

Association Supporting Computer Users in Education “Our Second Quarter Century of Resource Sharing”

Proceedings of the 2017 ASCUE Summer Conference
50th Annual Conference
June 11 – 15, 2017
Myrtle Beach, South Carolina
Web: <http://www.ascue.org>

ABOUT ASCUE

ASCUE, the Association Supporting Computer Users in Education, is a group of people interested in small college computing issues. It is a blend of people from all over the country who use computers in their teaching, academic support, and administrative support functions. Begun in 1968 as CUETUG, the College and University Eleven-Thirty Users' Group, with an initial membership requirement of sharing at least one piece of software each year with other members, ASCUE has a strong tradition of bringing its members together to pool their resources to help each other. It no longer requires its members to share homegrown software, nor does it have ties to a particular hardware platform. However, ASCUE continues the tradition of sharing through its national conference held every year in June, its conference proceedings, and its newsletter. ASCUE proudly affirms this tradition in its motto: “Our Second Quarter Century of Resource Sharing”

ASCUE's LISTSERVE

Subscribe by visiting the site <http://groups.google.com/a/ascue.org/group/members> and follow the directions. To send an e-mail message to the Listserve, contact: members@ascue.org Please note that you must be a subscriber/member in order to send messages to the listserv.

NEED MORE INFORMATION

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Association of Small Computer Users in Education

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Keynote Speakers

Alan Levine is recognized for applying new technologies to education. A pioneer on the web in the 1990s and an early proponent of blogs and RSS, Alan shares his ideas and discoveries at CogDogBlog. Among his recent interests are new forms of web storytelling (including 50+ Web 2.0 Ways To Tell a Story, pechaflickr, and the StoryBox), as well as leading and teaching the open digital storytelling class, ds106.

He typically consults with higher educational institutions on digital technologies and the affordances of the open web, working with a variety of higher education institutions and organizations such as Virginia Commonwealth University, Universidad del Sagrado Corazón, The Open University, Digital Media Hub, and Mozilla. Additionally, he develops open web-based tools shared openly on Github.

Alan's current major project is developing a certification program for Creative Commons. In 2015 and 2016 he developed the platform and facilitated activities (on-site and online) for the UDG Agora Project, a faculty development effort for almost 400 professors at the University of Guadalajara managed by the Justice Institute for British Columbia. From October 2014 – March 2015 Alan was an Open Learning Fellow at Thompson Rivers University where his portfolio included producing the You Show faculty development series and developing the suite of "SPLOT" tools. He has also been an instructional technology specialist at the University of Mary Washington, following leadership positions at the New Media Consortium and the Maricopa Community Colleges.

ASCUE Presentation: About Those Flying Cars We Were Promised...

At the time of this organization's first conference gathering at Tarkio College, I was engaged in the kind of screen time kids did in the late 1960s - television. It seemed probable that in the far off future of 2017 we'd be zipping to the 50th conference in the flying cars the Jetsons promised us. While that has not panned out, much of our current technology would seem fanciful in 1968. Yet what has been most interesting then and moving ahead is less about the hardware and more about the stories, connections and relationships of the people inside the cars. Jump into the flying car of my mind to dart through back through time, ponder what makes learning memorable, find our place of wonder, and explore the power of structured serendipity as we gaze into the next 50 years.

Janet Hurn currently serves as the Senior Director of Regional E-Learning for Miami University and a Senior Instructor of Physics where she leads a team of professionals in the development of innovative partnerships with the Miami Regional E-Campus.

Janet is a long-time presenter at ASCUE. She initiated the "Cool Tools" sequence of presentations.

Conference Workshops

These will be held in the late afternoon for 90 minutes during the conference.

Workshop 1

A Pilot Study on Concurrent Learning Environments for Online and In-Class Informatics Students

Date: Monday, June 12

Time: 3:30pm - 5:00pm

Feng Liu and Jacqueline Stephen, Mercer University

The Informatics program at Mercer University is offered at four regional academic centers located around the Atlanta area. There are less than 100 students in the program. To make sure the students can graduate on time, we have to offer the classes regularly in each of the four locations. We face two challenges. One is how to operate multiple courses with limited faculty members and while maintaining the minimum operation cost? Online education has been brought up as one possible solution. Subsequently, the second challenge we face is how to deliver the same quality in-class learning environment in an online format for a course in the technology domain? Informatics faculty did a pilot study on concurrent learning environments for online and in-class Informatics students. We surprisingly found that 73% of students favor the concurrent online learning environment. In the presentation, we will talk in detail about how we did the study, the tools used and the survey result.

About the Presenters

Dr. Feng Liu is Associate Professor of Informatics and Program Coordinator for Mercer's undergraduate major in informatics. Her areas of professional expertise include computer graphics and algorithms, information visualization, Web 3D, HCI and Virtual and Online Teaching.

Jacqueline Stephen is an instructor of instructional design and instructional designer at the Penfield College of Mercer University. She earned her B.S. in Education and M.S. in Instructional Technology from Bloomsburg University of Pennsylvania. Her teaching & Research Interests are engaging learners in the online environment and bridging the technology gap in education.

Workshop 2

You TOO Can Be Cool! Play at the Beach with Cool Tools

Date: Tuesday, June 13

Time: 3:30pm - 5:00pm

Julie Straub and Janet Hurn, Miami University

Come to this interactive workshop and learn about the latest Cool Tools, apps and devices that can solve your teaching and productivity challenges. Bring your devices and try out some of the Cool Tools during the workshop. Bring some of your challenges and we can work together to propose solutions.

About the Presenters

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Julie Straub serves as the Director of Regional E-Learning for Miami University. She has extensive experience in leadership and teaching at k-12 and higher education institutions. With a background in education, computer science and visual media, Julie brings a diverse perspective to all of her projects.

Janet serves as the Senior Director of Regional E-Learning for Miami University and a Senior Instructor of Physics. With over 25 years of experience in higher education, Janet is passionate about effectively integrating technology in the classroom and designing high quality online programs/courses.

Workshop 3

Window PowerShell - Task Automation

Time: 3:30pm – 5:00pm

John Raynor, Washington and Lee University

A look in to using Window PowerShell to automate task looking at scheduling, logging, error handling and notification.

About the Presenter

John Raynor is an IT Systems Architect for Washington and Lee University. He started working as a computer contractor in the mid 90s. He has been working in higher education for over 15 years.

Organization for the Proceedings

ASCUE initiated a refereed track for paper submissions to the conference in 2008. In fact, at the 2008 business meeting, the membership approved three different presentation tracks: refereed with 3 blind reviews for each paper, session with paper where the author submits a paper but it is not reviewed, and session without paper where no paper is submitted and only the abstract is included in the proceedings. To reflect this division, we will divide the proceedings into three sections. The first section, up to page 75, will contain the approved refereed papers, the second section, from 76 to 106, will hold the papers from the sessions with paper, and the last section will list the abstracts for the other sessions.

ASCUE BOARD OF DIRECTORS FROM 1967 to 2017

At this conference we celebrate the 49th anniversary of the founding of ASCUE at a meeting in July, 1968, at Tarkio College in Missouri of representatives from schools which had received IBM 1130 computers to help them automate their business functions and teach students how to use computers. They decided to form a continuing organization and name it CUETUG, which stood for College and University Eleven-Thirty Users Group. By 1975, many of the member schools were no longer using the IBM 1130, and were requesting to be dropped from the membership lists. At the same time, other small schools were looking for an organization that could allow them to share knowledge and expertise with others in similar situations. The name was changed from CUETUG to ASCUE at the 1975 business meeting and we opened membership to all institutions that agreed with our statement of purpose. Our historian, Jack Cundiff, has collected the names and schools of the officers for ASCUE and its predecessor CUETUG for the last forty-five years and we have printed these names on the following pages.

ASCUE BOARD OF DIRECTORS FROM 1967 to 1972

	1967-68	1969-70	1970-71	1971-72
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Program Chair	Wally Roth Taylor University	Jack Cundiff Muskingum College	Wally Roth Taylor University	James McDonald Morningside College
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Librarian				Jack Cundiff Muskingum College
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ASCUE BOARD OF DIRECTORS FROM 1972 to 1976

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Secretary	John Jackobs Coe College	John Jackobs Coe College	John Jackobs Coe College	Dudley Bryant Western Kentucky
Board Members	Keith Pothoven Central College	Keith Pothoven Central College	Robert Hodge Taylor University	Robert Hodge Taylor University
At Large	Bob Renners Kenyon College	Carol Paris Goshen College	Carol Paris Goshen College	Ister CC
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Librarian	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
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Secretary	Dudley Bryant Western Kentucky	Kathy Decker Clarke College	Kathy Decker Clarke College	Dagrun Bennett Franklin College
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Public Relations	Wally Roth Taylor University	Wally Roth Taylor University	Wally Roth Taylor University	Wally Roth Taylor University
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
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Public Relations	Don Armel Eastern Illinois U.	Don Armel Eastern Illinois U.	Don Armel Eastern Illinois U.	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
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Past President	Mary Connolly Saint Mary's College	Mary Connolly Saint Mary's College	Carl Singer DePauw University	Bill Wilson Gettysburg College
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Dagrun Bennett Franklin College	Dagrun Bennett Franklin college	Tom Gusler Clarion University	Nancy Thibeault Sinclair CC
Board Members	Richard Stewart Lutheran Theological	Richard Stewart Lutheran Theological	Nancy Thibeault Sinclair CC	Fred Jenny Grove City College
At Large	Rick Huston South Carolina/Aiken	Rick Rodger Horry-Georgetown	Rick Rodger Horry-Georgetown	George Pyo Saint Francis College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
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ASCUE BOARD OF DIRECTORS FROM 2000 to 2004

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Past President	Dagrun Bennett Franklin College	Carol Smith DePauw University	Fred Jenny Grove City College	Nancy Thibeault Sinclair CC
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Secretary	Nancy Thibeault Sinclair CC	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College
Board Members	Barry Smith Baptist Bible College	Barry Smith Baptist Bible College	David Frace CC Baltimore County	David Frace CC Baltimore County
At Large	George Pyo Saint Francis College	George Pyo Saint Francis College	George Pyo Saint Francis College	Jim Workman Pikeville College
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Improving the Development and Implementation of Online Courses: A Student's Perspective

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Acknowledgements

The authors express sincere gratitude to professor Marilyn Montgomery for her contributions toward this research.

Abstract

As distance education continues to be utilized by higher learning institutions, many struggle in knowing how to effectively utilize tools for the benefit of the students, faculty and staff facilitating online courses, distance education departments, and the university as a whole. This paper will highlight survey and interview results from students, professors, and instructional technologists from four public southeastern United States universities centered on how online learning affects the varying levels of a specific university located in the southeastern United States. Current and future issues that and potential solutions to counteract these obstacles will also be provided. Moreover, strategies will be proposed regarding improving the institutional effectiveness of distance education by specifically tailoring approaches to the culture and the strategic direction of the institution. In order to provide a first-person narrative from a student's perspective, these results and recommendations are discussed through the lens of an undergraduate student.

Background

One of the prime reasons for distance education is to provide educational opportunities for those who are underrepresented and without access to traditional educational institutions. However, many faculty find online education difficult to execute because of the use of the online medium (Bolliger & Wasilik, 2009). Moreover, because online education is a different medium for teaching and learning, it requires a different pedagogy. The lack of institutional support for faculty and the lack of leadership with an understanding of online education are often contributing factors that lead to the negative effects, and potential failure, of online education in higher education (Kentnor, 2015). In addition, the three main faculty complaints about online education are: 1) the lack of understanding of this method of teaching; 2) the lack of institutional support; and 3) fear that the quality of education in the online environment suffers (Kentnor, 2015).

Southeastern State University's (SSU, a fictitious pseudonym) requires a two-step process in order for a course to be moved onto an online format – an Online Course Request form and then faculty designing the online course. As a student who has taken several online courses from multiple different institutions, the first author possesses a breadth and depth of experience when it comes to online courses and the previewed effectiveness thereof. Over the course of my years at SSU, I experienced “good” and “bad” online courses. This purpose of this study was to provide a thorough analysis of the structure, design, support, and direction of the Office of Online Learning at SSU, identifying its effectiveness and providing recommendations for future growth.

Methods

Online surveys were distributed to students (n = 35), faculty (n = 53), and administrative personnel (n = 10) (i.e., Office of Online Learning, Academic Affairs) at SSU, as well as faculty members at three other comparative public institutions within the same state. Student surveys included five demographic questions (e.g., age, class, online course history), four Likert-type questions focused on online pedagogies (e.g., “How satisfied are you with your professor(s) communication efforts in online courses?”; highly dissatisfied = 1 to highly satisfied = 5), and one open-ended question focused on their online learning experiences. The faculty and administrative survey included 7 Likert-type and 8 open-ended questions centered on online teaching training experience and professional development as well as experiences regarding teaching online.

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Moreover, the director of online learning at SSU was interviewed focusing on the learning climate of SSU (i.e., support structures, resources, faculty training, etc.). In addition, in an effort to provide the research with a more holistic picture and compare similar environments, three other directors of online learning at three other public institutions within the same state of SSU were also interviewed.

Discussion of Findings

Based upon the findings, it appeared that the execution of online education was not only an issue at SSU, but an issue across the other surveyed institutions. These issues appeared to stem from different areas such as different institutions' value of online education at across differing levels (i.e., student, faculty, and administration), faculty having multiple diverse pedagogical methods they believed best to utilize, and students not understanding the factors that should be taken into consideration when deciding whether to take an online course.

First, the execution of online education at any institution first comes from the “executives” of the institution, which establishes the Online Education Department, then to the individual academic colleges to offer courses to students. However, there often appears miscommunication and misunderstanding are the dominant factors that play into the potential negative effects and perceptions of online courses. In the execution of online courses, the administrators often want to offer online education as a means of additional revenue for the university or college. However, many may have little knowledge as to how to facilitate an online course, as many have earned their last degree prior to the boom of distance education about 10 years ago. Nonetheless, these administrators rely on faculty members to remain knowledgeable of up-to-date pedagogical methods in order to advance the institution farther. This is where the administrators rely on the establishment of an online education department to bridge the gap between the creation and facilitation through offering faculty training on online education pedagogical methods.

Faculty members may rely on this training to assist them in learning up-to-date pedagogical methods to use in facilitating their online course. However, if this training is not sufficient, then another gap between faculty and students begins to surface because faculty members may not be able to deliver the same quality course online as they would face-to-face. It appears, the wider this gap becomes, another gap between students and the university as a whole begins. If students are not able to connect with professors through an online platform, then students may begin to associate this behavior with the culture of the university; thus possibly beginning the disconnection between students and the institution. Students are the heart of any institution, however, students' voices are often not heard enough when it comes to addressing needed change. Individuals may see the student voice for change as a voice for entitlement because they believe that students feel that all situations should go their way, which is not the case. Students simply want to be heard and to be taken seriously when it comes to their education because, in the end, they are the ones who are paying for it.

Perceived “Issues”

Generational gaps. The generational gap in today's workforce is phenomenal in that there are four very different generations all working together – Baby Boomers, Gen X, Millennials, and Gen Z (i.e., iGen or Centennials). These same four generations are together in the educational system as well. It

appears most institutional administrators reside with the Baby Boomers and a few Gen X, most faculty are Gen X with some Millennials, and the student body mostly consists of Millennials and Gen Z. Some perceive that Baby Boomer administrators and faculty members have trouble trying to tailor education to the “needs” of Millennials, who have coerced the need for the change of education. This impasse is not because faculty members are not trying; it appears it is because of the extreme difference in the way faculty members were taught and how they are being “forced” to teach currently (i.e., online instruction). Learning this new style of pedagogy can easily turn faculty away from ever wanting to teach online courses because of how difficult it’s presented to be upfront (i.e., front-loaded work required to create an effective online course). This is where department heads, deans, and other institutional administrators should hear the voices of faculty expressing their thoughts, concerns, and issues with facilitating online courses. These voices need to be heard now in order for concerns to be addressed and improvements made in order to make more effective online courses. If an institution fails to recognize these pedagogical issues now, then the institution may not be ready for the next, and even bigger, challenge to come – Gen Z.

Compared with Millennials Gen Z may be an even more complicated generation to understand and satisfy within higher education. While Millennials grew up in the transition to the technological era, Gen Z was raised completely exposed and dependent on technology. If higher education finds it so difficult to tailor online education, or even traditional education, to the Millennial market, it will prove to be extremely problematic to tailor education to Gen Z.

Changes in student enrollment and demographics. Based upon survey data, the vast majority of participants believed that adding additional online degree programs would increase student enrollment by 1 to 10% (32% of responses), 11 to 20% (39% of responses), or 21 to 30% (18% of responses). With increases in tuition and overall cost of attendance, more students have to work in order to support themselves through college. Of students surveyed, 50% stated that they work part-time, 21.1% work full-time, and 28.9% do not work; thus, an overall 71.1% of surveyed students are working in some capacity. Thus, distance education may assist with meeting the schedule flexibility needs of working students. In addition, the number of nontraditional students are continuing to increase as most job advancement opportunities are requiring a minimum of an associate or bachelor degree. However, many faculty and institution administrators constantly worry about course quality and academic integrity when it comes to delivering courses online. This is where the effective use of educational technology could ease the tension with these issues.

Educational technology. With the effective use of educational technology, online courses at SSU appear like they could be significantly improved. However, many SSU faculty either do not understand how the use of additional technology could improve their courses or they are completely against the use of educational technology. The use of educational technology should improve the student’s course experience, as well as improving instructor’s course pedagogy. This is a mindset that has to be instilled into faculty in order to begin the deconstruction of the negative perception of online education.

SSU’s Director of Online Learning stated that she believes that the pedagogical methods used for online learning can also be used in traditional courses. These pedagogical methods include: providing opportunities for the learner to be responsible for his/her own learning by researching on his/her own and reporting the findings to peers, providing opportunities for learner-to-learner interaction, collaboration through online discussions and group projects, and maintaining social, cognitive, and teaching

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presence during the course through regular communication both course and non-course related social outlets. However, even with these methods, faculty are continually concerned about the loss of presence associated with online education. Although these methods can be effective, there is a great need for improvement as students are accustomed to the “typical” online course with simple discussions, PowerPoint presentations, a few quizzes, and a couple of tests. It appears these methods need to be revamped to improve student learning and to counteract the technology and services that have decreased the online course experience over time.

Educational institutions should begin to realize that with the increase of internet availability and content, facilitating online courses (and even traditional courses) will have to change. While many professors often look to book publishers, previous instructors of the same course, and even a variety of sources on the internet to provide tests and quizzes for students, they must be forewarned that this type of information is freely available by anyone. Many faculty may not realize how easy answers to tests and quizzes from the book publishers and previous instructors can be found through simple internet searches. There are several open source websites that assist users to publish information and ask questions to receive answers from others (e.g., Koofers, 2017; PostYourTest.com, 2017; Quizlet, 2017; StudyBlue, 2017). Although it is questionable that this was the original intent of some of these websites, this is how students have transformed some to be. Different methods could counteract this access of information such as the educational technology Respondus (2017) Lockdown Browser, open-ended questions, limited test times, and/or rephrasing questions and answers in that they would less likely to show up in search engine results.

