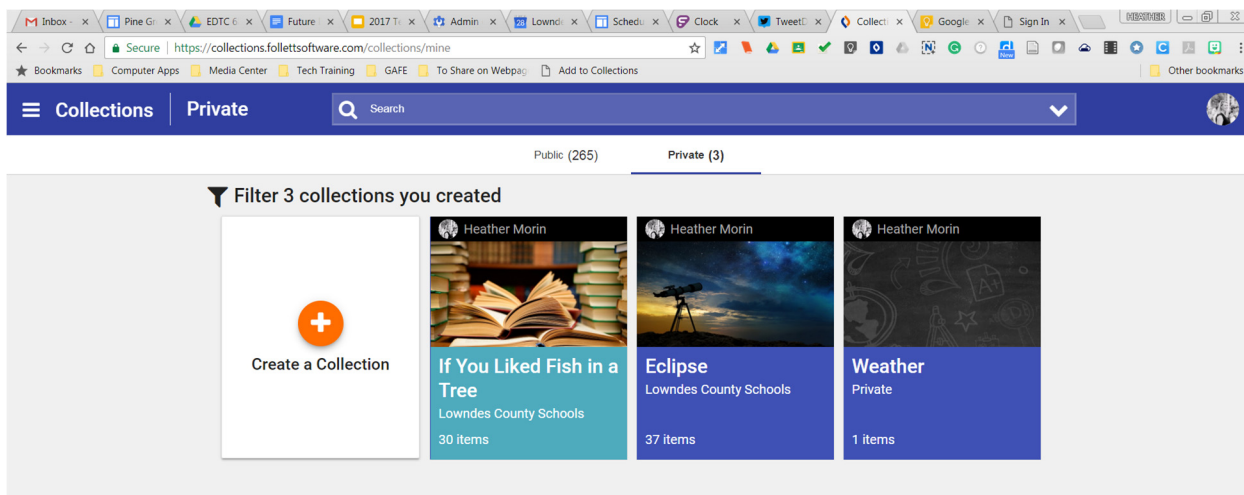
In that Collection, a patron might find the print library resources on eclipses and all the websites collected in the creation of the Collection. Teachers and other collaborators can quickly add resources to the Collection by clicking the "Add to Collections" bookmarklet.
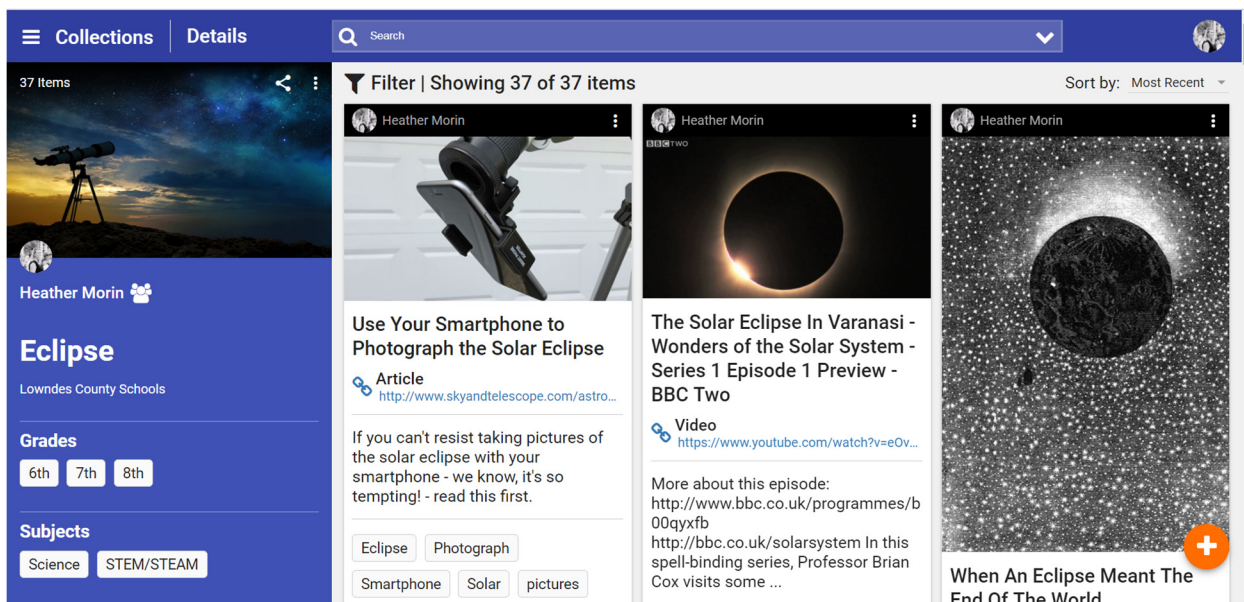
This service is also provided from other platforms and vendors. Some librarians have been able to use Google Drive to curate OER by setting up shared folders and team drives. CK-12 is an OER platform which provides Flexbooks, digital resources, videos, and simulations for classroom instruction. Flexbooks are online textbooks that are fully customizable by the individual teacher. The resources found in CK-12 are easily shared through a number of learning platforms such as Google Classroom, Canvas, and Edmodo (CK-12 Foundation, 2017). Although there are a number of resources available through which OER can be curated, the librarian must be willing to be the classroom teacher's instructional partner.

Curriculum, Instruction & Assessment: Builds Instructional Partnerships

To become an effective instructional partner, the librarian must be visible and willing to reach out to teachers. Some librarians attend weekly professional learning meetings and curriculum planning meetings. Many are mindful to stay abreast of changes in curriculum and standards. By knowing the requirements of the curriculum, librarians can prepare collections of resources for teachers to build those instructional partnerships. Through events, functions, and programming planned through the library, teachers gain a better awareness of the purpose and role of the media center and specifically of the librarian. A member of the school council for the Chicago Public Schools recently penned a letter of support in the *Chicago Tribune* saying, "librarians are essential partners for teachers and mentors for students in the buildings where education takes place" and "cannot be replaced by classroom libraries, digital libraries, or even by their colleagues in public libraries who are increasingly asked to serve in their stead" (Walter, 2017, "A 21st Century Education," para. 3).

In the state of Georgia, a library media specialist's professional certification is classified as service. A Future Ready Librarian provides a valuable service to the teaching community by locating, vetting, and curating OER, and also by empowering teachers to be OER users and creators through appropriate and relevant professional learning opportunities taught by the librarian. Servant leadership and having a strong desire to help others be successful plays a huge role in building instructional partnerships.

Co-teaching is another opportunity to build instructional partnerships. The librarian might offer to teach topics such as digital literacy, technology application, resource evaluation, conducting research, and accessing resources. When pairing the librarian's knowledge of information access with the classroom teacher's content knowledge, powerful lessons can be developed and delivered, and a great extension is that the classroom teacher views the librarian as an instructional partner.

Probably the most valuable service the librarian can provide is a listening ear. As teachers visit the library in search of resources for lessons or to check-out instructional DVDs or teacher support materials, this is a perfect opportunity to share about OER, to offer opportunities to co-teach, or to suggest working together to identify digital resources that meet the teacher's specific need.

Personalized Professional Learning: Facilitates Professional Learning

Teachers frequently attend professional learning opportunities taught by individuals are not a part of the school community. A district purchases a new digital tool, and that company sends a representative to provide professional development. Many times, however, professional learning deals with resources not currently available at a school on devices to which teachers do not have access. Teachers need relevant and appropriate professional learning opportunities, and one of the best facilitators is the school's own librarian. This is the person who is familiar with the devices on campus and how many there are, what the network infrastructure is, what programs are in use, but more importantly, the librarian is familiar with the people who will be attending the trainings. The librarian knows who teaches what subjects, how much teaching experience they have, and how comfortable they are with technology. This type of knowledge is built through instructional partnerships and will enable the librarian to work more effectively with groups or individual teachers.

Collaborative Leadership: Leads Beyond the Library

It would be easy for a librarian to sit at the circulation desk all day, checking in and out books, evaluating the library collection, oblivious to the teacher's needs. However, if a librarian is to be a forward-thinking, Future Ready Librarian, he/she must take time to discover new and innovative teaching resources and strategies, maintain a strong professional learning network, hone old or learn new skills by attending professional learning, and continually self-reflect on the effectiveness of library programming. Building instructional partnerships, conducting professional learning, and curating resources requires the librarian to assume a leadership role. Volunteer to serve on leadership committees to give a voice to the library while raising awareness of OER. Advocate for students and teachers in the adoption of devices, software, and other resources to include OER.

Conclusion

A Future Ready Librarian must consider that librarianship means more than just curating and organizing print books. As more and more people turn first to digital resources, the librarian as the information professional is in the position to guide patrons in finding, evaluating, and using digital resources, including OER. Public school

budgets are continuing to shrink, and there is less possibility of adopting new textbooks on a regular schedule. Transitioning to OER in place of copyright-restricted, printed textbooks is going to require strong leadership because change can be difficult. Some teachers will have to be eased into the change; others will willingly jump feet first into the change, but a Future Ready Librarian will lead the way knowing that "the more open we are, the better education will be," (Wiley, 2010).