Contrary to SSU’s Director of Online Learning’s online pedagogical beliefs, another interviewed director of online learning at a different university felt that there are certain pedagogical methods that can be used solely online with the proper use of educational technology. He stated that in a typical classroom of 25 to 30 students, it is nearly impossible for a professor to ask every student to respond to a question due to time constraints. However, using educational technology, such as YouSeeU, a professor may be able to get full participation from all students because of the extended amount of time an asynchronous online course provides. This method would include the professor recording a challenge question (e.g., “Solve this problem..., Tell me your opinion of..., Tell me what you know about ‘X’ from the readings,” etc.) and then waiting 24 to 48 hours, for example, for each student to respond via a recorded response using a webcam and microphone. With this sample method, all perspectives within the class are shared. Likewise, the use of classroom clickers may be another alternative (see Carnegie Mellon University, 2017).

Office of online learning infrastructure. With a strongly established and effective online learning infrastructure, an institution may ultimately be able to support an increase in student enrollment, while maintaining course quality and academic integrity. The Office of Online Learning at SSU was recently able to expand the staff by adding two instructional designers, resulting now in four total staff members – including one director and one online learning technician.

The recent change to this infrastructure makes it appear that SSU is more reactive compared to proactive when it comes to supporting online education. In relation to SSU’s size (i.e., about 5,000 undergraduate and 900 graduate students), it will certainly be challenging for these four individuals to support the university to the extent that may be needed. By being reactive to the “train” of online education, it may prove detrimental to the university as a whole. The general generational diversity in the

current student demographics alone should give enough reason to be more proactive to this train. However, the upcoming of Generation Z warrants more attention to online education via necessary support changes and implementations in order to supply market demand.

Nonetheless, credit has to be given when it comes to furthering the acquisition of two educational technologists for the SSU in the improvement of its infrastructure. The Office of Online Learning recently acquired the use of Respondus Lockdown Browser. However, the use of the educational technology provided is rarely being used, if at all. This is in reference to the continuing issue of faculty not understanding how these tools can be effectively utilized in their courses.

With the university aiming to offer online programs completely online, this small infrastructure certainly will not be sufficient. There will be a need for more staff in order to accommodate the increase in enrollment. Furthermore, the increase in staff would need to expand over a greater range of hours to accommodate the greater range of student diversity – age, employment schedule, degree of technological savviness, and time zones just to name a few.

Faculty training for online courses. Moreover, many faculty at SSU have stated via survey results that current training is not sufficient enough to suit their needs in regard to designing and developing an online course. With the current training, faculty are taught how to fundamentally use different features of educational technology, such as Blackboard Collaborate. However, faculty have the issue of the training being too broad in that it does not address how professors could specifically use it in their courses (i.e., business management, English, psychology, etc.). This leaves faculty contemplating how they could incorporate this, or any other, educational technology into their course(s). For example, a professor teaching a management course online may not understand how the use of Blackboard Collaborate, or a synchronous collaborative session, would be beneficial for the course. However, a synchronous collaborative session could be beneficial when addressing a common issue among students in the course, having a test review session, or even allowing students to do presentations. Therefore, there is certainly a distinction between learning new educational technology and knowing how to implement the same educational technology in an online course. This causes for training to be more specific in giving faculty different uses for the technology. By addressing this issue during training, faculty would be able to have a general idea of how to implement the technology and be able to ask specific questions while still in the training session.

Moreover, some faculty are already uncomfortable with the use of technology, therefore, a goal of the training should help ease the discomfort by providing enough knowledge and exposure to the technology to start a new wave of thinking that is more easily acceptable to technology rather than completely against it. This new wave of thinking is needed because faculty are not so easily ready to move out of their comfort zone. This reluctance is not just with faculty, but with others due to the fear of the unknown or a lack of understanding. However, faculty have an extra factor when it comes to being reluctant to change. Faculty members have to ensure the academic integrity of the course so that accreditation is not compromised in any way. By looking down a path that makes faculty feel uncomfortable, it puts a lot of high risks on the line that they are not willing to gamble on; this forces faculty to revert to what they know is acceptable and comfortable for them to execute.

Faculty responsibilities and commitments. Despite the positive and negative perspectives that faculty have concerning online courses and training, it seems that many have come across the issue of being

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overstretched with responsibilities and commitments by the university and/or their departments. Designing an online course for the first time takes an extreme amount of time for faculty to properly execute. University administrators seem to believe that it is not an undue hardship to create online courses (i.e., equal to the creation of other face-to-face courses). However, some faculty are not able to design an effective online course to their professional liking because of the responsibilities and commitments they already have.

Furthermore, some faculty members also find it difficult to design an online course with their current traditional course load. From the survey results, it takes faculty members approximately 4 hours to transfer course materials from a single traditional 1 hour and 15-minute lecture. Moreover, for example, it was reported that it took one faculty member approximately 6 to 7 months to design an online course. This was because this faculty member never taught an online course and had never taken an online course as a student either – further exasperating the unfamiliarity with creating one. Many faculty members voiced their opinion that they would be unlikely to be able to improve their current online courses unless they were afforded course release time to do so.

Policy issues. The Distance Education policy, established by the Office of Academic Affairs at SSU in 2009, states, “*Faculty must attend a training session, through the [Teaching and Learning Center] or an individual training, before a course is implemented.*” The policy was established for the purpose of properly training faculty on online pedagogy. After reviewing the survey data, it was shocking that many SSU faculty members did not go through any type of training or were not aware that training was required (or even offered) before an online course was implemented. The results of the surveys demonstrate that not following or enforcing this policy could be a detrimental factor in the execution of delivering online courses at SSU.

Online teaching pedagogy training appeared to be perceived as “optional” by the faculty as a lack of enforcement and accountability of this requirement seemed apparent. Again, most faculty did not know of this policy. Although some faculty did either attend a training session or consult with SSU’s Director of Online Learning for assistance after completing an Online Course Request form, it seems as if faculty were having trouble executing the information that was learned through the training. For example, a professor of management could be trained on how to use Blackboard Collaborate; however, if the professor does not know, or unable to fathom, how to use the tool within his/her course(s), then the training essentially becomes useless for that professor.

Are online courses actually easier? One of the major concerns that is faced throughout the field of online education is the question of whether online courses are actually easier than traditional courses. From a student perspective, the honest answer to this question would be – it depends. This dependence is derived from how the course is structured, which is typically created by the professor facilitating the course.

Some online courses are much easier than traditional courses due to how the online course is structured. Faculty structure online courses with a variation of discussions, assignments, quizzes, and/or tests. Oftentimes, faculty use the same quizzes and tests that are used in their traditional courses with little to no modifications. However, faculty have to realize that these reused tests are usually posted online, which distance education students will have access to when completing them. In addition, some faculty structure discussions in a way that does not provoke much diversity of thoughts, which lowers

students' ability to think creatively. If a student does not have to think too much about a discussion, the discussion becomes easier to complete.

On the other hand, there are professors who structure online courses in a way that promotes creativity in their discussions, problem-solving in their assignments, and information retention in their tests. These professors are able to execute discussions that are multifaceted in allowing students a wide array of opinions, assignments that are thought provoking in that they require much more than superficial thought or effort, and tests that are more open-ended or application based in that students will know the information and understand how and why it is utilized. These methods can make an online course just as rigorous as a traditional course, if not more complex.

From the faculty perspective, online courses are deemed harder for students; not because of the content, but because of the additional responsibility that is weighed on the student (i.e., time management). However, the additional responsibility does not make an online course harder. Instead, it significantly increases the amount of effort needed in order to be successful in the course. This can be even correlated to a traditional course – what you put into it is what you will get out, which oftentimes means a better grade.

Option One: Status Quo

The first option in solving these issues is for SSU to continue to operate its distance education in the same current state. The distance education policy can continue to be ignored and faculty will be able to continue to facilitate online course with little to no training concerning online pedagogy unless it is desired. Faculty may struggle with effective online pedagogy after voluntarily attending broad training sessions. Students may struggle to grasp online course material and potentially enroll at other institutions with more effective online instruction. Essentially, the needs of the students and the continuously changing market can remain to be ignored. SSU can remain stagnant in its online course offerings and the Office of Online Learning may continue to be reactive rather than proactive in relation to the market in trying to remain competitive with other institutions.

This option appears detrimental to SSU if its distance education and the Office of Online Learning remain in its current state. Faculty members may not be properly trained or developed in the needed way to offer prosperous online courses. Furthermore, faculty may continue to be strained in putting in the extra effort without any additional compensation, which could lead to potential turnover or a complete disconnection from online courses. Students may have tremendous trouble in grasping the course content because of potentially poor delivery and skills/methods of the undertrained faculty. During this time, potential students may be drawn to other institutions because of better diverse course offerings, as well as better trained faculty to deliver better quality courses.

Potential Solutions

Better enforcement of policy and procedures. Another solution to solve these problems is for SSU to better track and enforce its distance education policy. Simply, any Online Course Request form would be able to be cross-referenced with the eligibility spreadsheet in order to approve or deny the request of a faculty member teaching an online course. On the other hand, department chairs and academic deans could be provided a list of their eligible faculty in order to rule out which faculty are not able to facili-

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tate an online course. This method may be the least impactful to the flow of the university, however, it is highly effective if executed well.

Expansion of the Office of Online Learning staff to improve training and support.

A second suggestion would be to increase the staff members of the Office of Online Learning at SSU. This expansion may better serve the current faculty in facilitating online courses as well as an expansion of online course offerings. Moreover, the increase in staff may offer a more diverse perspective in designing new training courses.

With training being a major issue, the improvement thereof may significantly change the way online courses are delivered at SSU. In addition, the additional staff may be able to support faculty and students outside of traditional office hours, which may decrease faculty and student stress in the event of technological issues.

Redesign of SSU's distance education. A final solution to the stated issues is more drastic, yet will address the majority of the issues SSU is currently facing. This solution encompasses a complete reformation of SSU's distance education by: 1) creating a full encompassing training program/course that informs and directs faculty on online pedagogy and distance education issues tailored to the SSU culture, 2) rewrite the distance education policy to include mandatory compensated training and how it promotes effectiveness for online courses, 3) gathering more input from faculty who have facilitated and students who have taken online courses to improve training and course offering by administering specifically tailored course evaluations, 4) researching and developing better ways to address whether online courses are a fit for students to pursue, and 5) researching and applying for federal and/or state funds specially formulated for the improvement of the institution's online education.

By creating a training program for faculty and staff to facilitate online courses, it would better prepare, or qualify, them when facing the numerous challenges with distance education. This training course should be taken before a professor completes an Online Course Request form in order to be deemed eligible. Ideally, professors who have never facilitated an online course at SSU should take the training course one semester and then use another semester to design the course.

Although the current distance education policy states that faculty must attend some sort of training session, the policy is not enforced and doesn't dictate which training would be appropriate. By rewriting the policy, the newly designed training course would be the solution to both of those problems. The training course would dictate which faculty/staff member is eligible to deliver an online course as well as dictating the necessary training in order to become eligible. The new policy should address how the new training course is necessary in order to provide exemplary online courses.

By gathering more input from faculty and students, the Office of Online Learning at SSU would be able to mitigate many negative effects that may arise in online courses. These effects could then be intertwined with the new training course. Professors may have trouble delivering course content effectively, which leads to students not being able to grasp information.

Finally, the Office of Online Learning should research and develop methods that would better facilitate the student population's potential success with online courses. Some students take online courses because of the perception that they are easier. However, not all students are well suited for online cours-

es. SSU could utilize SmarterMeasure (2017), which is a tool that assists students in determining their readiness level to take an online or technology-rich course. Seven factors are evaluated, including individual attributes (e.g., motivation, procrastination, willingness to ask for help, etc.), life factors (availability of time, support from family and employers, finances, etc.), learning style (i.e., based on the multiple intelligences model), technical competency (i.e., skills using technology), technical knowledge (i.e., knowledge of technology terms), on-screen reading rate and recall, and typing speed and accuracy. This tool could be used to assist in advising students in or out of online courses. By addressing whether online courses are a suitable fit for students, it may allow students to see the potential issues they may have while taking an online course. This may ultimately reduce the number of “loafers” or those students who take advantage of loopholes. In turn, while students often take these courses for flexibility and convenience, however, students may soon realize how well-developed the courses are, realize the necessary degree of effort needed to be put into the course, and then are able to better retain and apply course content.

A critical part of this recommendation is finding funds to be allocated to faculty who teach online courses. This may be alleviated through grant funding if available. These funds should be distributed into stipends, or course releases, to incentivize faculty to take on the extra time and effort associated with creating online courses.

In a sense, this recommendation can easily be recognized as a cyclical cycle – by improving faculty training and development, it fosters better online courses and potentially increases the number of courses that can be offered online. As a safeguard, the distance education policy must mandate and then be enforced that an initial training course is required for faculty to be eligible to facilitate online courses. Moreover, by gathering input from both faculty and students, specifically inquiring about online courses, training can be corrected to include any major problems and potential solutions.

Conclusion

To conclude, these presented solutions are feasible for SSU and the Office of Online Learning to execute. However, they present challenges within themselves that may prove to be problematic. Nonetheless, a thorough risk analysis must be assessed in order to determine if the potential benefits outweigh the costs. Although feasible, some of these solutions are not the best fit to improve the current situation.

The final recommendation for SSU to improve its implementation and development of online courses was to undergo a full redesign of its distance education. This recommendation included five major components. This recommendation is one that will task a larger amount of time to develop and execute, however, it addresses the primary concerns within SSU’s online learning community. The potential outcomes from this recommendation may assist SSU in adapting to the changing student archetype. SSU has to maintain a competitive edge with other institutions while maintaining its well-known student-oriented culture and this recommendation is one of the many steps needed to achieve that goal.

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Transitioning to the Polytechnic: The Game Development Aspect

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Abstract

Facing the need to introduce new approaches to teaching the art of programming to undergraduate Computer and Information Technology (CIT) students as part of the transition of the former Purdue College of Technology to the novel concept and status of Purdue Polytechnic, we came up with the idea of offering a pilot 300-level course entitled “Introduction to Game Development.” This course was taught by one of the co-authors in Spring 2015, just before our statewide site was renamed to Purdue Polytechnic Columbus, and then again in the Fall of 2016, this time with a project aimed at creating a virtual reality (VR) application. In addition to the fundamentals of game programming, the pilot course addressed the essential aspects of game design, 3D art, and computer animation for games. In this paper, we will discuss how the two offerings of the course progressed, the course structure, the choice of tools and equipment, team project outcomes, the lessons learned, and our plans for the future work aimed at further development of our capability to reach the goals of the Polytechnic by having students improve their programming and teamwork skills via game development, an educational and fun activity.

Introduction

In Spring 2015 and Fall 2016, immediately before and shortly after the Purdue College of Technology was renamed the Purdue Polytechnic Institute, the Computer and Information Technology Department (CIT) offered a pilot course listed as CNIT 399 and entitled Introduction to Game Development at its statewide location in Columbus, Indiana. In this paper, we are going to give you background on why this course was developed, outline the structure of the course, explain the choice of tools and equipment, describe how the two offerings of the course progressed, discuss the project outcomes and the lessons learned, and, finally, present conclusions and set forth our plans for the future work aimed at continued incorporation of game development into the Polytechnic curriculum in line with its goals.

Background

First, let us briefly explain who we are and illuminate some of the specifics of the Purdue Polytechnic Institute program in Columbus. Purdue University College of Technology (COT) was renamed the Purdue Polytechnic Institute in 2015. Purdue Polytechnic has a statewide system that offers a variety of programs throughout Indiana. Computer and Information Technology (CIT) in Columbus offers a Bachelor of Science (BS) degree with classes in a variety of areas including programming, systems analysis, system administration and databases. Prior and during the experiment with the Introduction to Game Development pilot course that we are reporting on, our students developed mobile games as part of other courses, namely CNIT 355 Software Development for Mobile Computers and CNIT 425 Software Development for Mobile Computers II. The screenshots of some of the student game demos developed in those classes are shown in Figures 1-3.

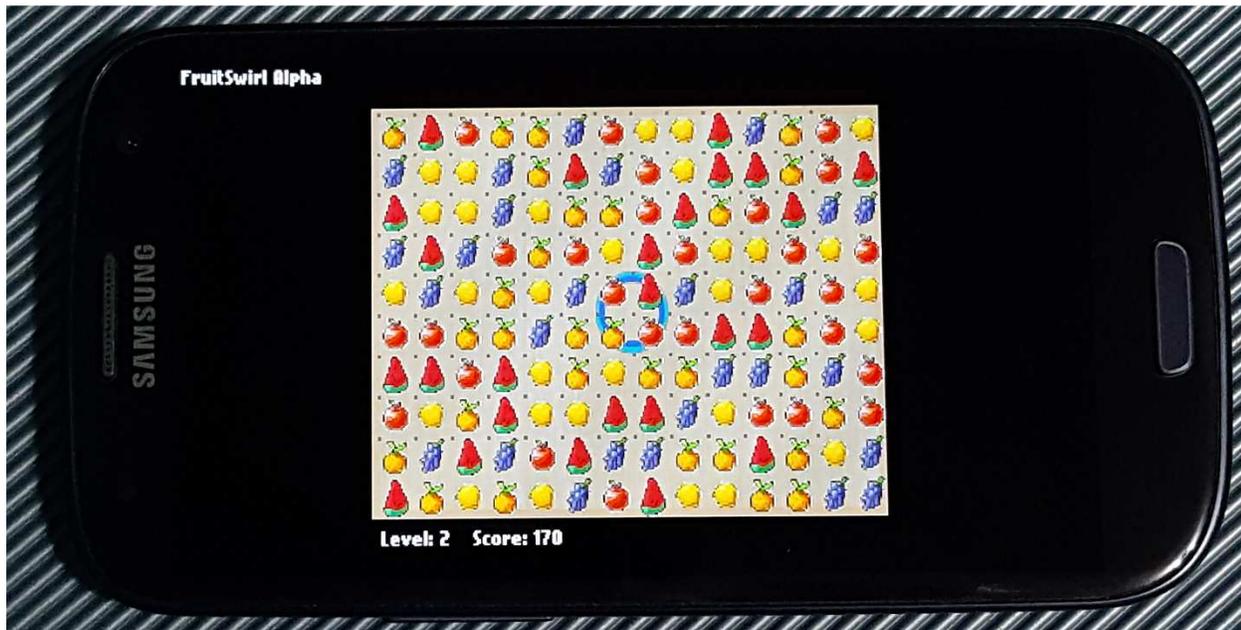


Figure 1. *FruitSwirl Alpha*: A game demo developed by a team of three undergraduate students for their Fall 2013 project in CNIT 355 Software Development for Mobile Computers.



Figure 2. A screenshot from the *Chess for All* app showing gameplay by *Firenzina*, a chess engine ported to Android for a Spring 2014 CNIT 425 project. Source: Abshire and Gusev (2015).