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Evaluation of the Duolingo English Test: Implications for K-12 English Language Learners (ELL)

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Abstract

The Duolingo English Test (DET) is an English proficiency exam that "generates a CEFR-aligned score" and compares to "other major assessments such as the TOEFL and the IELTS." (Duolingo English Test, 2016). The test is designed to provide an English proficiency score and "…make standardized tests more accessible to Duolingo users, particularly those outside the U.S., who want to apply for jobs and schools that require English certificates." (Rodriguez, 2014, p. 1). The test provides "a video that showcases the applicant's practical communication skills" and "a rigorous, quantified score that signals the applicant's English level." (Duolingo English Test, 2016). Paired with the Duolingo English app, data the DET provides can help teachers and administrators benchmark English proficiency across their English as a Second Language population. For this evaluation, the evaluation team negotiated with Duolingo for temporary, free access to the test. Based on the evaluation of the product, we created a learning technology evaluation framework CPR: Context, Pilot, and Report.

Introduction

Duolingo is a technology company based out of Pittsburgh, PA that offers customers different products around language learning. Since its creation in 2012, the company has expanded to include three main products, Duolingo, Duolingo English Test (DET), and TinyCards. Duolingo, original product created by von Ahn and Hacker in 2012, is a free language learning platform offering customers a way to learn a variety of languages on the web or through a mobile application. DET, created in 2014, is an online proficiency testing that allows customers to showcase his/her level of knowledge with the English language. The DET English test, unlike the language learning tool, is not free to use. The funding model for this product is $49 a person, marketed heavily towards universities and businesses using it to accept non-native English speaking students or employees.

About the DET

A common issue for schools that work with English Language Learners (ELL) students is categorizing the learner's English language proficiency. Currently, this is often evaluated by the Test of English as a Foreign Language (TOEFL) scores. However, the TOEFL is expensive. Prices vary by country, but usually fall between $160 and $250 USD. A primary outcome of the DET is to certify the test taker in the English language. A potential reason Duolingo decided to go in this direction is due to the cost of the TOEFL test as well as the time it takes to receive the results. Duolingo's version allows users to take the test in the comfort of their own home via the web, cost significantly less, and allows test takers to post results to social media and institution applications.

One concern would be whether DET would be an acceptable comparison the TOEFL scores. Ye (2014), found that amongst a sample of non-native English speakers, "scores from the Duolingo English Test were found to be substantially correlated with the TOEFL iBT total scores, and moderately correlated with the individual TOEFL iBT section scores, which present strong criterion-related evidence for validity" (p. 11). Despite it being proctored online, there are multiple safeguards in place such as having a live proctor watch a recording of the assessment. The test is said to provide universities with "a video that showcases the applicant's practical communication skills" and "a rigorous, quantified score that signals the applicant's English level." (Duolingo English Test, 2016). These benefits make the DET a great option for English language testing. DET administration opens a world of possibilities for future applications.

Evaluation Framework

To analyze and evaluate the DET, we created an evaluation framework called CPR. CPR stands for Context, Pilot and Report. Often in learning technology, proper evaluation is costly and time consuming. By using CPR, administrators and stakeholders can focus on elements of an evaluation that can lead them to data informed decision making.

Context

For the first step, Context, we took a hard look at the fundamentals of DET. Using our log ins, each member of the team stepped through logging in and taking a practice test. We each took notes about our own experiences and meet to discuss the pros and cons. We then created several evaluative questions around our initial needs for the DET. From here, using our initial thoughts and guiding questions, we created a practical approach to

reviewing the product. This allowed us to critically explore the technological requirements, cost, and feasibility of mobile access.

Pilot

For the second step, Pilot, we identified a population to test out DET. Using the evaluative questions as guides and our prior experiences, we surveyed the population after their review of the product to gather additional evidence for the evaluation of DET. The pilot step is often the one that is over looked, but is critical to gather perspective from the users.

Report

Lastly, for the Report step, we gathered the data and began to create a story. We had the reporting step in mind during the context and pilot phases. We asked ourselves, what information do we need to answer the evaluative questions? The results of the population survey as well as the DET scores and other valuable information gathered from population were critical in making inferences about the product viability.

Recommendations

From the CPR process, recommendations for product improvement were shaped. While the DET is a well-rounded product, there are several recommendations that should be considered to make the product better. When evaluating the DET, our group approached it from multiple perspectives including the user experience, educational value, and future implications. Based on these lenses, we have identified four recommendations for the DET: enhance the certificate the user is awarded after the exam, create Section 508 of the American with Disabilities Act test items, provide instructions to the Duolingo English Exam in a user's native language, and provide percentage breakdowns on the report of the test.

Certificate Improvements

Once a user completes DET and their exam has been reviewed by the Duolingo reviewer, the user will receive an email notifying them of their certificate. To access the certificate, a link is sent to the user. On this link, the certificate includes the following information: a photo of the user from the exam, the name of the user, the date the exam was taken, and the level assigned to the user (beginner, intermediate, expert, etc.). Along with the level, Duolingo provides context about each of the levels. One improvement that should be considered is that it seems the level information pre-populates in a section with a character limit. In the example of the certificate above, the description of being an expert in English cuts off. The user and anyone with the link to the certificate is left without a full description of the level. Additionally, going more in depth on what a level means and sharing how it relates to the Duolingo app data would be helpful. Also, an improvement that could be considered is listing all of the levels a user can earn. One way of doing this is to create an artifact to accompany the user certificate. This way users, as well as organizations that the user may share the certificate with, will have more information about the levels. Furthermore, the artifact can provide organizations information about the DET as a whole. Another recommendation for the user certificate is providing a secure URL. The way the DET certificate is shared currently is through a URL. This URL has no safeguards so anyone with the URL can access a user's certificate. Depending on how the user feels about this, it would be an improvement if the URL had a captive portal or some type of safeguard to protect the information.

Create Accessible Test Items

While the DET does a great job with offering a variety of types of questions, it could be improved by taking in Section 508 of the American with Disabilities Act into consideration to create test items that are accessible. Throughout the DET, there are various types of questions such as choosing the best word from a drop down menu, speaking about a topic, and selecting words from a list that are English words. While this variety makes the DET unique, it could be improved by considering different formats that are accessible. For the items that ask users to choose the best word from a drop down menu, Duolingo should consider enabling keyboard shortcuts and arrow key usage to make this type of question more accessible. Many users who use screen readers rely heavily on keyboard shortcuts in the same way that other users utilize a mouse. Furthermore, the speaking of topic items would be

difficult for users who are deaf. Offering an alternative question type such as an essay would be ideal. One way Duolingo could help users who may have disabilities is to ask in the beginning while setting up the test if they require an accommodation. Duolingo staff could then reach out to the user before the test or perhaps Duolingo would provide contact information for the user to contact Duolingo directly in order to assist the user.

Provide Instructions to the DET in User's Native Language

During our evaluation of DET, a group member served as a pre-test proctor, sitting in the room to assist the user to get the test set up. While a primary purpose of this was to make sure the users were set up properly, another reason for the pre-test proctor is because the DET has all instructions in English. Depending on the English level of the user, this may be a hindrance. Due to the specific instructions such as having no one in the room as well as taking photos of government issued identification, it is imperative the user understand the process in order to complete the DET without fear of it not passing audit review. If DET offered instructions in multiple languages, it could guarantee that users understand the protocol and policies of the test. As discussed above, we believed the test would allow users to set up the test in their native language. But, it did not work during the learners' try-out testing when students tried to select a language other than English.

Provide Percentage Breakdowns on the Report of the Test

Since the DET has many different types of items, it would be helpful for a user to receive a breakdown of the percentage correct in each different type of question. One item type asks the user to talk about a specific incident, such as a time they had to wait for something. Based on the information in our evaluation, we believe that the speaking part of the exam is not factored into the overall score in the DET. Having a breakdown of the item type would help both the test taker as well as an organization receiving the score to make an accurate judgement about someone's English abilities.

Conclusions

The Duolingo English Test, when paired with the Duolingo English app, could provide ELL instructors multiple types of data for their students. Students who take the DET will be provided a digital artifact and encounter multiple question types to test their English proficiency. Before considering a full adoption, an evaluation is recommended using the framework Context, Pilot, and Reporting (CPR).

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An Exploration of the Enhancing Student's Cross–Cultural Competence in Ubiquitous MOOC Instructional Design Model

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Descriptors: MOOCs; Instructional design

Abstract

This study used the qualitative research methods to explore the enhancing higher education student's cross–cultural competence in ubiquitous MOOC instructional design model. The participants were undergraduate students who have experienced in a ubiquitous MOOC instructional model. The researcher used a reliability technique in an interview procedure by having multiple coder in the step of intercoder agreement. The findings divided into three codes: ubiquitous MOOC learning, cognitive dissonance, and recommendations for ubiquitous MOOC.

Introduction

MOOCs, the massive online learning course, usually allow open enrollment leaners to access the worldwide communities with a diversity of cultural background and communication. MOOCs have remaining increased articles discussed empirical evidence from case studies especially in higher education (Liyanagunawardena, Adams, & Williams, 2013).In Thailand, e-learning was promoted by Thailand Cyber University (TCU) which start over ten years, more than 800 courses, 185,000 registered, and participated by 45 institution members (Na-songkhla, Thammetar, & Chen, 2015). OECD/UNESCO (2016) suggested that Thailand should train instructors how to use ICT and arouse them to integrate it into curriculum. In 2016, the first Thai MOOC Platform called Thai MOOC was established by TCU, then almost 2 million students registered (Thai MOOC, 2016). Likewise, some Thai universities also have created their own MOOC with no cost for anyone interested. For example, Chulalongkorn University had more than twelve courses created by seven faculties (Chula MOOC, 2017). Mahidol University also had MOOC called "MUx" and there were thirty-eight courses about the medicine contents (MUx, 2017). Not only Thai language MOOC but also English MOOC, there was more than thirty-five course for international students as AsianUx Academy of Asian University (AsianUx, 2017).