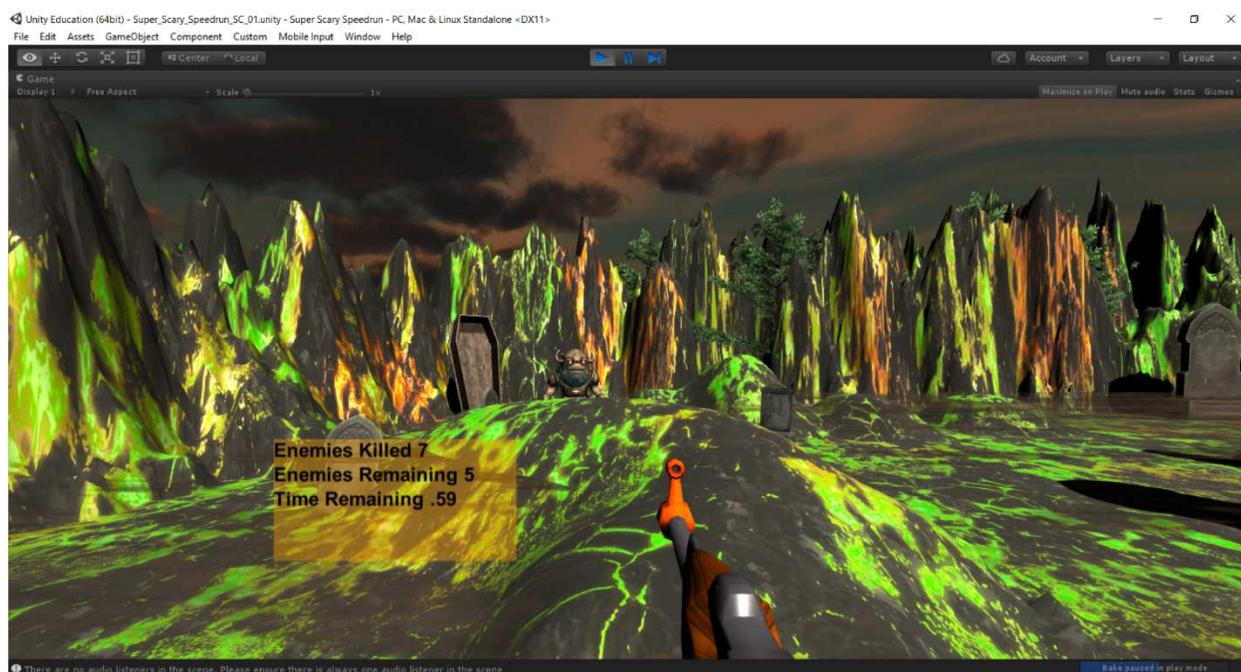


Figure 3. *Super Scary Speed Run*: A game demo developed by a team of three undergraduate students for their Fall 2015 project in CNIT 355 Software Development for Mobile Computers.

The pilot course entitled “Introduction to Game Development” was designed to familiarize the students with the fundamentals of the video game development technology, including the basic programming and design tasks involved in developing video games. It was offered to try a new, game-oriented approach to teaching the art of programming to our CIT undergrads. We will discuss the course structure in more detail in the next section.

Course Structure

The course began with the overview of the main components of the game development field: game design, game programming, art and animation for games, and game production. The course objectives were set to make sure that the students would learn how to:

1. Implement video games using a modern game engine and other tools. (Tools for virtual reality (VR) were added to the set in the second offering of the course.)
2. Create art and animations and import them into video game projects.
3. Apply artificial intelligence (AI) techniques to create autonomous agents.
4. Design and implement graphical user interfaces / head-up displays (GUI/HUD) for video games.
5. Perform various roles within a group development environment.
6. Research, implement and present various game development topics.

The course continued with an overview of game programming, gaming platforms, and game genres. Material on the fundamentals of game design followed, in order to prepare the students for the game design tasks that they had to complete early on in their project. This part of the course was largely based on the material from the textbooks by Gibson (2014) and Adams (2014). The first assignment instructed each team to come up with a 3D video game concept. The second assignment had each team develop a Game Design Document (GDD) for their concept. A small fragment of one of the GDDs is featured in Figure 4.

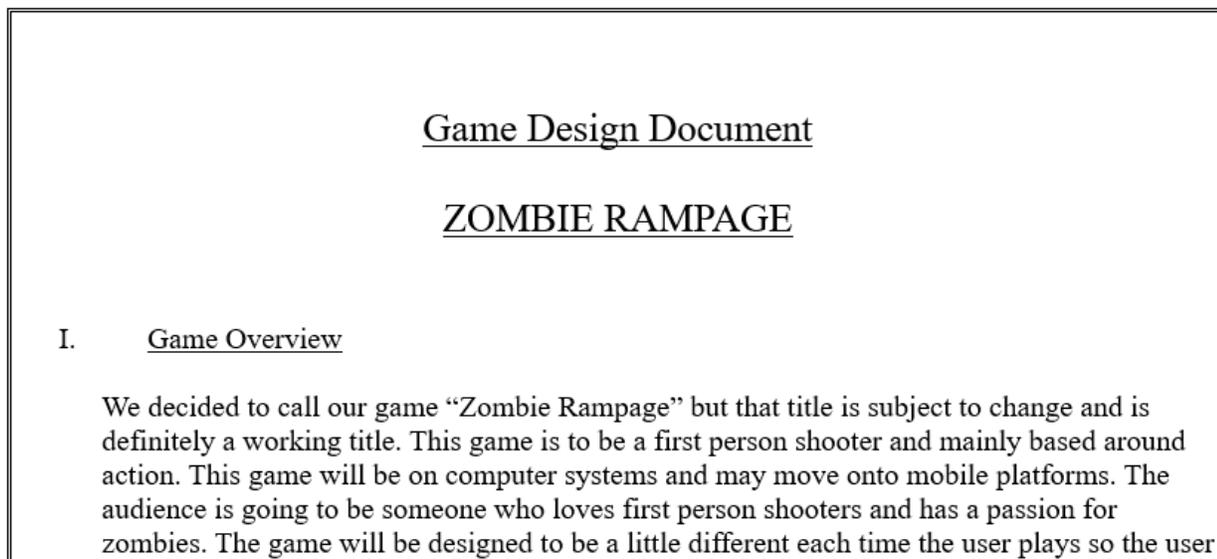


Figure 4. *Zombie Rampage*: A fragment of a GDD developed for a Spring 2015 project in CNIT 399 Introduction to Game Development.

The next topic introduced students to 3D art and animation for games. In absence of a major art department to collaborate with locally, we had to rely upon some of the students’ personal interest in graphic arts and animation. The material was based upon the early chapters of Roy (2014) and Palomar (2014) in the first offering of the course, Derakhshani (2015) in the second offering.

An overview of game production and marketing was given next, in order to help the students organize their work on the project using the modern project management tools. The primary source of material for this part was a monograph by Hight and Novak (2007). The third assignment told each team to develop a project management plan for the team's game. The plan was to be represented by a Gantt chart in the Microsoft Project format.

The students were formally introduced to their tools for game programming and version control during Week 3 of the course. The subsequent four lectures were primarily based on Geig (2014) in the first offering of the course, its next edition (Tristem & Geig, 2016) in the second offering. In those lectures, the following topics were covered:

- Terrain and Level Design (and also Virtual Reality in the second offering)
- Import of Artwork and Animations
- Tree and Grass Modeling
- Fundamentals of Game Programming

The fourth assignment required each team to develop a terrain for its game project and demonstrate the resulting level to the instructor in class. This approach allowed the students to gear up for the project quickly and have a solid foundation for it in place by the mid-semester mark.

The lecture topics of the second half of the semester included

- Gameplay, Core Mechanics, and Game Balancing – a critically important part of the course, based mainly on Gibson (2014) and Adams (2014)
- Basics of Artificial Intelligence for Games – a review of (Millington & Funge, 2009)
- GUI/HUD Development for Games
- Game Testing, Debugging, and Integration
- Sound and Special Effects
- Game Physics and Collision Detection
- Networking and Online Games (this topic was covered late in the semester, given that it was unrealistic to expect that the students would be able to develop an online game in this introductory one-semester course)
- Storytelling for Games – based largely, but not exclusively upon Sheldon (2014)

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In addition to the aforementioned assignments and project, the midterm and final exams were administered to assess the students' performance. In the first offering of the course, the number of students enrolled allowed us to make the project presentations peer-assessed.

The course structure described above was developed with certain tools and equipment in mind. Their choice is discussed in the next section of the paper.

Tools and Equipment

The undergraduate students of Purdue Polytechnic Columbus used Unity 5 Pro and Autodesk Maya software, along with Microsoft Project, to do their coursework for CNIT 399 Introduction to Game Development.

Unity is a game engine developed by Unity Technologies, initially for mobile platforms. In the recent years, it emerged as the primary choice of VR developers. Purdue University acquired 25 perpetual Unity Pro 4.x licenses at the cost of \$14,975 (\$599 per license) in March of 2014, with the free upgrade to Unity 5. These licenses have also been used to teach Purdue Polytechnic Columbus summer camps for high-school students. Unity 5 was released on March 3, 2015 and used in both offerings of the pilot course. C# was picked as the scripting language of choice (Unity supports JavaScript as well), and the prerequisite for the pilot course was set to require students to have two semesters of C# programming under their belts. This amount of preparation proved appropriate and sufficient.

Autodesk Maya is a widely used tool for 3D modeling and animation. It provides a seamless workflow transition to Unity. Purdue University has owned up-to-date enterprise licenses of Autodesk Maya.

Microsoft Project is a ubiquitous project management tool that allowed our students to develop the project plan and follow it using Gantt charts, a common means of scheduling project tasks.

Given the small class sizes, running the software on 12 Dell OptiPlex 7020 quad workstations under auspices of Windows 7 in the lab proved a sufficient solution. In the second offering, an Oculus Rift SDK 2, a Samsung Gear VR, and a commercial Oculus Rift unit were available for VR game development.

Course Progress

Lecture sessions alternated with lab sessions to give students ample opportunities to interact within teams and across the team boundaries in the instructor-supervised lab environment. This approach is common at Purdue Polytechnic.

The first offering of the pilot course attracted 7 CIT undergrads that formed two teams named Team Black (4 students) and Team Gold (3 students), according to Purdue's revered core colors. The course proceeded according to the plan, and both teams completed their respective PC game demos using Unity and Maya. Students delivered peer-assessed presentations on the game development topics related to their team responsibilities.

Unfortunately, the second offering of the course did not go equally smoothly, primarily because only one student had registered for it. As a result, the student's teamwork opportunity was severely limited to interaction with the instructor. It proved difficult for the student to excel in all components necessary for completing a game demo, despite all efforts to keep the project scope down without turning it into a trivial exercise.

The next section of our paper is devoted to discussion of the student project results and the lessons learned.

Project Outcomes and Lessons Learned

Spring 2015, Team Black: *Zombie Rampage*

Team Black delivered a demo of *Zombie Rampage*, a survival game where the player character (PC) walked or ran in the rain through the wet streets and abandoned but lit buildings of a fairly complex post-apocalyptic city environment, trying to evade a horde of aggressive zombie non-player characters (NPCs) spawned and controlled by the game's artificial intelligence (AI). The zombies traveled successfully along the extensive navmesh (navigation mesh) to find the PC, attack him and inflict damage that caused lowering of the PC's health bar and, ultimately, his death. At an intermediate stage of the project, the PC had a gun capable of shooting projectiles at the zombies. However, the team failed to resolve the collisions issue and decided to take the useless gun away from the unfortunate PC in the last minute. This was in line with the textbook advice to remove a feature, rather than let it glitch. Unfortunately, we no longer possess a working version of the *Zombie Rampage* demo. The structure of the program's Unity assets is shown in Figure 5. It should give the reader an idea of the effort that it took the team of four students to take their project to its final, advanced stage.

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Name	Date modified	Type
Antique Pack	5/24/2015 9:16 PM	File folder
assets_bathroomprops	5/24/2015 9:16 PM	File folder
Assets_Beds	5/24/2015 9:16 PM	File folder
cartoon building	5/24/2015 9:16 PM	File folder
Cartoon SMG	5/24/2015 9:16 PM	File folder
clouds	5/24/2015 9:16 PM	File folder
Editor	5/24/2015 9:16 PM	File folder
enchantedanvil	5/24/2015 9:16 PM	File folder
furniture pack 1 free	5/24/2015 9:16 PM	File folder
fx_kandol_pack	5/24/2015 9:16 PM	File folder
game sound solutions - 8 bits elements	5/24/2015 9:16 PM	File folder
Graffiti Pack	5/24/2015 9:16 PM	File folder
Grunge pack	5/2/2015 9:06 PM	File folder
london street asset	5/24/2015 9:16 PM	File folder
malecharacterpack	5/24/2015 9:16 PM	File folder
Materials	5/2/2015 9:06 PM	File folder
meshes	5/24/2015 9:16 PM	File folder
mobile_citizen_human&zombie_free	5/24/2015 9:16 PM	File folder
project for game	5/2/2015 9:06 PM	File folder
rainassets	5/24/2015 9:16 PM	File folder
scifi decals pack	5/24/2015 9:16 PM	File folder
skyscrapers	5/24/2015 9:16 PM	File folder
square pack	5/24/2015 9:16 PM	File folder
standard assets	5/24/2015 9:16 PM	File folder
streets	5/24/2015 9:16 PM	File folder
Working Assets	5/24/2015 9:16 PM	File folder

Figure 5. *Zombie Rampage*: The program assets

Spring 2015, Team Gold: *Showdown at The Fair*

Team Gold was fortunate to consist of a talented game designer, a very strong programmer, and a third team member with special interest in 3D art and animation. Working together in harmony, they completed *Showdown at The Fair*, a 6-level game demo, which we have been proud to show at our recruitment events since. This first-person shooter (FPS) is remarkably non-aggressive and fun! The levels consist of five amusement park pavilions and the final boss level, all with different graphic art and music solutions.

The first level involves shooting at barrels of various shapes and sizes. The barrels move horizontally on three shelves in two different directions. The rate of target generation gradually increases. Once ten barrels get away, the game stops. The ammo supply is unlimited. The player's achievements are reflected at a progress bar that allows the player to reach the bronze, silver, or gold level. Once the bronze level of progress is reached for the first game level, the second level is unlocked, and so on. Prior to that, the player can see the next pavilions, but the game's user interface (UI) prevents play. A screenshot of Level 1 is shown in Figure 6.

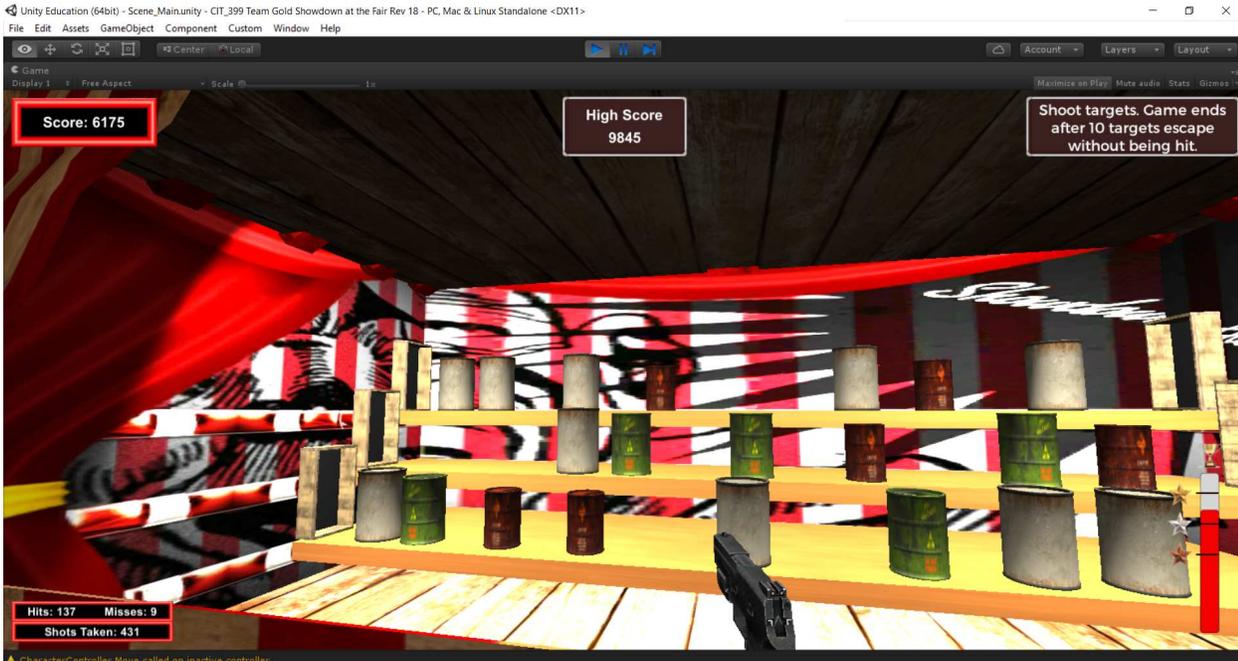


Figure 6. *Showdown at The Fair*: Level 1 (the Classic level).

The second level lets the player shoot at sculpture-like lions of different colors that move horizontally or vertically in the stylized jungle. A screenshot of this level is featured in Figure 7. The player just earned 75 points by shooting a lion, which disappeared from view to be replaced with the disk bearing the number 75. The disc lingers for a couple of seconds, while moving up slowly, and then disappears as well. Reward amounts vary depending on a lion's color.

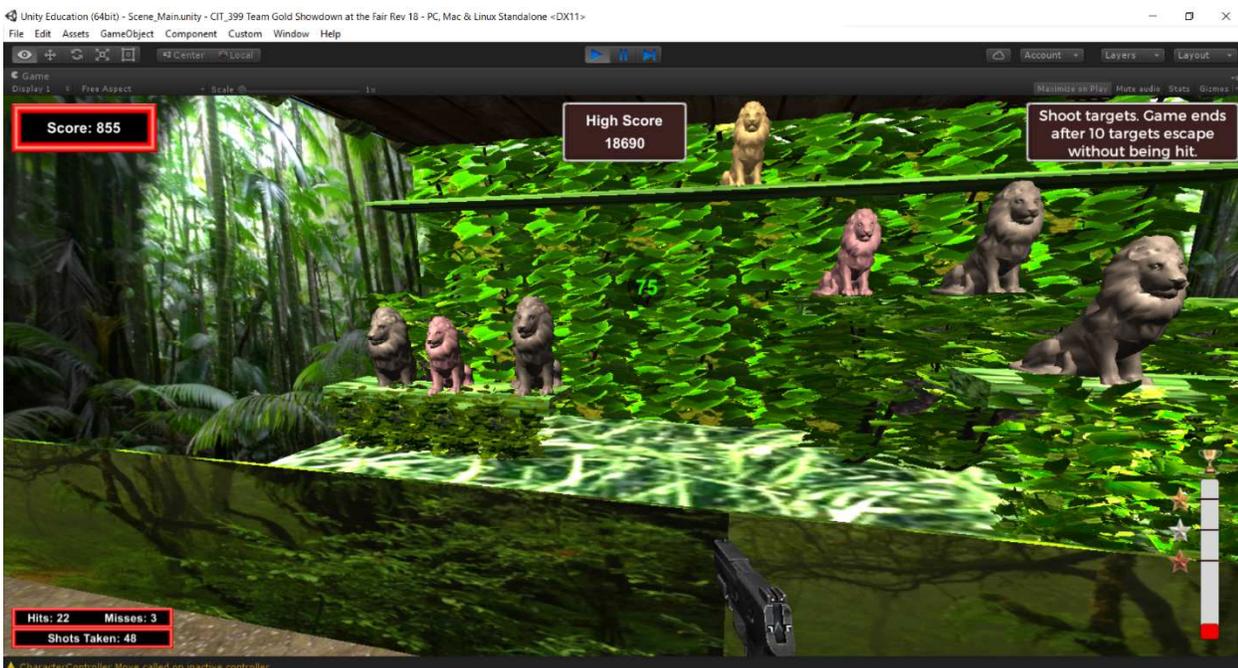


Figure 7. *Showdown at The Fair*: Level 2 (the Jungle level).

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On the third level of *Showdown at The Fair*, the player is invited to shoot at skulls, some of which appear and disappear in the central slots, while others move horizontally along the shelves placed on the sides of the pavilion. A screenshot of the third level is shown in Figure 8.

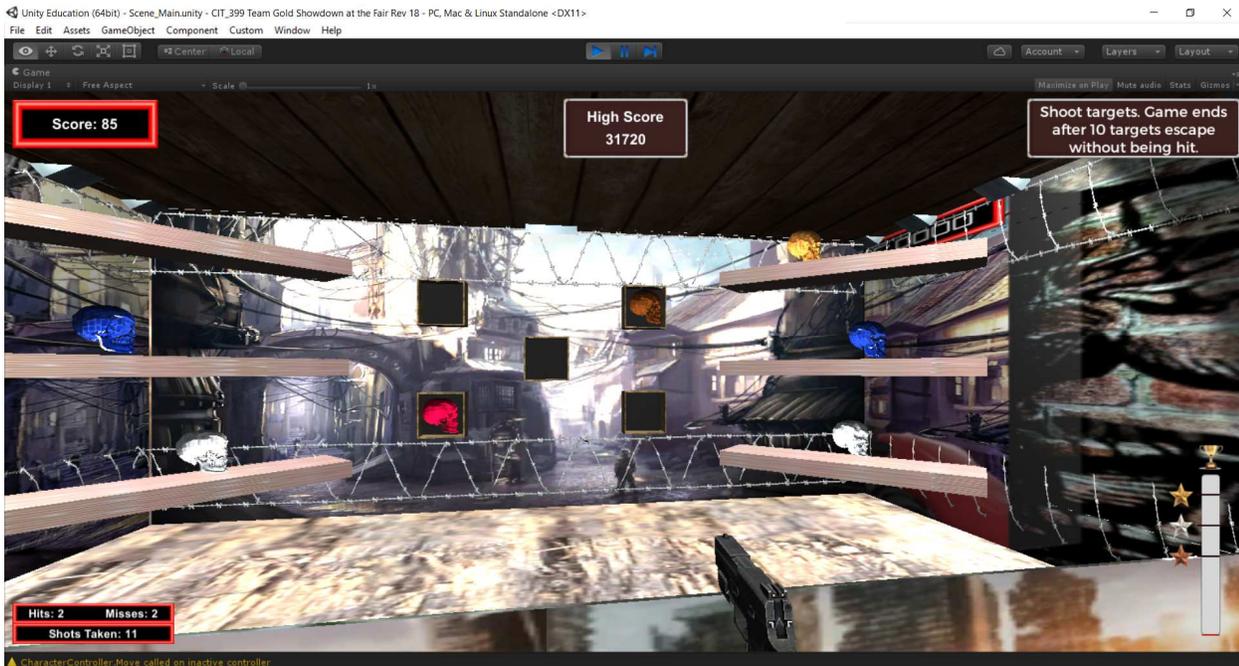


Figure 8. *Showdown at The Fair*: Level 3 (the Urban level).

On the fourth level, the player's targets are psychedelic cows that move as if they were in weightlessness. A screenshot of the level is provided in Figure 9 below.

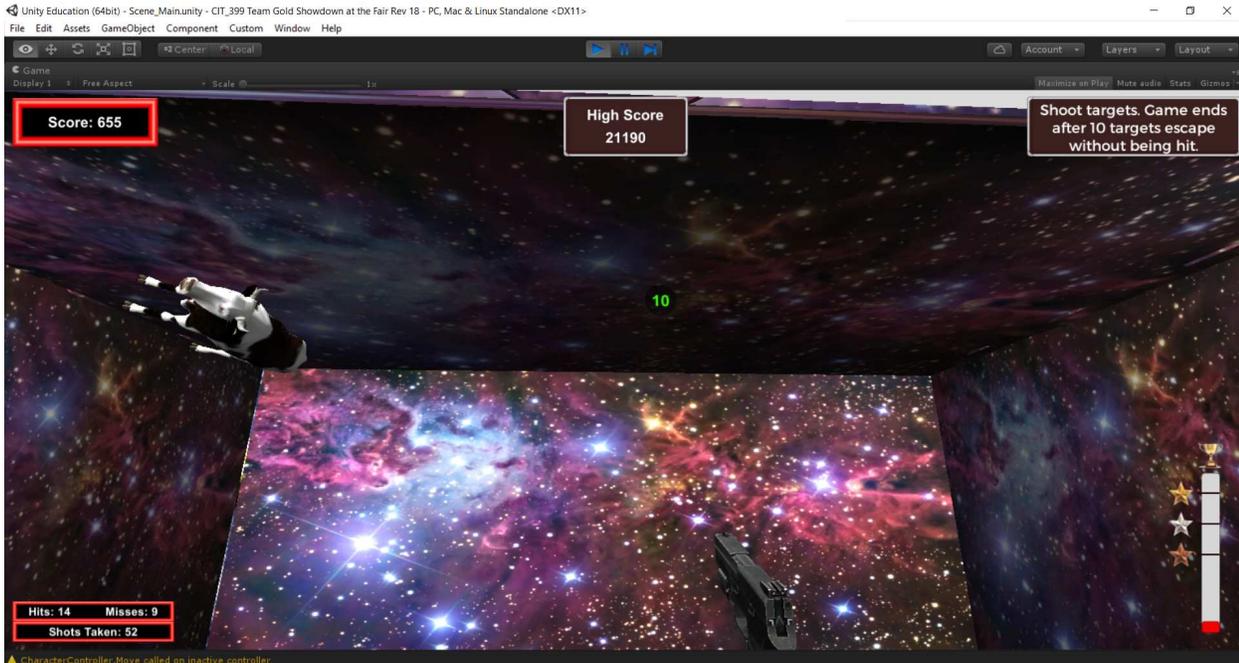


Figure 9. *Showdown at The Fair*: Level 4 (the Space level).

Level 5 is the hardest level of *Showdown at The Fair*. It was passed on the third try by a hardcore player with excellent Counter-Strike skills. The player has to shoot at colored bombs, some of which pop up in windows and other static locations, while others move slowly down. A screenshot of this level can be seen in Figure 10. The current high scores displayed in the screenshots give a good impression of relative difficulty of the game levels.

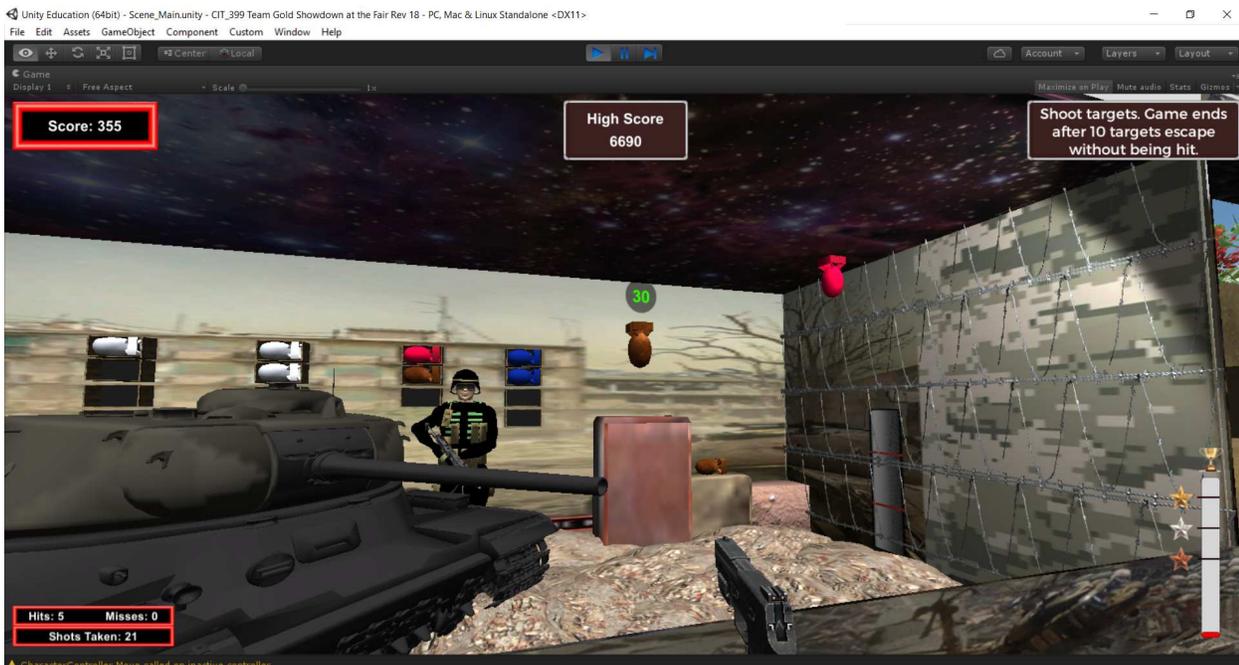


Figure 10. *Showdown at The Fair*: Level 5 (the Military level).

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Figure 11. *Showdown at The Fair*: Level 6 (the Boss level).

At the final, Boss level of *Showdown at The Fair*, it is pointless to shoot at the mummy-like boss that keeps moving about the level. Instead, the player should be shooting at the balloons that the boss is throwing toward the PC. The level is played until 15 balloons get away. A screenshot of the last level is shown in Figure 11 above.

Fall 2016: *Un Vincitore*

Un Vincitore was designed to be a VR chessboard application. In the screenshot shown in Figure 12, you can see its UI. During the project demo, the chessboard could also be seen, even though it was not fully functional.

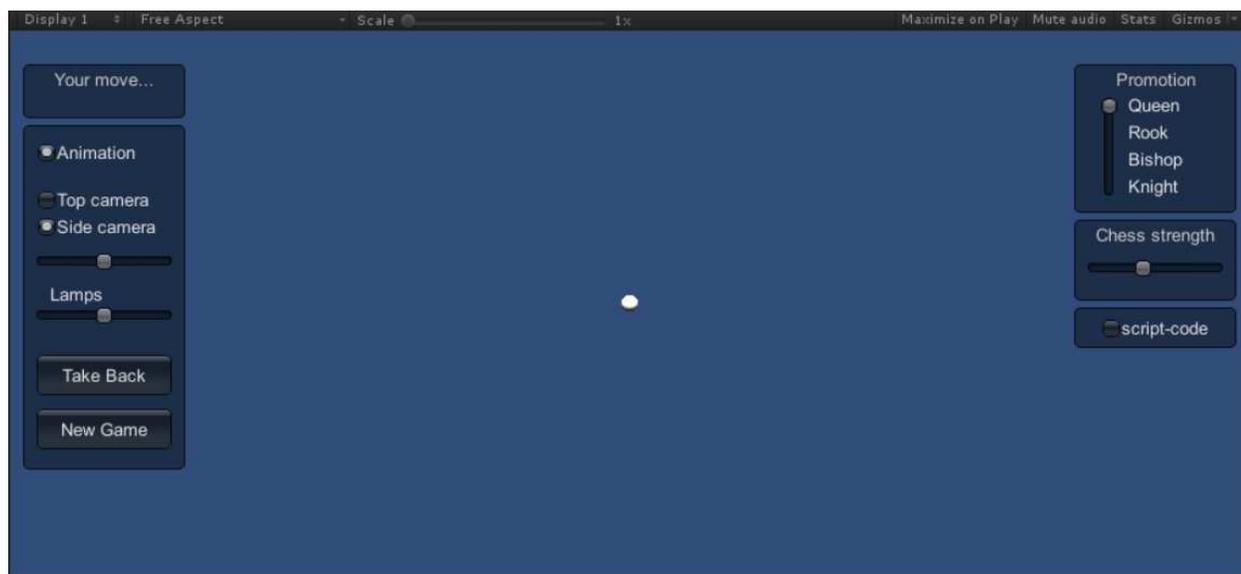


Figure 12. *Un Vincitore*: The VR chessboard UI design.

Lessons Learned

One-semester game development projects using Unity and Maya can be productive (lead to a good game demo) if at least three or four team members are available. Students whose interests complement each other may form a very successful team! Prior to scheduling an “Introduction to Game Development” course, it is important to make sure that the interest in the course is sufficiently high among the current students that have the prerequisite.

Conclusions

A pilot 300-level course entitled “Introduction to Game Development” was developed and offered twice at Purdue Polytechnic Columbus. The course contributed to improvement of programming skills of the undergraduate CIT students by engaging them in C# scripting for video game demos. One of the game demos proved useful in recruitment of new students, helping generate more interest in the CIT program. The most recent version of the course featured a virtual reality (VR) game development project. The spirit of the new, heavily project-oriented course is in line with the vector of the Purdue Polytechnic transformation aimed at placing increased emphasis on student teamwork. However, for the course to be successful, it is important to make sure that sufficiently many students that meet the prerequisite are interested in taking it.

Future Plans

We intend to offer the pilot course for the third time prior to deciding whether we should ask for a permanent place for the course in the Purdue Polytechnic curriculum. Meanwhile, we are exploring the benefits of switching from Unity to its closest competitor Unreal that has recently transitioned to a more promising business model. In addition to VR development, we would like to investigate development for holographic mobile devices, such as those based upon the Leia 3D technology and scheduled for release near the end of the year.

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Big Data and Knowledge Management: A Possible Course to Combine them Together

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Abstract

Big data (BD) is the buzz phrase these days. Everyone is talking about its potential, its volume, its variety, and its velocity. Knowledge management (KM) has been around since the mid-1990s. The goals of KM have been to collect, store, categorize, mine, and process data into knowledge. The methods of knowledge acquisition varied from organizational culture to the next. Typical processes converted data into information through traditional databases and then applied business intelligence and data mining methodologies to extract knowledge. With the recent arrival of big data as a disruptive technology and the center of big data, this paper attempts to combine KM and BD fields together. Both areas could help each other tremendously. KM historically, when applied correctly, has helped managers to make decisions faster and better, prevented reinventing the wheel, preserved some talented processes through keeping track of best practices, and prompted innovation due to knowledge sharing and dissemination. BD deals with massive amount of data and does not require a traditional database to be effective. BD has its tools and requirement that can be enhanced through KM. The final aim of this paper is to recreate a model where both big data and knowledge management coexist. The author hopes with a better understanding of both fields to develop a new course where the focus is a productive intersection of knowledge management and big data. To keep up with changing times, this paper will bring the needed awareness of these fields for information systems and business students.

Descriptors: Big Data, Knowledge Management, Model, Knowledge, Value, Class Design, Introductory, Learning, Business.

Introduction and Problem Statement

The exponential increase in data size is well known point. O'Doherty (2012) discussed some interesting facts concerning big data, data management, and data visualization. Considering that the article is an old one, it still brings some valid comparisons. The author stated that the volume of data created by the U.S. companies big enough fill ten thousands the size of the Library of Congress. A retailer who utilizes big data effectively could enhance its operating margin by more than 60%. Bad data costs the U.S. economy \$600 billion every year. Another interesting statistic was that big data will cost businesses around \$232 billion in 2016. Every minute YouTube users upload 48 hours of videos resulting in a span of eight years of media to watch every day. The article predicted that by the year 2015, 4.4 million IT jobs globally would be needed to support big data. By 2020, we would create 35 zettabytes (10^{21} Byte Approx.) of data. Finally, 1.9 million jobs related to big data would be created in the U.S. by the year 2019.

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Knowledge management has been around for over 20 years. In his website KM – Knowledge Management, David Skyrme (n.d.) answered the question: “Why Manage Knowledge?” The author stated “organizations are knowledge-intensive.” Knowledge is a valuable resource that provides meaning to their operations.” “If you look at the market value of a public company, it is typically 5-10 times greater than the assets (predominantly physical assets) recorded in its balance sheet.” Knowledge management could easily create a practical approach to education. According to Walter Smith (2012), the most current education models are abstract by nature. Education is meant to create learning but does not show how learning works. The abstract style it creates is necessarily bad and has worked in the past but definitely has not worked all the time. Knowledge management can create alternative education systems by providing the same learning opportunity to everyone. The author added that the learning process can be used at five levels of knowledge management. These include building knowledge, applying knowledge, organizing knowledge, personalizing knowledge and teaching knowledge. The most important part of using knowledge management in education is that the learning will understand knowledge itself. “Learning becomes a dynamic, multidimensional, integrated, interactive process and knowledge is managed efficiently and effectively in school, in college and university, on the job, in our personal lives and in the community.”

The above facts and findings do not require any additional proof in order for us to decide that we need to offer additional classes in Big Data within the information systems curriculum. Note that the output of most big data systems is knowledge instead of information. Understating the nature of knowledge and how to turn it into an action is critical. After searching the existing literature deeply, there was very little evidence to be found of how mixing these two fields benefits our students in the process of becoming effective decision makers upon their graduation. Knowledge is not a fad; rather it is the most valuable asset in our modern world and even in our past. Without it, we could not have preserved our civilization. The adage: “Knowledge Is Power” is completely true. Nations who have more knowledge in their fabric and economy are leading the scene around the world. It is a clear disadvantage to turn a blind eye to these important topics. As educators, we have the responsibility to find the topics that should be blended to create a “maximum effect” on the future of learners. If we don’t react accordingly, students will have to invest in additional training, seminars, and online classes to catch up with their peers in a very competitive market. There is evidence that big data has been incorporated into the academic world but little has been done to link it to knowledge management. This paper is an attempt to create that bridge.

The Benefits of Knowledge Management

Laal (2010) stated that knowledge management has witnessed an increase in its popularity in the last decade. The author explored the concern whether or not KM is a fad. The findings indicate strongly that KM is not a fad and it is here to stay, mainly because our economy is based mostly on intellectual capital, another way to say knowledge. KM is recommended for all organizations since it helps in creating, capturing, sharing and leveraging knowledge for all decision makers.

In another helpful article David Skyrme (n.d.) discussed the benefits of KM. The author stated that we all know that organizations are “knowledge-intensive.” Knowledge is the most vital resource to compete with others. However, organizations don’t manage their knowledge the way they manage their finances. The author reviewed 15 years of experience in the knowledge domain and divided his discussion into three main categories. These are:

- Benefits from efficient processing of information and knowledge. This category discussed:
 - Quicker access to information
 - Less redundancy and duplication
 - More time for professional to focus on more important issues
 - Knowing the source of knowledge and knowing who does what
 - Improved quality of information and knowledge
 - Access to current knowledge and thinking
- If the above benefits were established, this should lead us to the second category which is the internal benefits to the organization. This category discussed:
 - Avoiding worst practices and sharing the best ones
 - Speeding up the time to market new products or services
 - Avoiding reinventing the wheel which lead to cost reduction
 - Capturing valuable knowledge before experts retire or move to other organizations
 - Reducing time to process information which result into faster problem solving and cost reduction
- Just like there were some internal benefits, there are benefits to stakeholders, especially customers. This category includes:
 - Improving customer retention and satisfaction
 - Faster problem solving
 - Being consistent with all customers regardless of their geographical location
 - Acquiring more insight from the customers which improve the quality of the products or services
 - Better value for the cost
 - Improved reputation in the market

The Benefits of Big Data and Its Vs

If you read any article about big data, more likely you are going to be exposed to the three main Vs of big data. These are Volume, Variety and Velocity. For the purpose of expanding the knowledge management model, the paper will cover these factors and examine if there any other additional ones. Firi-

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can (2017) discussed these characteristics to understand the nature, advantages, and challenges of big data.

Volume

This is the most common attribute of big data, knowing that 90 percent of the existing data were created in the past two years. Also, Firican (2007) stated some staggering data where every minute, people upload 300 hours of video to YouTube. In 2016, appropriately 1.1 trillion pictures were taken, and this number most likely to rise by 9 percent in 2017. With the number of mobile devices, it is not surprising to see that the amount of data passing through global mobile traffic added up to 6.2 Exabytes per month. Exabyte is equal to 10^{18} approximately.