The number of international students additionally increased for higher education institutions (HEIs) in Thailand (Bureau of International Cooperation Strategy, 2010; Chunpen, 2013). Since 2014, there were more than 10,000 international undergraduate students in Thailand (The International Trade Administration, 2017). The Office of the National Education Council (2005) in Thailand has stated that Thai people should understand, accept, and appreciate the cultures different both their own and others. Moreover, previous studies (Bennett, 1993; Nieto & Bode, 2008; Rasmussen, 2013), cross-cultural competencies help educators develop mutual understanding, human relationships, and broaden their worldview. Furthermore, the cross-culture confliction occurred would occur while the cultural difference students was learning together even the MOOC in Thailand. Instructional designers and developers

should make use of cultural sensitivity to reducing cultural barriers so as to design international online learning (Alabdullaziz, 2015). A crucial factor cross-culture competent is attitude (Abbe, Gulick, & Herman, 2007; Gabrenya Jr, Griffith, Moukarzel, Pomerance, & Reid, 2012) could develop by changing the attitude change through Cognitive Dissonance Theory (Huffman, 2012).

In order to enhance cross-cultural competency and undergraduate students' opinions about ubiquitous MOOC for enhancing cross–cultural competence (Plangsorn, Na-Songkhla, & Luetkehans, 2016), the researchers developed the ubiquitous MOOC model (U-MOOC) based on cognitive dissonance theory as instructional design model for creating the MOOC in everyday life that learner can enhance knowledge everywhere every time and the contents are available view on PC, tablet, or smartphone. The evaluation of e-learning should investigate how course design and how learner learn by learner viewpoint (Khan, 2005). Although the U-MOOC could improve the undergraduate students' higher cross–cultural competence, it would be necessary to remain developing the model. An Exploration of the Enhancing Student's Cross–Cultural Competence in U-MOOC would be reflect the students' feedback to improve the MOOC instructional model.

Research Objectives

The purpose of this study was to explore the enhancing higher education student's cross–cultural competence in ubiquitous MOOC instructional model.

Research Methods

Qualitative research approach was employed to an exploration of the enhancing student's cross–cultural competence in ubiquitous MOOC instructional model. The researcher conducted an informal unstructured interview and collected data from six participants. The participants were undergraduate students who had experienced learning in the MOOC designed by a ubiquitous MOOC instructional model. This number of participants was relevant to Polkinghorne (1989), who recommended that the interviewees should range from 5-25 individuals and have related experience with the phenomenon. The unstructured interview began with an open-ended question and built interviewees next questions based on what they said (Savenye, 2014).

The researcher developed the interview protocol by focusing on the cognitive dissonance for enhancing higher education student's cross–cultural competence in ubiquitous MOOC instructional model. The interview protocol was developed based on the instruction of ubiquitous MOOC following Creswell and Plano Clark (2011) who stated that the interview protocol compose with four parts of interview questions; (1) introduction question, (2) ice-breaking question, (3) sub-question, and (4) closing question.

Interviews occurred at the end of the course which design by U-MOOC instructional model. The researcher contacted potential participants and asked them if they would be interested in participating. Each interview was 20-30 minutes in length, and all the interviews were audio recorded and transcribed verbatim by the researcher.

The researcher used a reliability technique in an interview procedure by having multiple coder in the step of intercoder agreement (American Psychological Association, 2010). All interview transcripts from the individual interviews were imported into MAXQDA 12 software. An inductive coding procedure was implemented as an analytical method in order to explore the enhancing student's cross–cultural competence in ubiquitous MOOC instructional model.
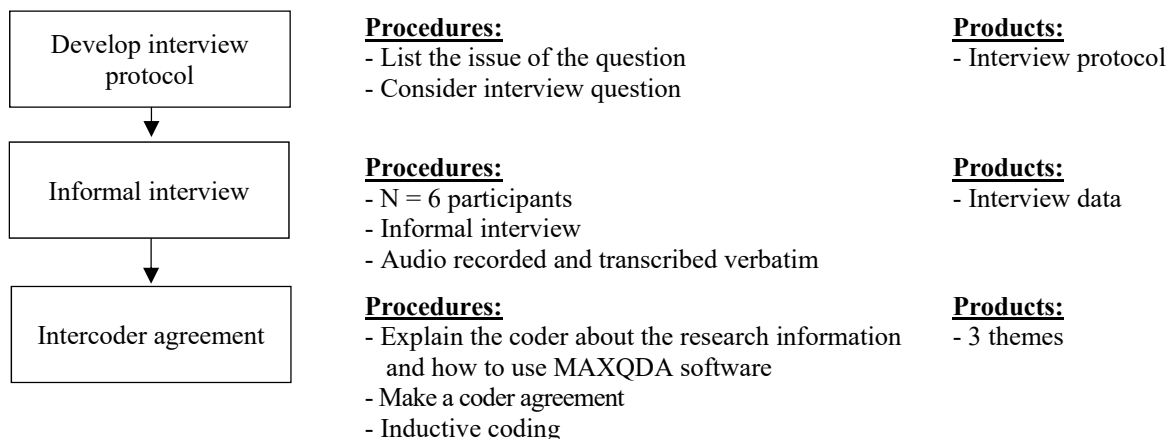
Develop interview protocol	**Procedures:** - List the issue of the question - Consider interview question	**Products:** - Interview protocol
Informal interview	**Procedures:** - N = 6 participants - Informal interview - Audio recorded and transcribed verbatim	**Products:** - Interview data
Intercoder agreement	**Procedures:** - Explain the coder about the research information and how to use MAXQDA software - Make a coder agreement - Inductive coding	**Products:** - 3 themes