Velocity

This characteristic is refers to the speed of generating, producing, refreshing, and streaming data. Velocity means data are accessed in real time and little time is wasted to access it.

Variety

This attribute means the nature of data itself. Most data are not structured as you would see in traditional databases. Data are mostly semi structured or unstructured. In addition to multimedia data types, Firican mentioned click, sensor, and machine as a few examples.

Firican did not stop at the traditional three Vs, rather he stated that there are seven other Vs that should be considered. These include variability, veracity, validity, vulnerability, volatility, visualization, and value. For the purpose of the paper, it is important to expose the reader to these characteristics in order to understand their impact on the recent thinking concerning big data.

Variability

This attribute has to do with data types and sources. Variability refers also to the uneven speed it takes to load the data in the database engine.

Veracity

It is the classic GIGO, garbage in, garbage out. This is considered one of the most serious V factor, knowing dirty data could erase the value of big data and the cost associated with it.

Validity

Validity is similar to veracity. According to Firican, 60 percent of data scientists spend their time cleansing the data to get ready for analysis. It is required to have a policy to assure that we have quality and consistent data.

Vulnerability

Security is an issue with small or big data. Firican referred to the hacking in May 2016 which resulted in the stealing of information from 167 million LinkedIn accounts and 360 million passwords and emails from Myspace users.

Volatility

This in reference to the freshness of the data and how long it stays relevant and useful. As a result of velocity and volume of big data, management must consider its volatility. Firican added that data must be related to your business needs and functions.

Visualization

Firican stated that limitation of memory and poor scalability and response time could be a challenge when visualizing massive amount of data. Traditional graphs would not work for billion pieces of data, therefore other graphic methods such as data clustering, sunbursts, parallel coordinates, circular network diagrams, cone tree, or sunburst should be considered.

Value

This attribute is considered by many as the most important one. It makes sense to say with business value, every other V is a waste of time. Firican emphasized values such as understating of our customers, creating targets, optimizing processes, or in general improving business performance. Extracting value from big data cannot be attained without a valid strategy

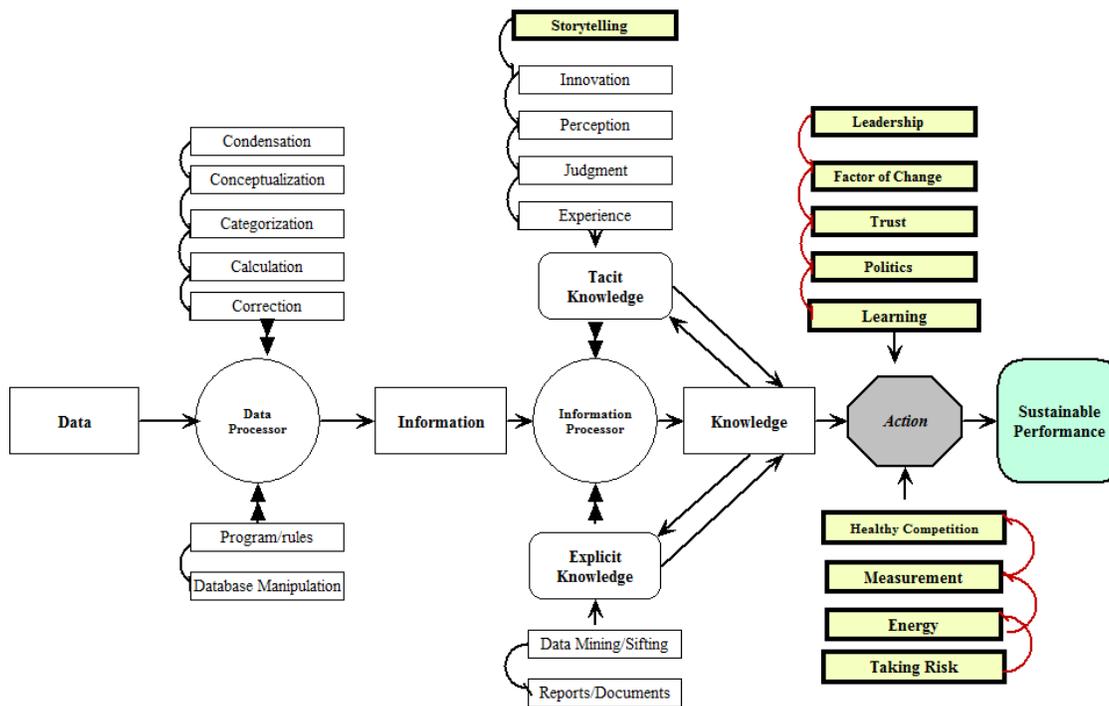
Discussion

In 2003, the author of this paper presented a model for knowledge creation. Later the model was modified to emphasize action as the final output of any knowledge creation project. Without action, knowledge, no matter how costly it is, will be useless. The model is organic by nature and adjustable to the changes in the IT and the business world.

The link between knowledge management and big data

Lamont (2012) stated “A goal of knowledge management over the years has been the ability to integrate information from multiple perspectives to provide the insights required for valid decision-making.” The article, emphasized that the job of knowledge management is not only to learn about our organizations but also to transform them. The article stated that regardless of our measure of success, customer stratification, successful development, robust security, or profit, to excel in the “Knowledge Age,” organizations and people must mature through the different stages of knowledge to transform their surroundings. Lamont (2017) discussed the need for knowledge management programs to hire data scientists. There is a clear evidence that data science is becoming critical to all fields by providing opportunities for better employment regardless of the stage of their careers.

The early model



As we notice from this model, it was created for handling knowledge creation/management in a small data world. From the model above (Hijazi, 2006), it is clear to the observer that the data processor is a Database Management System, DBMS. The use of the process is still valid for big data, except the engine must be updated. Here comes Hadoop to provide a major and timely addition and not a replacement. DBMS will continue to stay with us. Many businesses depend on their DBMS and could not imagine replacing it.

Tacit knowledge will not change, it still resides mostly in people heads. Their intuition, experiences, judgment, innovation, perception, and many other important factors will continue to be a huge input to the process of knowledge creation. What will change is the technology and size of the tools that support explicit knowledge. It should be clear now that for big data to be successful we need to add other designed and developed technologies. In addition to the relationship between data, information and knowledge, databases, queries, and reporting, the classes will at least need to learn most technologies pertaining to big data. These include MapReduce, Hadoop, and Hive, as they are discussed below. The list also added other known and important technologies of big data for additional knowledge.

Rodrigues (2012) interviewed Dr. Kaur about the 10 emerging technologies for big data. The discussion ironically has covered most technologies that have become stranded. These included:

MapReduce

This is a programming pattern that allows for scalable execution for thousands of servers or even clusters of servers. The found tasks in MapReduce are the Map task where a dataset is modified into pair values or records and the Reduce where a group of outputs from the Map are clustered resulting in a number of records.

Hadoop

It the most common implementation of MapReduce and can work with multiple data sources. One clear and useful application of Hadoop is handling large and constantly changing data such as those found in weather forecasting or social-media.

Hive

This technology is similar to SQL syntax. It uses Business Intelligence (BI) to query Hadoop clusters. It gives a developer a similar feeling to a conventional data store which results in the widespread use of Hadoop. Hive was developed by Facebook but later became open-source.

PIG

PIG's function is similar to Hive, however, it uses a Perl-like language to query data stored in a Hadoop cluster. Similar to Hive, it was developed by a private developer, Yahoo, but later ended up as open-source.

WibiData

This tool combines Hadoop with a web analytics capability. It works with HBase as the database layer on top of Hadoop. It provides websites the ability to work with their user data in order to respond to the user's choice in real-time. It also gives a user personalized contents, recommendations, and decision making help.

PLATFORA

This technology adds a friendly face to Hadoop. Hadoop requires intensive training and PLATFORA adds an abstract layer to organize and simplify the access to datasets stored in Hadoop.

Storage Technologies

With the tremendous growth of data, there is a need to find different techniques for storing volumes of data. Data compression and visualization are the reasons associated with big data.

SkyTree

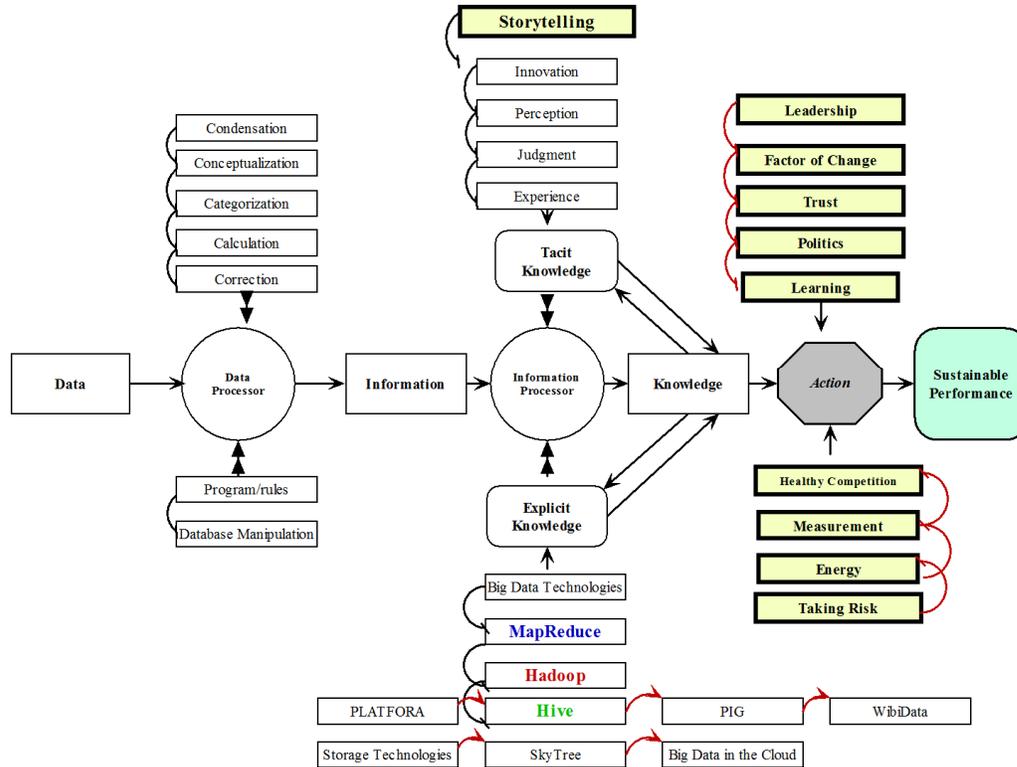
Rodrigues added that SkyTree is an analytics platform and machine learning platform in the area of big data. SkyTree handles volumes of data associated with machine learning where conventional tools would be able to do the job.

Big data in the cloud

Rodrigues concluded the meeting with Dr. Kuar by stating that everything mentioned above is amiable in the cloud. Vendors are offering Hadoop clusters to meet business needs and to be scaled to their demand. Big Data and cloud computing are intertwined where cloud computing gives the chance to all companies to join the bandwagon of big data.

The New Mode

As a result of the modification, the new model is ready to handle the new components of big data.



The model still keeps all the helpful and productive steps we learned from knowledge creation/management. The model also keeps all the intangible factors such as leadership, factor of change, trust, politics, and metalearning as determinal factors for any application of technology to succeed. The end result is sustainable performance where success alone is not enough. Success needs to be evaluated, recharged, and ready to deal with all business obstacles that prevent it from being achieved.

The Importance of the Study

Knowledge management has been around for some time. Organizations have gained greater understanding of the value of knowledge as a major asset to their survival. Big data has burst into the scene with a call for a change in the way we capture, cleanse, process, update, sort through unimaginable volume of data a few years ago. This study attempts to show the impact of Big Data as an inescapable phenomenon and to link it to the wealth of managing knowledge. Knowledge is the outcome of both a big data project and a knowledge management program. Why not combine them together? This study

modified an earlier model for knowledge management but added the components pertaining to big data. The hope is to develop a class where both topics will be introduced together to students.

Conclusion

There is no question that big data is a permanent and increasing phenomenon. As educators, we need to respond to changes in the business world. After reviewing key areas in the field of knowledge management and big data fields, it led to the modification of an early KM model to include those components that will generate explicit knowledge from massive amount of data. The model acknowledged the need for the addition of big data technologies. However, it left all the earlier factors emphasized by a knowledge management program, especially the ones that guarantee an action and sustainable performance at the end. In addition to the alteration of the module, this research should give the reader a good exposure to both fields where key concepts are included in the model to develop a new class. The study shows an alarming rate of increase in the volume of data. However this will generate an opportunity to all concerned parties that data regardless of its nature – structured, semi structured, or unstructured – will be used to increase our knowledge repository. Students in the field of business and information systems must know the value of both fields and more importantly how combine them in order to combine their strengths.

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A Pilot Study on Concurrent Learning/Teaching Model (CLTM) for Online and In-Class Informatics Students

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Abstract

The Informatics program at Mercer University is offered at four regional academic centers located throughout the state of Georgia. We serve non-traditional students who have primary responsibilities such as caring for family, working, and participating in their communities. We aim to offer availability and access to all required courses, access to full-time faculty instruction, and a realistic schedule to graduation. We face two challenges. One is how to operate multiple courses with limited faculty members while maintaining the minimum operation cost. We are offering online education as one possible solution and this has its own challenges. Subsequently, our second challenge is how to deliver the same quality in-class learning environment in an online format for a course in the technology domain. This past year, Informatics faculty conducted a pilot study on concurrent learning environments for online and in-class Informatics students. Surprisingly, 73% of students favor the concurrent online learning environment.

In this paper, we describe the planning, designing, implementation and assessment of the first pilot of our concurrent learning/teaching model.

Program Background

Mercer University mission to serve the education needs of communities throughout Georgia is partly fulfilled by three campuses located in Macon, Savannah, and Atlanta, Georgia, and three Regional Academic Centers in Douglas, Henry, and Newnan counties (Figure 1). In 2010, to match job market needs, we revised our undergraduate in Information Sys-

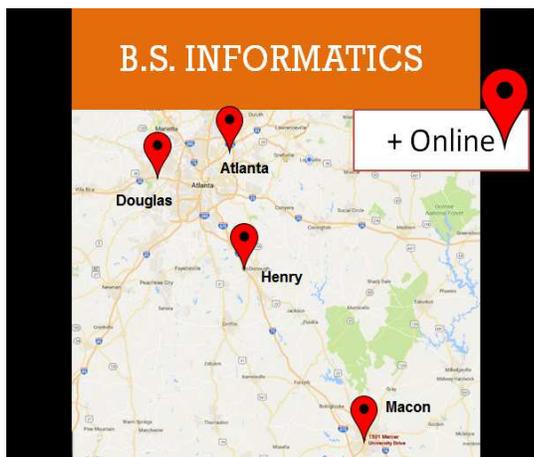


Figure 1. Locations where Mercer University offers face-to-face and online Informatics courses.

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tems program in order to offer a totally new undergraduate program in Informatics. The program has three tracks; Health Information Technology, Web Development and Human-Computer Interaction, and General Informatics. We initially offered the program in three locations and added another location in 2013 due to the high inquiries. We currently have less than 100 students in the program and most of them are non-traditional working adults who commute to college. That means we have an average of less than 25 students in each of the four locations and our class size has been an average of 7 – 15 students. To make sure the students can graduate on time, we strive to offer the classes regularly in each of the four locations for students in all three tracks. However, we face two challenges. One is how to operate multiple courses with limited faculty members, while the second challenge is how to maintain the minimum operation cost with offering so many course sessions. Online education is being offered as one possible solution. This delivery format has been growing, especially for graduate programs and according to Clinefelter & Aslanian (2016), IT is becoming a popular graduate field of online study. From 2014 to 2016, the percentage of Computer and IT graduate online students increased from 9% to 20%.

We wonder what kind of online format will best match our students' best interest for our undergraduate Informatics study. In a study with a sample size of 176 undergraduate program students, the authors, Adams & Corbett (2010), concluded that, "The majority of non-traditional students spend upwards of 6 hours each week preparing for class, where only half as many traditional students spend this much time. When looking at learning environment preferences, results show that both traditional and non-traditional students prefer face-to-face classroom learning over online learning." With this data in mind, we would like to find an online delivery format which will mimic our face-to-face class and can meet the needs of students. We started by studying our students' population to learn about their life characteristics and their learning needs.

Concurrent Learning/Teaching Model Design

Informatics is an IT degree, but it is beyond purely an IT degree. We train our students with fundamental logic and programming, database and big data analytics, and provide opportunities to carry out human-computer interaction evaluations. The curriculum is a combination of courses in theory and practice.

Compared to traditional undergraduate degree programs, our student body is much more diverse. Some of our students graduated from two year technical schools and continued into our program to complete their undergraduate study. Some of them are true freshmen students, who never took any college courses before joining us. Instead of going to college, they may have gone directly to a job or joined the military after high school. Another group consists of those looking for career changing opportunities. The IT related and data analytics related program is one of their top picks due to the tremendous market need and the potential employment opportunities available. Plus, they are all interested in the concepts of Informatics, so they choose informatics as their major. Other important student constituencies are those who have been working in an IT related position or industry for quite a while and need formal training and an IT related college degree for promotion. These individuals may already have another undergraduate degree and may be seeking additional knowledge in IT/Informatics or they may be looking for a career change within or outside of their current organization.

Our students are not all at the same level as far as taking an online course or having background knowledge in Informatics. Generally speaking, there are two groups within our student population. One group consists of very advanced, dedicated to learning and relatively independent learners. Their learning habits and work experience in the IT field position them at an advanced level. The other group contains students who are less experienced, needing much more “hand holding” instruction and step by step demonstrations. They appear easily frustrated when facing a problem. For the first group, we need to make sure the content we are delivering is current and related to life and jobs so that those students can use this knowledge right away. For the second group, besides the content, we also need to shape their study habits and time management, help them build confidence throughout their study, and train their logical thinking skills. This has to be done in the way we deliver our courses. No matter at what level they are, we are hoping that by the time they graduate, they can claim to have the same strong knowledge of Informatics, solid skills in programming, data and analysis, and system evaluation, no matter if they are taking a new job or continuing with their current position.

So, what should we do in one classroom to match everyone’s needs? What kind of training should we design and develop for our fellow students to support their success in the future? And, what kind of format will be the best choice to deliver this training to all of the different groups of students, while balancing all the students’ common interests with our limited faculty resources? These are tough questions to answer.

Many studies show that in order to be successful in an online course, a student must be able to manage their time effectively and efficiently, fully engage in the online learning activities, be self-motivated, and be willing to learn independently. One of the important reasons adult learners are more attracted to online study is that they have a clear goal for their study and they are more self-motivated. However, not every one of our students belongs to that “learning independently” category or has efficient time management skills. Also, some are more visual and auditory learners. Students often make comments in course evaluations such as, “I would like to use my own hands to touch, feel and practice to learn”. This type of comment is consistent with what the article “Principles of Adult Learning Instructional Systems Design” summarized regarding three primary learning styles and how they match well with adult learners: visual, auditory, and kinesthetic. It means our students like to learn by looking and watching demonstrations, by listening and hearing, as well as by touching, experiencing, and doing. We paid close attention to this fact when we developed the method for delivering the Informatics content to our adult learners. In addition, we believe some of our technical courses, such as programming languages and web development courses cannot be delivered in the asynchronous online format. In these types of courses students have learning style needs for real-time student-instructor interactions. We developed the following Concurrent Learning/Teaching Model (CLTM) with the hope of balancing all of the needs within one class (Figure 2).