Figure 1 Research procedures

The results were divided into three themes: (1) U-MOOC learning, (2) cognitive dissonance, and (3) recommendations for U-MOOC, as follows.

Theme 1: U-MOOC learning, this theme was explored how the respondents' behavior in the MOOC that design by U-MOOC instructional design. The opinions on U-MOOC learning could divided into eight dimensions: (1) learning device, (2) learning motivation, (3) learning tools, (4) e-learning experience, (5) learning outcome, (6) communication skill, (7) learning place, and (8) learning time, for example:
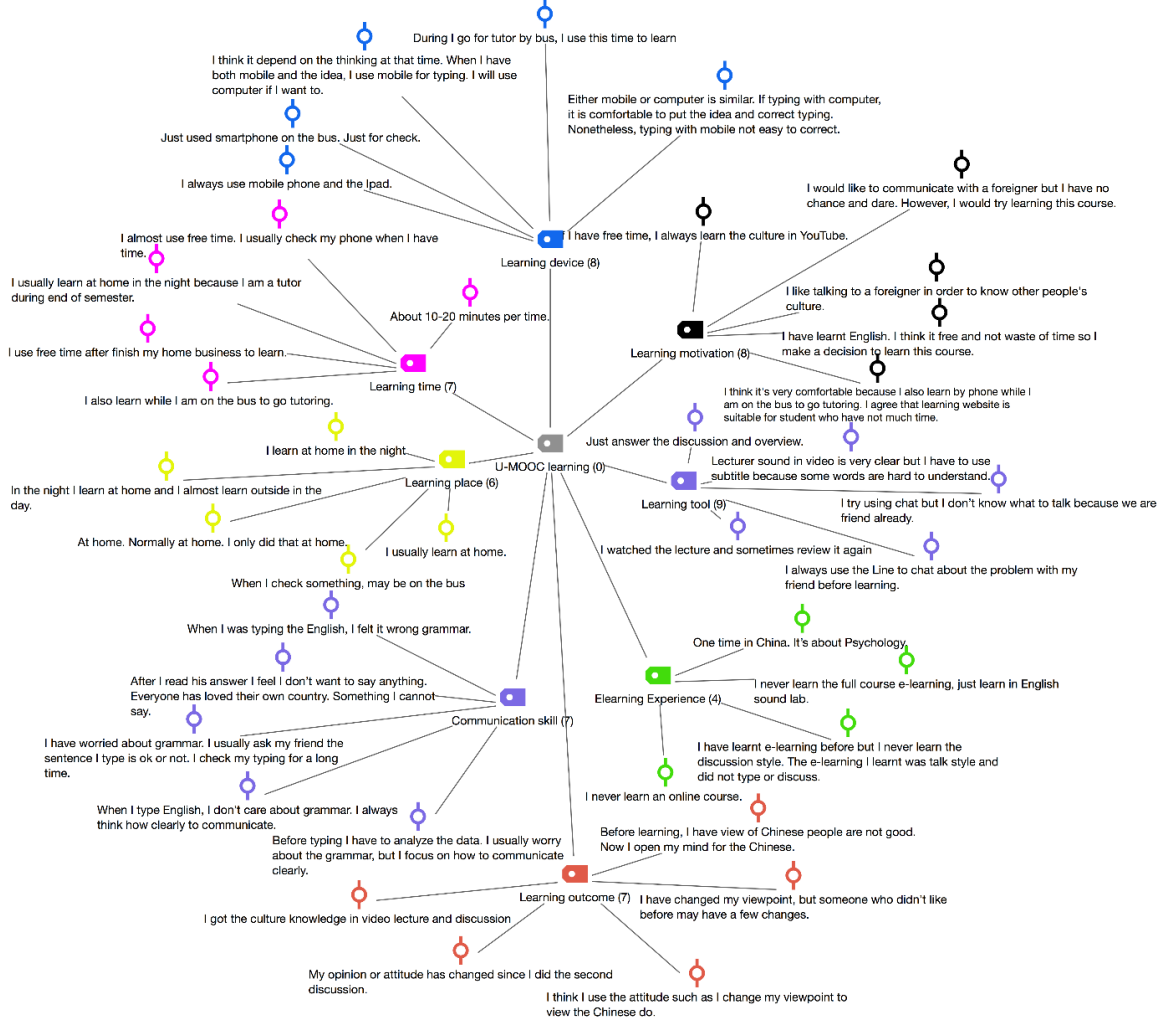