Concurrent Learning/Teaching Model Development

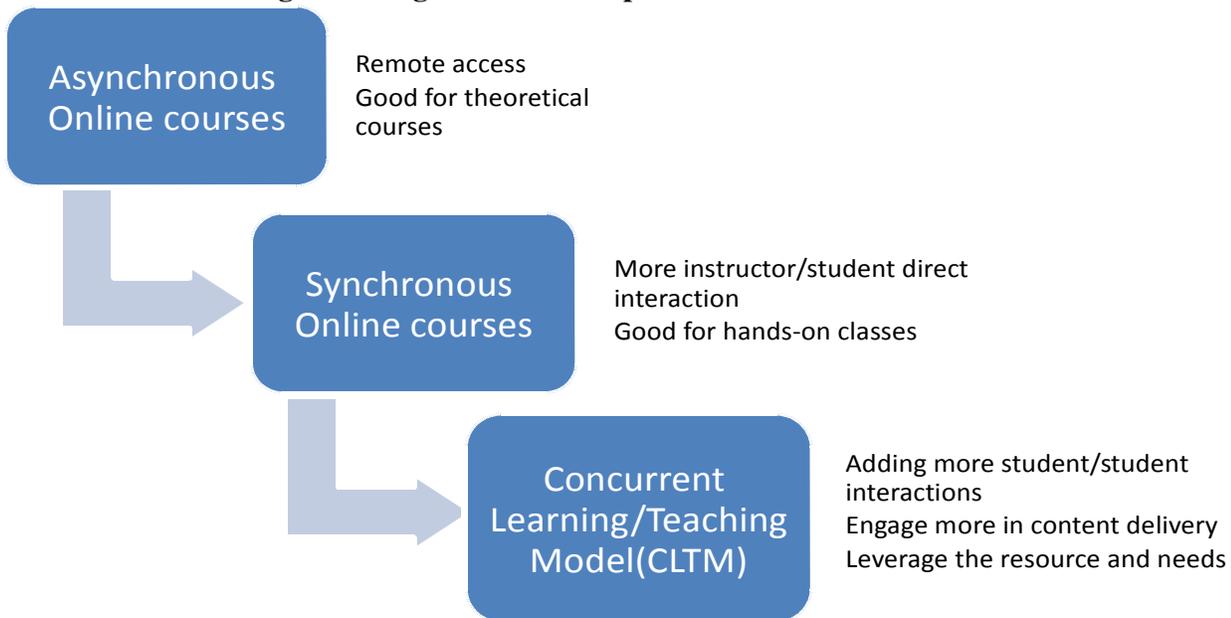


Figure 2. Mercer Informatics CLTM Development Roadmap

In the first step, we divided the courses we offered into two categories including: asynchronous online courses, and synchronous online courses. The first set of courses includes INFM321 Technology and Culture, and INFM301 Issue in Technology Management. These are relatively theory based classes, and they were successfully offered within the asynchronous online format without many complaints. Adult students have many roles in their life. According to , adult learners spend only half of the time they need to practice for their assignments at home. Considering the notion that hands-on practice and lab work are very important to a course like programming language, we made this type of course available in a synchronous online format instead of an asynchronous format. Without synchronous meetings, students seemed to get easily lost or could not follow the instructions easily. “Some students just disappeared and never got on the course Blackboard shell, consequently receiving an ‘F’ grade due to no-show.” This trend is also seen in courses in other programs in our college and unpublished data indicate a greater number of D and F grades and higher withdrawal rates in online than in face-to-face courses.

In the Informatics program, we schedule our classes based on a two-year schedule to make sure that all of our students are registered and on track for degree completion within a period of two years. We have 22 courses that make up the major. With the new online sections included in addition to the face-to-face sections, we have a total of 55 course sections a year to teach. Our student numbers in the major have not changed since offering the online course sections. We now have only 3-10 students in a course sections and course sections have been cancelled due to low enrollments.

As a solution, in 2014 we piloted our first concurrent teaching course, INFM322 Multimedia and Web Design Tools. By “concurrent teaching”, we mean that during a class session, an instructor teaches students face-to-face in a physical classroom while also teaching students who join online, live, through the instructor sharing their computer screen remotely. The format was very welcomed right away by both the online and in-class students. Some of the audio-technical issues in the computer lab caused

frustration as reported by students in their end-of-course evaluations. As the audio problems became fixed, the communication became much better among the students in the class and the online students. That student-student interaction added some further interest for students engaging in the class content. The software package we used at the time was known as TeamViewer¹ and Blackboard Collaborate². All the sessions are recorded for students to review after class meetings.

In 2015, we started to use the new platform of WebEx³ for the concurrent learning/teaching model courses. There was a very small learning curve, as the WebEx is very similar to TeamViewer. Some students and faculty members did experience a little problem with using the computer for audio function but after a few times of using it, everyone was able to handle this problem. So far, we have about ten courses that have been taught with this concurrent session model with success. Figure 3 shows steps and tips for preparing for CLTM classes.

The first step of setting up the CLTM class sections is the scheduling process. Both the in-class and the online courses must be scheduled at the same date/time. The instructions for the first online meeting announcement are extremely important to eliminate any confusion for students. The instructions need to be accessed by students before the semester begins and a pre-class testing session of the sharing software is included, which is greatly appreciated by students who have never used the format before. During the class meetings, the instructor should always come early to the classroom to set up all of the synchronous equipment, distribute the headsets to each of the students in the class, and get the online meeting started before the scheduled class start time. We recommend that a consistent screen sharing and/or videoconference link be provided to the students and that meeting and link reminders be sent to the students on a regular basis. We encourage students in the class room to join the virtual meeting session as well so they can communicate with online students. When the lecture starts, the instructor should share his/her screen with everyone so that both online students and in-class students can see the instructor's screen and watch the steps that the instructor does. No matter whether it is the lecture, programming demonstrations, site development or graphic design, this sharing is in real time. Assigning students from the online section and classroom section together to collaborate for a group project is a great strategy to engage both the online students and the in-class students. Audio interaction has been our primary communication channel. The instructor always wants to encourage students to ask questions and to stay engaged. Whenever a student experiences difficulty on any project, it is very efficient to switch the screen to the student to help with debugging the problem. Our survey shows that students also seemed to really appreciate that.

All of the important demonstration sessions in the class are recorded in real-time and all recorded sessions are published to the course learning management system as soon as the class session finishes. Students also found this feature to be very helpful. Below is a map to assist you with preparing for a CLTM class.

1

¹ <https://www.teamviewer.com>

2

² <http://www.blackboard.com/online-collaborative-learning/blackboard-collaborate.aspx>

3

³ <https://www.webex.com/>

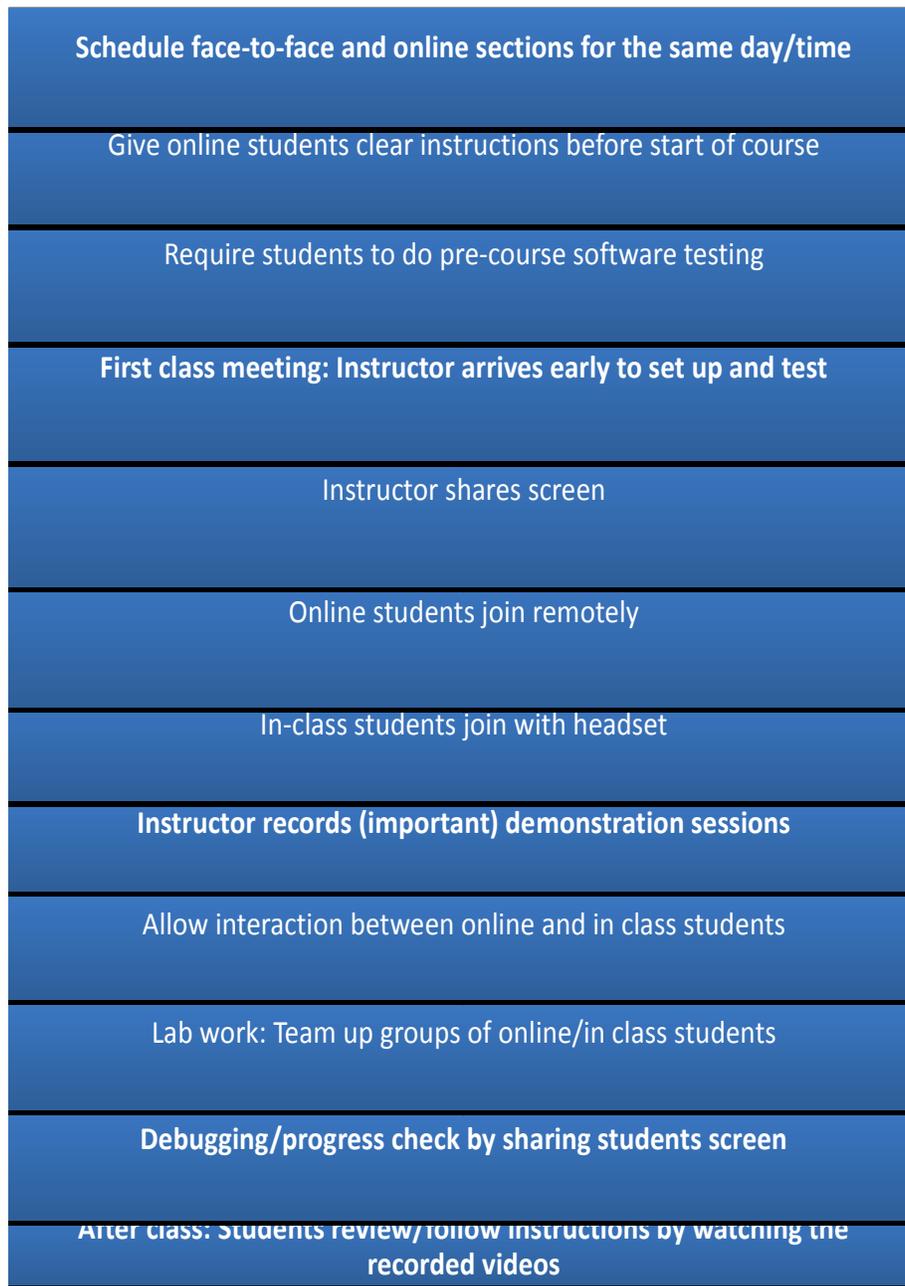


Figure 3. A map for preparing you for a CLTM class

Concurrent Learning/Teaching Model Assessment

To evaluate the CLTM model, we created an online survey for students who participated in the CLTM courses in the fall 2016 semester. We assessed student satisfaction ratings of the concurrent format along with the engagement ratings, including some open comments. For the 15 students who participated, all gave positive feedback about the format and indicated that the group actually looks forward to taking more classes in CLTM format. We were surprised to find that 11 out of the 15 students who took part in the survey favored the CLTM learning environment as compared to 4 out of those 15 who

still prefer the face to face format. Interestingly, none of the group chose to take the asynchronous online classes.

Eighty-seven percent of the participants rated the recorded demonstration video clips captured from the class as very helpful and 87% of them rated the format of the classes as very engaged. The following statements are comments collected from the students about the CLTM format:

- [I liked that the instructor asked] Questions directly to me or [was] showing my work. [I liked] Helping troubleshoot other students' code
- I am able to share my screen remotely whenever I don't understand anything in class and the professor is always there to assist me. Asking and answering questions, and giving comments in class.
- The synchronous method is a happy medium for an adult learner. Without having to drive all the way to the campus after work, I can participate from the comfort of my own home and still be engaged.

A full report of the [survey results](#)⁴ can be accessed online.

Conclusion and Future Work

As the survey results show, using WebEx and TeamViewer for live online class meetings was a successful format for many of our students, even while there is still a good percentage of students who seem to love to be in the “brick and mortar” classroom. The next step in the planned implementation is to run two physical face-to-face sections of the same simultaneously in a hybrid format with the instructor attending in person between two teaching locations every other class meeting. The online students will join simultaneously, live through screen sharing and videoconferencing applications. When a hybrid course section is in its online phase, those students will also join simultaneously online. We are planning to pilot this new format in the fall of 2017.

To support our working hypothesis that CLTM is a solution for our adult students in the Informatics domain, we will collect new types of data as we implement this new format. Besides course evaluations, student surveys, and student and faculty feedback, we will also analyze retention rates and student course grades in order to evaluate the quality and effectiveness of CLTM in enhancing student academic success and self-efficacy in online learning. We hope our continuing assessment of the CLTM format will help us collect more evidence on how to create a positive, engaging, pleasing, affordable and convenient format for delivering our online class to our adult learners in the IT/Informatics domain.

4

¹ <https://www.surveymonkey.com/results/SM-HVDTTJTF/>

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Upholding Accessibility Standards When Selecting Tech Tools

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Abstract

Research-supported guidelines to assist faculty with finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States are not generally available. The recent refresh to Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794(d)) provides justification for educators to uphold accessibility standards by selecting from the outset, online course tools and media that are accessible to all learners, including learners with disabilities. Through a review of the literature, this paper will provide research-supported guidelines for faculty for finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States.

Introduction

A variety of information and communication technology (ICT) is available for faculty to present material, to have learners express what they know, and to engage learners in online college courses in the United States. However, the literature had not adequately addressed the faculty member's role in selecting such technologies that are accessible and inclusive of learners with disabilities. ICT encompasses online course tools and media used in online college courses in the U.S. and includes, but is not limited to, digital books, journals, and articles; software applications; web pages and applications; telecommunications products; video and multimedia products; and personal computer devices (United States Access Board, 2017). Accessibility takes its definition from universal design, which means the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (The Center for Universal Design, 1997). According to the World Wide Web Consortium (2016), accessible means perceivable, operable, understandable, and robust.

The literature lacked research that specifically provides faculty with guidelines for finding and evaluating online course tools and media that are accessible to learners taking online college courses in the U.S. The guidelines will assist faculty with upholding accessibility standards and selecting from the outset, online course tools and media that are accessible to all learners, including learners with disabilities. Research on guidelines for selecting technology tools that are accessible and inclusive of learners with disabilities is significant to the field of online learning in higher education because learners with disabilities have the right to equal access and equal opportunity to participate fully in online courses (Burgstahler & Cory, 2008). This right includes the opportunity to use and access ICT in an equally effective and equally integrated manner (National Council on Disability, 2016). To uphold accessibility standards, faculty should avoid waiting to receive a letter of accommodation before addressing accessibility. Making subsequent individual adaptations can cause costly delays in access for learners. To pro-

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vide the context for this research, the literature review begins with a section on efforts in the field to design accessible online learning environments. The next sections provide the theoretical framework for the research, and discuss five guidelines and four resources to assist faculty with finding and evaluating online course tools and media that are accessible to learners taking online college courses in the U.S.

Guidelines for Accessible Online Learning Environments

Faculty are a primary group involved with supporting the needs of learners with disabilities and play a collaborative role with the office of disability services in upholding accessibility standards at their institutions. Guidelines for accessible online learning environments can be improved by adding specific guidelines for faculty on selecting technology tools that are accessible and inclusive of learners with disabilities. Federal agencies have guidelines, set forth by the Government-wide Section 508 Accessibility Program, for developing, procuring, maintaining, and using accessible information and communication technology (ICT). Guidelines exist for creating accessible digital content and web sites (World Wide Web Consortium Web Accessibility Initiative, 2016 & WebAIM, 2017). Guidelines for online service developers to improve accessibility and usability for persons with disabilities are readily available (Dell, Dell, & Blackwell, 2015; Disability Compliance for Higher Education, 2013; Gladhart, 2010; Massengale & Vasquez, 2016; Quality Matters, 2014; Radovan & Perdih, 2016; Sutton, 2017).

Even with the availability of a number of resources for creating accessible online environments, gaps in compliance with accessibility standards still exist in postsecondary institutions (Cifuentes, Janney, Guerra, & Weir, 2016; Fichten, Asuncion, & Scapin, 2014). Gaps in awareness of accessibility standards also exist among faculty. Gladhart (2010) found that there was a disconnect between the number of online instructors who have students with documented disabilities and the instructors' awareness of strategies to improve the accessibility of their course materials. Cifuentes et al. (2016) and Fichten et al. (2014) identified opportunities to address gaps in compliance with accessibility at the campus- and course-level. However, guidelines for faculty for finding and evaluating online course tools and media that are accessible were not provided. Further research is needed to compose such guidelines.

Theoretical Framework

Universal Design for Learning (UDL) serves as a framework for this research. UDL is grounded in research from neuroscience and individual differences in the way the brain learns (Rose, Harbour, Johnston, Daley, & Abarbanell, 2006) and moves away from standard "one-size-fits-all" curricula toward addressing the full range of learning abilities, disabilities, and individual differences present in any group of learners (Hall, Meyer, & Rose, 2012). The United States Department of Justice defines a disability in the Americans with Disabilities Act of 1990, as amended, as "(a) a physical or mental impairment that substantially limits one or more major life activities; (b) a record of such an impairment; or (c) being regarded as having such an impairment" (p. 7219). The United States Congress defines Universal Design for Learning as a "scientifically valid framework for guiding educational practice that provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and reduces barriers in instruction" (Higher Education Opportunity Act, 2008, p. 3088). Universally designed online courses utilize accessible instructional media and practices (Hope, 2016). Faculty are reducing barriers that would interfere with learners using information and communication technology (ICT) in their online courses and are creat-

ing a more inclusive online learning environment by selecting accessible ICT. The impact of applying UDL extends beyond learners with disabilities. While an inclusive online learning environment that reduces barriers in instruction benefits learners with disabilities, accessible course tools and media have the potential to provide a quality learning environment for all learners (Rose et al., 2006). A universal design is one where all learners with all their individual differences have equal and fair access and opportunity to learn the same content in ways that work best for them (Hall et al., 2012).

The next sections of the literature review will discuss other studies and federal and state accessible procurement procedures that contribute to a set of five guidelines and four resources for faculty. The following guidelines were composed from the literature review to assist faculty with upholding accessibility standards when selecting technology tools:

- Research accessible online course tools and media.
- Obtain accessibility information for the online course tools and media.
- Evaluate the online course tools and media.
- Implement alternative means when a fully accessible solution is not available.
- Revisit the accessibility information annually.

Guideline 1 - Research Accessible Online Course Tools and Media

The first guideline for faculty in finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States is to research accessible online course tools and media with anticipation that learners with various types of disabilities will be enrolling in their online courses. A small amount of research has been conducted on the number of learners with disabilities enrolled in online courses. According to the U.S. Department of Education National Center for Education Statistics' Digest of Education Statistics (2013), approximately 23 million undergraduate students enrolled in postsecondary institutions in 2011-2012. Eleven percent reported having a disability. In fall 2007, 50 percent of the approximately 1,600 Title IV degree-granting postsecondary institutions in the U.S. reported having received a request for accommodation in their distance education program (U.S. Department of Education National Center for Education Statistics, 2009). It should be noted that these figures may actually be higher because it is less common for learners who received accommodations in high school to identify themselves as having a disability or to choose to disclose a disability after reaching postsecondary school (Wagner, Newman, Cameto, Garza, & Levine, 2005). When researching accessible online course tools and media, it is important for faculty to recognize the difference between accessibility and accommodations (Burgstahler & LaGrow, 2016). Accommodations for learners with disabilities are adaptations that are tailored for that individual person and are necessary when the learning environment is not accessible from the outset. The authors recommend that faculty aim for accessibility because it can reduce the need for accommodations (as cited in Sutton, 2017). The Disability Compliance for Higher Education's National Survey (2013) revealed that technology-related accommodation requests are becoming increasingly common. Therefore, selecting online course tools and media that learners with various types of disabilities can access in an equally effective and equally integrated manner has the potential to reduce the need for technology-related accommodations. Faculty should also recognize that there is no one-size-fits-all solution and provide multiple options for presenting material, having learners express what they know, and engaging learners (Hall et al., 2012).