Figure 2 Exploration of U-MOOC learning

(1) Learning device

> *"I think it depend on the thinking at that time. When I have both mobile and the idea, I use mobile for typing. I will use computer if I want to"*
>
> Participant 1

(2) Learning motivation

> *"I would like to communicate with a foreigner but I have no chance and dare to. However, I would try learning this course"*
>
> Participant 5

(3) Learning tools

> *"Lecturer sound in video is very clear but I have to use subtitle because some words are hard to understand"*
>
> Participant 2

(4) E-learning experience

"I never learn the full course e-learning, just learn in English sound lab"

Participant 3

"One time in China. It is about Psychology"

Participant 6

(5) Learning outcome

"Before learning, I have view of Chinese people are not good. Now I open my mind for the Chinese"

Participant 3

(6) Communication skill

"I have worried about grammar. I usually ask my friend the sentence I type is ok or not. I check my typing for a long time"

Participant 2

(7) Learning place

"In the night, I learn at home and I almost learn outside in the day"

Participant 1

(8) Learning time

"I also learn while I am on the bus to go tutoring"

Participant 4

Theme 2: Cognitive dissonance, this theme was explored the dissonances that occurred while the respondent was learning in the MOOC, for example:
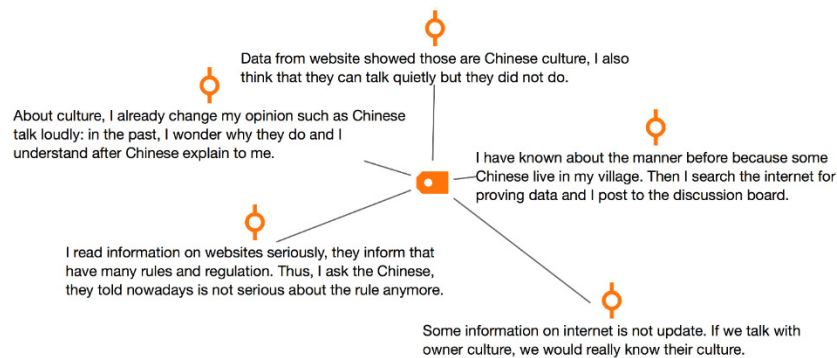

Figure 3 Exploration of cognitive dissonance

"About culture, I already change my opinion such as Chinese talk loudly: in the past, I wonder why they do and I understand after Chinese explain to me"

Participant 5

"I have known about the manner before because some Chinese live in my village. Then I search the internet for proving data and I post to the discussion board"

Participant 4

Theme 3: Recommendations for ubiquitous MOOC, this theme was explored the recommendation about the U-MOOC that consist of two dimensions: (1) learning system and (2) learning strategies, for example:
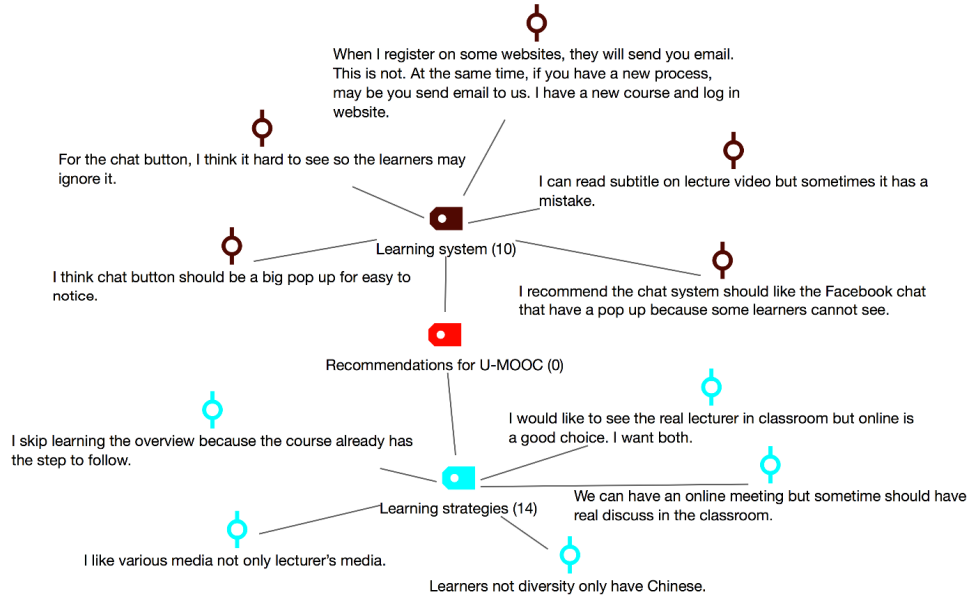

When I register on some websites, they will send you email. This is not. At the same time, if you have a new process, may be you send email to us. I have a new course and log in website.