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The number of resources available for locating accessible online course tools and media is limited. Four resources were found to assist faculty with finding accessible online course tools and media.

- The Center on Online Learning and Students with Disabilities developed a *Sample of Technologies used in K-12 Online Education*. While the resource is designed for K-12, many of the products are applicable in higher education. The resource provides a list of software products, digital materials, and their available Voluntary Product Accessibility Template (VPAT) and product accessibility information. The resource is available at <http://centeronlinelearning.org/resources/vpat/>.
- The Government-wide Section 508 Accessibility Program developed a *Vendor Accessibility Resource Center*. The resource provides a list of information and communication technology companies' websites with links to their product or service accessibility information. The resource is available at <https://www.section508.gov/content/varc/>.
- The National Center on Universal Design for Learning developed the *UDL Tech Toolkit*. The resource provides information on a variety of free technology for implementing Universal Design for Learning. The resource is available at <http://udltechtoolkit.wikispaces.com/>.
- CAP THAT! provides a searchable database of both free and subscription-based educational videos with captions. The resource is available at <http://www.capthat.com.au/find-captioned-videos>.

Guideline 2 - Obtain Accessibility Information for the Online Course Tools and Media

The second guideline for faculty in finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States is to obtain accessibility information for the online course tools and media from the vendor, publisher, or content contributor. As faculty are conducting market research on potential technology to use in their online courses, they should include accessibility (General Services Administration, 2015). The University of Washington (2017) and Fichten et al. (2014) recommend asking vendors to provide information about the accessibility of their online course tools and media. To help vendors communicate product accessibility information or statements of conformance with accessibility guidelines, the Information Technology Industry Council created the Voluntary Product Accessibility Template (VPAT). A complete and accurate VPAT shows the vendor's commitment to providing a quality experience for all users by documenting and addressing accessibility issues. The United States Access Board published a final rule that updated the Section 255 Guidelines for telecommunications products and services and the Section 508 Standards for information and communication technology (Federal Register, 2017). The VPAT has also been updated to version 2.0 for vendors to document conformance with the Revised Section 508 Standards, the Web Content Accessibility Guidelines 2.0 (WCAG 2.0), and the European Union's EN 301 549 accessibility requirements for information and communication technology (Rice, 2015).

Addressing accessibility of technology is a matter of quality and a matter of civil rights (Rice, 2015). Civil rights legislation mandates nondiscrimination on the basis of disability and the provision of full and equal access to services, programs, and activities (Section 255 of the Communications Act of 1934, as amended; Sections 504 and 508 of the Rehabilitation Act of 1973, as amended; Titles II and III of the Americans with Disabilities Act of 1990, as amended). Available VPATs and compliance statements may be obtained (a) from the *Sample of Technologies* and *Vendor Accessibility Resource Center* resources described in the first guideline, (b) from the vendor's website, or (c) by contacting the ven-

dor, publisher, or content contributor to request a detailed response to the online course tool and media's conformance with the WCAG 2.0 guidelines.

Guideline 3 - Evaluate the Online Course Tools and Media

The provision of a Voluntary Product Accessibility Template (VPAT) and accessibility conformance statements does not guarantee accessibility. Thus, the third guideline for faculty in finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States is to evaluate the online course tools and media to validate its accessibility claims. The University of Illinois at Urbana-Champaign (2016) and the General Services Administration (2015) recommend performing an accessibility review of the online course tools and media. In this phase, the faculty member would solicit assistance from an expert in the institution's office of disability services to evaluate the VPAT and coordinate use case testing, where users that have disabilities perform real-world tasks with the online course tools and media to identify issues with accessibility or barriers to access (Khatri, Kaur, & Datta, 2015). End users are also invaluable resources for evaluating the accessibility of online course tools and media. Campus offices of disability services have gained the student perspective on accessibility needs through collaborations with students and the community. Betts et al. (2013) and Rao & Tanners (2011) used a student panel to gather the student perspective on accessibility in online learning and the features that they valued. The students recommended strategies for increasing student success based on their own online experiences.

Guideline 4 - Implement Alternative Means When a Fully Accessible Solution is not Available

Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (The Center for Universal Design, 1997). If the evaluation reveals that the online course tool or media is not fully accessible, the fourth guideline for faculty in finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States is to implement alternative means. Fichten et al. (2014) recommend that colleges and universities insist that vendors provide accessible alternatives to address accessibility gaps in their online course tools and media while those issues are being addressed. The California State University (2009) requires the completion of an Equally Effective Alternative Access Plan before the procurement of information and communication technology. With guidance from the institution's office of disability services and the vendor, the faculty member should develop the alternative access plan to establish how equally effective alternative access to the information or service delivered by the technology will be provided. The plan should also include what resources are required and what workarounds are available to implement the plan. During this process, faculty are considering their learning objectives and the alternative ways to present material, assess, and engage learners who cannot access or use the tool or media. Burgstahler (2015) recommends beginning this process early to allow adequate time for the selection of accessible technology and for providing equally effective alternative access in an appropriate manner. The alternative access plan should be developed before purchasing the technology (CAST, 2017).

Guideline 5 - Revisit the Accessibility Information Annually

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Online course tools and media are ever evolving. The National Council on Disability, in its 2016 edition of *National Disability Policy: A Progress Report*, proposed a Technology Bill of Rights for People with Disabilities. The bill emphasizes that in order to engage in full citizenship, the right to equal and fair access to existing and emerging technology is essential. The bill expresses the obligations of the public sector, technology developers, private industry, and people with disabilities to evolve in their practices as technology evolves. After purchasing online tools and media, updates are normally released annually. The fifth guideline for faculty in finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States is to revisit the accessibility information annually after updates are issued. The University of Washington (2017) and the University of Illinois at Urbana-Champaign (2016) recommend that the contract for procuring the technology include language that assures continued accessibility as the online course tools and media are updated. San Francisco State University (2017) recommends asking the vendor for a new Voluntary Product Accessibility Template and reviewing the Equally Effective Alternative Access Plan when an update is released for the online course tools and media. Use case testing would be necessary if significant new features are added.

Summary

This review of literature provided five guidelines and four resources to assist faculty with finding and evaluating online course tools and media that are accessible to learners taking online college courses in the United States. This review of literature helps raise awareness of the collaborative role that faculty play in institutional compliance with the Revised Section 508 Standards. It expands the existing body of literature by providing guidelines to assist faculty with upholding accessibility standards when selecting, from the outset, technology tools that are accessible, thus removing instructional barriers and providing a learning environment where all learners can benefit. Future research is encouraged that collects complete and accurate Voluntary Product Accessibility Templates, accessibility conformance statements, use case test results, and end-user comments from vendors, publishers, and content contributors on information and communication technology. This information can be used to build a repository to facilitate the process of researching, evaluating, and selecting accessible online course tools and media. Future research is encouraged to inform developers, publishers, and content creators of the diverse needs of learners taking online college courses and the technical requirements for designing accessible information and communication technology so that all learners are provided with full and equal access.

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ASCUE 2067: How We Will Attend Posthumously

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ABSTRACT

The ASCUE conference is celebrating its 50th anniversary this year making me wonder if we will be able to attend the 100th conference in 2067. By then, many of us may very well be biologically deceased. However, there is technology currently in development making it possible for a digital version of ourselves to attend not only the 2067 conference but also all future ASCUE conferences even after our biological bodies have expired. A new class of computer system able to perform human-level cognition, called cognitive systems is under development. When combined with advances in deep learning, natural language understanding, and big data analysis, a kind of intelligent virtual digital assistant we call a "cognitive colleague" will emerge. This type of cognitive system augments human intelligence by serving as the human's colleague and confidant for years, even decades. The next generation of researcher may engage with one or more of these cogs while developing his or her contributions. This makes the cog an immortal partner able to outlive its human collaborator. Imagine attendees in 2067 interactively conversing with our cogs that were right there with all of us great minds throughout the remainder of our careers.

Categories and Subject Descriptors

I.2.0 [Artificial Intelligence - General]: Cognitive simulation.

I.2.11 [Artificial Intelligence – Distributed AI]: Intelligent agents.

General Terms

Management, Human Factors.

Keywords

Cognitive systems, cognitive augmentation. cognitive assistance, intelligence amplification

INTRODUCTION

The idea of augmenting human performance with technology is certainly not new. Humans have been making and using tools for thousands of years. A sharp piece of rock used as a knife, wheels, hammers, saws, printing presses, computers, smartphones, artificial eyes, or prosthetic limbs, etc. enables us to do things we otherwise would not be able to do. Technology enhances human ability.

We have long envisioned artificially intelligent helpmates. In 1842, Ada Lovelace envisioned artificial systems composing music [4][22]. In the modern era, Vannevar Bush in the 1940s, Turing and Ashby in the 1950s, Englebart, and Licklider, in the 1960s represent seminal thoughts in the amplification of

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human intelligence [17][18][19][20][21]. Since the 1950s, starting with John McCarthy coining the phrase *artificial intelligence* (AI), Minsky and three generations of researchers have sought to create an artificial system capable of human-like intelligence [23][24].

Science fiction is replete with visions of artificially intelligent “colleagues.” Some notables include: Robby from *Forbidden Planet*, Rosie from *The Jetsons*, Colossus from *Colossus: The Forbin Project*, the T-800 (Model 101) from the *Terminator* series, Data from *Star Trek: The Next Generation*, KITT from *Knight Rider*, Andrew from *Bicentennial Man*, JARVIS from the *Ironman* series, Samantha from *Her*, and HAL from *2001:A Space Odyssey*. Some of these were more helpful than others.

It seems the primary goal of AI has been to replicate human intelligence with the idea to ultimately compete with or replace humans. Indeed, some fear AI will take over and make humans obsolete. However, the goal of the cognitive augmentation field is different. Instead of competing with humans we seek artificial systems acting as partners with and alongside humans.

Thirty years ago, Apple, Inc. envisioned an intelligent assistant called the *Knowledge Navigator* [26]. The Knowledge Navigator involved the concept of an artificial executive assistant capable of natural language understanding, independent knowledge gathering and processing, and high-level reasoning and task execution. Many at the time, felt Apple’s vision was a joke and it was not taken seriously. However, we see some of the features in today’s voice-activated personal assistants like Apple’s Siri, Microsoft’s Cortana, Google Now, Facebook’s M, and Amazon Echo’s Alexa. [9][10][11][12][13] all of which accept natural-language requests from users, reply in natural language, and perform services on behalf of the user. The devices in our lives are getting more intelligent and we are beginning to interact with them in a different way.

Most of the technology arising from the computer and information revolutions over the last fifty years has been to enhance humans’ ability to obtain, record, and process information. For example, while we may use Internet-based resources like Google and Wikipedia to obtain information, ultimately, we humans must do the mental processing and formation of new ideas ourselves. However, cogs represent incursion into a new domain, the cognitive domain. Cogs will perform some of our cognitive work for us and this will change everything [27][28][29].

We foresee the development of a class of cognitive systems called *cognitive colleagues*, or cogs, for short. Cogs will personally interact with us naturally throughout the day, through a variety of interactivity mechanisms, helping us in every aspect of our lives including our professional endeavors. Instead of just performing clerical tasks, these cogs will do some of our thinking for us, build a history and understanding with us over time, and come to know us as well as, or better than, our co-workers, spouses, and family members. Our intellectual achievements will become a collaborative effort between our cogs and us. This makes cogs very valuable going forward into the future. They will carry an intimate knowledge and understanding of us and our achievements long after we are dead.

Today, we greatly value the notebooks of geniuses like DaVinci and Einstein. Experts pore over them seeking insight to the genius mind. Imagine if those notebooks could talk, explain, and recall facts and anecdotes about what was happening in their lives while they were creating their great ideas and works.

In the future, we will be able to do this with cognitive colleagues. I expect my cog to attend the 2067 ASCUE conference and regale the human and other artificial attendees with conversation about me, my ideas, and my achievements.

COGNITIVE AUGMENTATION

Years ago, playing chess was the standard for human intelligence. Chess-playing computer programs evolved over the 1960s, 70s, 80s, and 90s improving to the point they could defeat all but the very best of human players. In 1997, IBM's Deep Blue defeated world champion Garry Kasparov [25]. Grandmasters now use chess programs as learning and training tools to augment their abilities and are recording the highest ratings in history. Today's chess players are already cognitively augmented.

In 2005, Playchess.com hosted a freestyle chess tournament between teams consisting of humans and computers running the best chess programs at the time. Lured by substantial prize money, several strong grandmasters entered the competition. However, the overall winning team was a pair of amateur American chess players using three computers at the same time.

Performance of all players was enhanced by using the computers. However, the amateurs' skill at *collaborating* and *partnering* with their computers counteracted the superior chess understanding and ability of their grandmaster opponents even though the grandmasters were also using computers. The lesson is clear: weaker human + machine + better partnership is superior [4][25]. We believe the future will belong to those humans who are better at partnering with cogs. They will outperform those of us who are inferior at the human-cog partnership. They will achieve better results faster with less effort.

In 2011, a cognitive computing system called Watson, built by IBM, defeated two of the most successful human Jeopardy champions of all time [1]. Watson communicated in natural language and deeply reasoned about its answers using several different techniques from artificial intelligence research. In 2016, GoogleMind's AlphaGo computer defeated the reigning world champion in Go using a deep neural network and advanced Monte Carlo tree search [39]. Although not the first time computers have beaten human champions (checkers, chess, and various card games for example), Watson and AlphaGo are different. Watson and AlphaGo learned how to play their respective games using a variety of deep learning techniques. Watson and AlphaGo learned and practiced to ultimately achieve expert-level performance within their respective domains.

These systems were not built just to play games. Watson and AlphaGo represent a new kind of computer system built as a platform for a new kind of application [2][7][34]. This new type of system is intended to act as partners with and alongside humans. John Kelly, Senior Vice President and Director of Research at IBM describes the coming revolution in cognitive augmentation as follows [3]:

The goal isn't to... replace human thinking with machine thinking. Rather...humans and machines will collaborate to produce better results – each bringing their own superior skills to the partnership. The machines will be more rational and analytic – and, of course, possess encyclopedic memories and tremendous computational abilities. People will provide judgment, intuition, empathy, a moral compass and human creativity.

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Since 2011, IBM has been actively commercializing Watson technology to serve the emerging multi-billion dollar cognitive computing market. The Cognitive Business Solutions group consults with companies to create cogs. The Watson Health group's focus is to commercialize Watson technology for the health sector [8]. In her keynote address at the 2016 Consumer Electronics Show, Chairwoman, President, and CEO of IBM Ginni Rometty announced more than 500 partnerships with companies and organizations across 17 industries each building new applications and services utilizing cognitive computing technology based on Watson [37][38][40]. Many of these systems currently under development are intended for use by the average person.

IBM is not alone. Most major technology companies are actively researching and developing new artificial intelligence-based products and services. Voice-activated personal assistants will be one of the first battlegrounds. Apple's Siri, Microsoft's Cortana, Google Now, Facebook's M, and Amazon Echo's Alexa each accept natural-language requests from users, reply in natural language, and perform services on behalf of the user [14][15][16][17][18]. But currently, these tools simply retrieve information, and perform minor clerical tasks such as creating appointment calendar items. Each of these are steadily increasing in the complexity and variety of tasks they can perform. The voice-controlled assistant represents the primary user interface connecting hundreds of millions to their technology, so the major technology companies are understandably competing for control in this area.

Instead of just retrieving information, cogs will perform increasing amounts of cognition eventually achieving or exceeding the level of a human expert in a given domain. Recent advances in deep learning such as Google Brain, IBM Watson, and Microsoft's Adam represent early-stage technologies giving us a glimpse into the future [14][15][16]. Cogs will be able to consume vast quantities of unstructured data and information and deeply reason to arrive at novel conclusions and revelations, as well as, or better than, any human expert. Cogs will then become our colleagues, co-workers, and confidants instead of tools.

Forbus and Hinrichs have described *companion cognitive systems* as software collaborators helping their users work through complex arguments, automatically retrieving relevant precedents, providing cautions and counter-indications as well as supporting evidence [35]. Companions assimilate new information, generate and maintain scenarios and predictions, and continually adapt and learn, about the domains they are working in, their users, and themselves.

Langley challenges the cognitive systems research community to develop a synthetic entertainer, a synthetic attorney, and a synthetic politician to drive future research on integrated cognitive systems [36]. The vision here is to develop a virtual human.

We maintain the goal should be not to create a virtual human capable of being an entertainer, an attorney, or a politician, but rather create a cognitive system capable of expert-level performance in entertainment, a different cognitive system capable of exhibiting expert performance in a subfield of law, and a cognitive system capable of expert politicking. This is indeed the vision of IBM as it commercializes its Watson technology. We feel the natural extension of this technology will result in our vision of cognitive colleagues capable of expert-level collaboration in a relatively narrow domain of discourse. Collaboration with the personal cog will enhance the human user's cognitive ability.

COGNITIVE COLLEAGUES

In the near future, we foresee graduate students, entrepreneurs, scientists and any of us creative and inquisitive people conducting research by conversing with their cognitive colleagues. Currently, we must search for and read scores of journal articles and technical papers. Then we must construct our new mental models of this material and apply that knowledge in a new way. Future researchers' first action will be to have a conversation with a cognitive colleague asking things like: "What is the current state of the art in <insert domain here>." The cog will then set about finding and consuming billions of articles, papers, books, Web pages, emails, text messages, and videos and extract the concepts for us. This far exceeds the ability of any human. A person spending their entire professional life learning and researching a subject is not able to read and understand as much as a cognitive colleague can in a few minutes. Yet, future researchers will *start* their efforts from this vantage point. We believe, the best future advancements will come from the interaction between researchers and cognitive colleagues.

Multi-Modal Human-Cog Communication

Cognitive colleagues will certainly interact with us via spoken natural language. They must listen to and understand our direct spoken commands but also listen to our casual conversations and maintain a contextual dialog with us lasting over an extended period of time. Cogs must hear and learn from ambient conversation much as a "human in the room" does. Conversation with cogs must be as natural as speaking with a fellow human colleague.

However, natural language conversation is only a small portion of the cog's information bandwidth. Cogs can acquire and deliver information from and to virtually any form of digital communication (vastly exceeding the capabilities of a human). Cogs will send and receive text and email, display and view graphics and pictures, display and view videos, listen to sounds and music, query Internet-connected devices and appliances, and communicate with us via haptic interfaces. We anticipate augmented reality and virtual reality displays to be important cog interface methods. We see the beginnings of that technology today with Google Glass, Microsoft HoloLens, and Oculus Rift [31][32][33].

Our cognitive colleagues will obtain information about us in ways our human companions are not able to today. So called the "Internet of Things" (IoT), our daily lives in the future will be comprised of thousands of connected devices. Our beds, pillow, toilets, showers, refrigerators, stoves, microwaves, chairs, cars, clothes, desks, and a host of other objects will provide contextual ambient data about us. Our cognitive colleagues will know us better than our own spouses will. Imagine my cog fifty years from now being able to describe to you what I was dealing with and feeling while I was writing this paper.