For the chat button, I think it hard to see so the learners may ignore it.

I can read subtitle on lecture video but sometimes it has a mistake.

Learning system (10)

I think chat button should be a big pop up for easy to notice.

I recommend the chat system should like the Facebook chat that have a pop up because some learners cannot see.

Recommendations for U-MOOC (0)

I skip learning the overview because the course already has the step to follow.

I would like to see the real lecturer in classroom but online is a good choice. I want both.

Learning strategies (14)

We can have an online meeting but sometime should have real discuss in the classroom.

I like various media not only lecturer's media.

Learners not diversity only have Chinese.

Figure 4 Exploration of recommendations for U-MOOC

(1) Learning system

"I can read subtitle on lecture video but sometimes it has a mistake"

Participant 2

"I recommend the chat system should like the Facebook chat that have a pop up because some learners cannot see"

Participant 1

(2) Learning strategies

"I would like to see the real lecturer in classroom but online is a good choice. I want both"

Participant 3

"We can have an online meeting but sometime should have real discuss in the classroom"

Participant 4

Discussion

U-MOOC Learning

Recognizing U-MOOC learning is important. The U-MOOC learner can enhance knowledge everywhere every time as a result of the U-MOOC instructional model's flexible learning. The results show that, some students learned in free time and the others learned at night. The findings were supported by a key-informant who stated that *"I also learn while I am on the bus to go tutoring"* and *"In the night, I learn at home and I almost learn outside in the day"* The finding was congruent with Jansen and Schuwer (2015) who stated that all features of MOOCs were available online, therefore participants could access the Internet anywhere. In other words, time was not a barrier to learn in this course.

The results showed that the contents could be viewed on a PC, tablet, or smartphone. Some students used a personal computer (PC) when they were home because it was required typing for the course. Sometime they used a tablet or mobile phone when they were not at home. The findings were supported by a key-informant who stated that *"Either mobile or computer is similar. If typing with computer, it is comfortable to put the idea and correct typing. Nonetheless, typing with mobile not easy to correct".* The finding was supportive of Mehlenbacher (2010) who stated

that MOOCs would require distributed technologies (e.g., laptops, mobile phones, and production handhelds) and wireless, connected technology (e.g., networks, Internet-enabled interaction systems). In the same way, the ubiquitous system in U-MOOC could support students who were uncomfortable moving to another place (McKay & Lenarcic, 2015).

In recognizing learning outcomes, the U-MOOC learning activities were observably and could help students change their cultural attitude. This outcome was supported by a key-informant who stated that *"Before learning, I have view of Chinese people are not good. Now I open my mind for the Chinese".* The finding was congruent with Watson et al. (2016) who found that the MOOC used dissonance to make the attitude change.

Cognitive dissonance

Dissonance could be defined as a confliction between the three attitudinal components: cognitive, affective, and behavioral (Watson et al., 2016). The cognitive dissonance which is found in ubiquitous MOOC instructional design model could divided into two types. One was the dissonant that occurs during the course, and another dissonant was what the students already have before learning in this course.

Cognitive dissonance concerned the strategies in U-MOOC to resolve the cultural conflict. This evidence was supported by two key-informants who stated that *"About culture, I already change my opinion such as Chinese talk loudly: in the past, I wonder why they do and I understand after Chinese explain to me"* and *"I have known about the manner before because some Chinese live in my village. Then I search the internet for proving data and I post to the discussion board"* The finding was consistent with Schunk (2012) who stated that dissonance should increase as the discrepancy between cognitions increases. The finding was also similar to Jonassen, Spector, Driscoll, Merrill, and van Merrienboer (2008) who reported that dissonant situations must be carefully selected experiences that are real to the learner so that the learner cannot easily dismiss the situation as untrue. The former learning dissonant occurred because they did not have a chance to communicate with foreign student to reduce any dissonance. Some learners changed their thought by new added information. Also, Cooper (2007) indicated that learners could cope with dissonance by changing their beliefs to eliminate the dissonance. Moreover, Schunk (2012) stated that cognitive dissonance can be reduced by changing a discrepant cognition.

Acknowledgements

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