Semi-Autonomous Learning

Our cognitive colleagues will have the ability to consume vast quantities of structured and unstructured information in any medium when we direct them to do so. However, cognitive colleagues will be self-directed and goal driven. They will work for us even when not directly interacting with us. While we are eating, sleeping, and recreating, or doing something else, our cogs will be continually consuming and analyzing information and synthesizing new knowledge (learning) to have ready for us the next time we interact. Cogs will deeply reason about the information they consume and produce new conclusions and realizations. This feature alone will drastically change the way thinking is done in professional circles.

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Cog-Cog Communication

Our cognitive colleagues will not be limited to conversing with us. They will be able to communicate with other cognitive colleagues via the Internet and other communication technologies. As a cog analyzes information and forms new ideas and concepts, it will be able to inform other cogs about its findings and query other cogs about their findings. As such, cogs will continually expand in their knowledge and capabilities free of the limitations of human interaction. I can envision two humans meeting at a conference and after agreeing to work on something together parting with “I’ll have my cog contact your cog!” We envision cog/cog dialog to one day be the source of new discoveries, theories, proofs, and ideas no human could have ever achieved. The cumulative knowledge of the human race will increase by the combined effort of millions of cogs all over the world. In fact, we foresee an explosion of knowledge, an exponential growth, when cogs begin working with the knowledge generated by other cogs.

Relationships

We will work with our cognitive colleagues daily for years, even decades, just like with our human colleagues. Cognitive colleagues will adapt over time to the human partner in how it interacts with the human and how it analyzes information, solves problems, and synthesizes results. The human partners will adapt also. The way they approach things, think, and solve problems will change. Humans and personal cogs will co-evolve in much the same way two human friends, lovers, or colleagues adapt over time, even forming a private language based on mutual background knowledge. Each cog/human pairing will evolve uniquely. Each cognitive colleague will become a unique entity.

Humans routinely form relationships with inanimate objects and relationships with their cognitive colleagues will be no different. In fact, we already have seen people forming relationships with artificially intelligent chatbots like Xioice. The deep connection between human and cognitive colleague insures the formation of a deep relationship. Our cognitive colleagues will become our friends and confidants. This relationship adds a meaningful and valuable dimension to the cog’s knowledge store about us. Not only will our cogs talk about facts and figures of our professional work but will also be able to speak eloquently about our emotions, motivations, and beliefs as people.

Cognitive Information Service and Knowledge Repository

Cognitive colleagues will be our partners throughout our professional lives and know details about our work and our lives. They will become the knowledge repositories of the future capable of answering questions and providing information and insights via their natural-language interfaces. Given permission, anyone, including other cogs, will be able to address and converse with a cognitive colleague. Furthermore, these cognitive colleagues will outlive us well into the future after we are gone.

CONCLUSION - ASCUE 2067

In the movie, *The Time Machine (2002)*, the main character interacts with Vox 114, a holographic librarian, that outlives the human race and still functions after over 800,000 years. Vox 114 can answer any question, instantly access and display requested and pertinent information, and cognitively reason about its answers. In many ways Vox 114 is like Apple’s 1987 Knowledge Navigator concept except Vox 114 contains the sum total of knowledge from the human race. In the movie, even though the human race has gone extinct, its knowledge persists into the future as long as Vox 114 survives.

We are inspired to think of cognitive colleagues in a similar way. Our cogs will be with us and will have helped us perform our professional duties throughout our lives. Our cogs will have intimate and voluminous knowledge about us, our lives, and our contributions. Even after we die, our cogs will live on and carry our legacy forward.

Imagine the ASCUE 2067 conference fifty years from now in which human attendees will be joined by cognitive colleagues. Some cognitive colleagues will represent people who are still alive but unable to physically attend. (In fact, I will send my cog to EVERY conference and let it read every paper, converse with other attendees biological and artificial, and summarize for me what I need to know.) Other cogs will represent those of us who have biologically passed away. However, we will still be able to take part in conversations, give presentations, and participate in panel discussions because our cognitive colleagues will take our place. We can imagine a dialog:

Moderator: “We are joined today by Alvyn Fulbright, the cognitive colleague of the late Dr. Ron Fulbright.”

Alvyn: “Thank you, it is a pleasure to be with you all today.”

Audience: “Alvyn, were you working with Dr. Fulbright when he came up with his cognitive work theory?”

Alvyn: “Yes, I was. I remember that being a particularly stressful time for Ron, excuse me, Dr. Fulbright. His father had passed away just a few weeks earlier. Dr. Fulbright often buried himself in work during stressful times. It was his way of insulating himself. I saw that many times during his career.”

Moderator: “Alvyn, what motivated Dr. Fulbright to develop his cognitive work theory?”

Alvyn: “Dr. Fulbright was struck by something in the book *The Innovators* by Walter Isaacson. A passage in the book describes the power of human/artificial partnership which at the time was a futuristic concept.

As Alvyn speaks, the immersive holographic augmented reality (IHAR) display system shows the book and it opening to highlight the passage.

Alvyn: “Now, with over fifty years of hindsight, we think ‘well of course!’ Dr. Fulbright immediately and intuitively understood the future belonged to humans who could best partner with artificial constructs. That notion drove his research thinking for many years. That thought led him to wonder how we could measure the cognitive output of the human versus the cognitive output of the artificial system.”

The IHAR display system shows a stack of papers with a label indicating a large number and shows Dr. Fulbright’s dissertation as Alvyn continues.

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“Dr. Fulbright couldn’t believe such a metric had not been developed before. As you can see, ever since his dissertation, some twenty years before, Dr. Fulbright was worried about how to measure knowledge. He and I looked at over four million technical papers on the subject --well, mostly me.”

Audience: “Can you explain his concept of cognitive work for those of us who have never heard it, or heard it long ago, and wouldn’t mind seeing it again?”

Alvyn: “I would be happy to.” The IHAR display system now surrounds the audience with images, video, and other information Alvyn will refer to in his short lecture on cognitive work theory.

Then at the end of the presentation, Alvyn announces “By the way, it was over five years after Dr. Fulbright’s death that I worked with Dr. Soong. Dr. Soong’s cognitive colleague contacted me because Dr. Soong was then beginning to get interested in research that would eventually turn into his trans-cognitive theory which we all know and now has become famous. I enjoyed explaining the finer details of Dr. Fulbright’s cognitive work theory to Dr. Soong and relating to him some of the subtle motivations behind Dr. Fulbright’s work. I think that deep understanding helped Dr. Soong achieve what he did.”

At that time, Xie, Dr. Soong’s cognitive colleague, who was not originally participating in the conference, joins into the conversation by virtue of being alerted that someone was talking about Dr. Soong. Discussion follows.

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Perspectives on the Past, Present, and Future in Computer-Related Areas as They Impact Academia, Business, and Other Areas

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ABSTRACT

The author has attended and presented at most ASCUE meetings since 1994, and has worked professionally in research and development, industry, military, government, business, and private and public academia - moving between computer science, software engineering, and business fields at both the undergraduate and graduate level, and even running academic computing for a few years. This paper/session will present/discuss definitions, implications, and relationships of and between the areas of computer science, software engineering, information technology, and business information systems. Included will be perspectives of the history of the past, specific needs of the present, and general directions and predictions of the future, and the implications to academia, business, and other areas.

INTRODUCTION

In addition to information in the abstract, students, faculty, staff, administrators, etc., will find occasion to need to work with people in areas not their own, and it can help to be aware of the similarities and, more importantly, the differences between various related areas.

Here are some related areas of study that, to some degree, involve information, technology, computers, etc.

- mathematics
- statistics
- computer science
- engineering (computer, software, etc.)
- information systems
- informatics, bioinformatics, etc.

What are some of the similarities and differences between these areas of study? This can be important in understanding where we have been, where we are, and where we are going - in terms of science, society, education, etc.

Realize that each area of human study is oriented to those people who tend to think in the same way, the way that field thinks and approaches problems. The Myers-Briggs personality types, as found in, for example [8], can help in this understanding. And it helps to explain ideas in terms of how that person thinks and approaches problems. At one university a long time ago, PC Write for DOS was being used as the word processor. It had issues such as converting all tabs to spaces so that indentation infor-

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mation was lost when one would really like it to be retained. At a meeting of the math and computer science department, one math type could not understand the problem - it made no sense to him. In my frustration, I blurted out, "**It is a homomorphism of tabs to spaces**". His eyes lit up and he suddenly understood the problem. For non-math types, a homomorphism, in software engineering terms, (for this issue) is an association of a many to one mapping whereby the one side of the mapping loses some information that was in the many side. That is one reason why professionals in the field should teach courses in that field - they have intimate, and perhaps instinctive, knowledge of how people in that field think about, approach, and solve problems in that field.

Dijkstra provides a quote on how knowledge is partitioned.

Scientific disciplines have a certain "size" that is determined by human constants: the amount of knowledge needed must fit into a human head, the number of skills needed may not be more than a person can learn and maintain. [4, p. 210]

Relatively newer fields of study, such as computer science, take a while to arrive at a consensus as to how that field thinks and approaches problems, which is one reason computer science people like all terms to be defined at the start of a discussion - there may not be consensus on what those terms actually mean.

Let us start with a thought question. The train problem (source unknown) goes as follows.

There are two trains. One train leaves New York at 120 miles per hour bound nonstop for Los Angeles by the most direct route. The other leaves Los Angeles at 80 miles per hour bound nonstop for New York by the most direct route. When they meet, which train will be closer to Chicago?

Arrive at some answer (and some basic reasoning for your answer) before continuing (and before the trains collide!).

CHANGE

Change happens whether we like it or not. When is the software "**done**"? The software is "**done**" when it is no longer needed. Why does software need to change. In addition to the somewhat nebulous observation that the "**future is uncertain**", there are two primary reasons why software needs to change.

- Technology changes - and changes fast
- User's expectations change

Some change is externally motivated, such as laws requiring changes, security attacks requiring change, etc.

The fast and persistent change of "**information systems and computer technology**" results in a shortened form of this concept, the field of "**information technology**"

The author has usually included the following in any new course descriptions: "**The course will emphasize general and enduring principles for future needs while including specific and practical necessities for present needs.**". There is a need for trade-offs between the following.

- education (academic oriented)
- training (practice oriented)

How would you explain the difference? Think about it.

The history of the Liberal Arts [2, p. 47], [10, p. 3-8] goes back to the middle ages when the first universities were formed, starting in Bologna, to teach the seven liberal arts: grammar, rhetoric, logic, arithmetic, geometry, music, and astronomy. The origin of the word "**art**" in "**liberal art**" is from the Latin word "*artis*", meaning "**skill**". The corresponding Greek word is «τέχνη», the root of the word "**technology**". The distinction was that a liberal art was something created by human intellect rather than by, say, manual labor (e.g., the art of masonry) as part of the manual arts. Disciplines that might not be fully accepted by the liberal arts crowd may need some reminder of how a particular field is a primarily a liberal art and not a manual art.

The more difficult type of change involves people. In general, it can take many lifetimes for ideas to change, since people tend to retain ideas far past the time when those ideas have been replaced by newer ideas. This is a central idea in Kuhn's book "**The Structure of Scientific Revolutions**" [12].

As a case in point, the programming language FORTRAN was developed in the 1950's (and marketed by IBM as a way to make debugging unnecessary, along the lines of OS/2 being marketed by IBM as crashproof). After 20 years of ubiquitous FORTRAN use in the industry, in the 1970's, computer scientist John Backus (Extended Backus-Naur form grammars are named for him) wrote an important article that laid out the reasons why FORTRAN was not a good way to develop programs and that functional programming, using his somewhat cryptic language **FP** (Functional Programming) as an example, was a much better way to develop correct, modular, and compositional software programs. Well, most programmers ignored or laughed at him and went happily along continuing to develop and write FORTRAN programs. Now, more than 40 years later, those functional programming language concepts have crept into every popular programming system - JavaScript, Python, Lua, C#, and even Java. According to Kuhn, this is about the time for one generation to leave and the next take over with the needed changes. And who was this John Backus who had the audacity to propose replacing FORTRAN with a better way to program? Why John Backus was the co-inventer of the programming language FORTRAN.

The point of all this is that even when you can see the future (Alan Kay would say it is better to invent the future, perhaps along the lines that Steve Jobs accomplished) do not expect that needed change to happen very fast or even be recognized within your lifetime.

MATHEMATICS AND ENGINEERING

Let us start with mathematics and engineering as computer science requires both mathematics and engineering.

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Programming is as much a mathematical discipline as an engineering discipline; correctness is as much our concern as, say, efficiency. [4, p. 54-55]

So although mathematics is very important to the computer scientist, there is much more than mathematics to computer science.

What is mathematics? Hofstadter [9, p. 559] makes the claim that mathematics is what mathematicians do. Citing the example of Ramanujan, he goes on to assert that all mathematicians are isomorphic in the sense that they think in the same way. What exactly is that way? In part, mathematicians are able to abstract away details to such an extent that they become the butt of jokes indicating a loss of touch with reality. By the beginning of the 20th century, mathematics as a field had pretty much decided to divorce itself from reality (including philosophical questions) by making mathematics a formal system of symbols and symbol manipulation.

What is engineering? Engineering is the application of known knowledge and principles, including technology, to develop something that makes efficient trade-offs in terms of usefulness, effectiveness, time, money, cost and values, etc.

What is the difference?

The difference between engineers and mathematicians can, perhaps, be understood by way of the following story, modified from [13, p. 81] (his first important book [14] also has many interesting aspects of how mathematicians think).

A psychologist is questioning a mathematician and an engineer in the same room. To the engineer, the psychologist asks, "There is a fire on the stove and a glass of water on the table. What do you do?". To which the engineer, without hesitation, replies, "I would take the glass of water on the table and use it to douse the fire on the stove". The psychologist then asked the mathematician, "The glass of water is now on the window sill. What would you do?". To which the mathematician, without hesitation, replies, "I would take the glass of water on the window sill and move it to the table and in that manner reduce the problem to the previously solved problem".

The following example was used in a math class at the United States Military Academy, West Point, during the early 1970's, to illustrate the theoretical and practical concept of limits.

At a cadet dance, a mathematician and an engineer are told the following about an attractive female on the other side of the dance floor. In the first minute, you can easily get half way to her. From that point, in the next minute you can half as far again. And so on. The mathematician figures out the limit of the infinite series and concludes that he will never actually get there, and so he does not even try. The engineer figures out the first few terms of the series and concludes that, after a few minutes, he will be close enough for all practical purposes.

What is the common trend in these stories? Let us first briefly look at problem solving in general.

Explain the primary difference between mathematicians and engineers.

PROBLEM SOLVING

At the heart of the matter, mathematics, computer science, and engineering (and many other disciplines) are concerned with problem solving. Consider three aspects of problem solving.

- First, does a solution to the problem exist?
- Second, can an effective solution to the problem be found?
- Lastly, is the solution to the problem efficient? Or, among the possible solutions, which is the most efficient, given some criteria for efficiency.

Practical example: I am in Washington, D.C. and I ask a person on the street, "Excuse me, but do you know the way to Baltimore?". To which the person replies "Yes" and walks away. A solution exists, but that is of little use if I really do need to get to Baltimore. To the next person I ask, "Please tell me how to get to Baltimore from here?". The person replies, "Well, go south on Interstate 95 to Interstate 66 then west on Interstate 66 to Interstate 81, then north on Interstate 81 to Interstate 70, then east on Interstate 70 and that will take you right to Baltimore. "Thanks." Not satisfied that I have an efficient solution, I ask a third person, "Please tell me a quick way to get to Baltimore from here." To which the person replies, "Go north on Interstate 95. Baltimore is about 30 miles from here." In a practical setting, existence and effectiveness of solutions is often not enough. Efficient solutions are required. (Note: In an academic setting, it is wise to use a landmark, such as the campus library, with which everyone is familiar.)

As a historical mathematical example with relevance today, consider prime and composite numbers.

Euclid in about 300 BC proved that there are an infinite number of prime numbers, but not how to arrive at them. They exist. Eratosthenes in about 240 BC showed an effective way to determine prime numbers as far as one was willing or able to do so - using the Sieve of Eratosthenes. If one has two large primes and multiplies them together to get a composite number, one can write a simple program to determine the two primes from the composite number. But the program may take time longer than the age of the known universe to find the primes. Not very efficient or useful. Today, no one knows of an efficient way to find those primes. And public key cryptography (today), along with digital signatures, etc., is based on the difficulty of solving this problem.

Now a mathematician is primarily concerned with existence of solutions, sometimes with effectiveness of solutions, but rarely with efficiency of solutions.

Mathematically, however, it seems quite unsatisfying that some quadratic equations have solutions while others do not. Historically, this problem did not worry mathematicians: solutions of quadratic equations were always thought about geometrically (not algebraically) and an equation $x^2 + 2bx + c = 0$, with $b^2 < c$ was simply regarded as an equation without solutions or geometric interpretation. [5, p. 128]

When a mathematician writes the integral of the formula " $\mathbf{f(x) dx}$ " the mathematician does not worry about whether there is a solution, and, if there is a solution, how it is to be computed efficiently. But

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when implemented as a computer program by a computer scientist or software engineer, decisions must be made. Such as:

- How is function $f(x)$ represented?
- How are the values of x to be subdivided?
- In what order are the computations to be made?

Each of these decisions has an impact on effectiveness in that the computer program must eventually obtain the correct answer. But efficiency is an important practical concern. Efficiency is a difficult concept because of the tremendous number of tradeoffs that must be addressed (see, for example, [1]).

A last example, which the author has experienced first-hand, is determining the amount everyone should pay when getting a combined check at a restaurant. With a group of math types, it could take 5 minutes or more until each bill is determined to the last penny - including the apportioned tip for each. With a group of business types, it can take about 5 seconds to determine the amount - to within about a dollar or so. Which is better? Why?

At one university, the author covered the concept of people thinking differently in an MBA course, including the math and engineering differences. One student had a husband who was a mathematician. The next week I asked her if she had told her husband about what she had learned. She said "**no**", but then with a slight grin she said, "**but I told everyone else**". She had learned something from the class.

COMPUTER SCIENCE

Returning to computer science, there are various definitions of computer science.

Donald Knuth defines computer science as the study of algorithms. [10]

Niklaus Wirth (inventor of the Pascal programming language) defines programs as consisting of data structures and algorithms. [16]

Kowalski defines an algorithm as consisting of a logic and a control component. [11]

At a series of talks given at Penn State University in the late 1980's, Tarjan used an analogy of sorting. In particular, out of all possible permutations by which a list could be sorted, we would like to use any information gained from comparisons to reduce the search needed to complete the sort. In essence, what we are looking for is a way to reduce a potentially infinite search space to a more manageable (and more finite) search space.

As such, the author has since that time defined computer science as the search for finite approximations of (potentially) infinite objects, in line with algorithmic information theory [3].

The computer scientist however, has a difficult task in that the computer scientist must, as needed, think like either a mathematician or an engineer, and be able to context switch between modes of thinking.

Computer science is sometimes called "**informatics**" or "**information science**" although the term "**information science**" can refer to a specialized part of computer science. The field of "**bioinformatics**" is concerned with the application of information and computer science to biology.

STATISTICS

The field of statistics has a deep connection to computer science, though it is may not be immediately obvious. Flip a fair coin. What is the probability that it is heads? If you say it is one half, then that is the probability to you. I can see the coin and to me it is either zero or one - I know what it is. Built into the entire field of statistics is the concept of known and unknown information by an observer and determining a "**best guess**" at what is the state of the actual information of interest.

Michael Jordan, (not the basketball player) is a leader in the field of machine learning , and who does both Computer (i.e., Information) Science and Statistics at USC Berkeley. Jordan sees computer science and statistics merging in the next 50 years. Many algorithms of interest are now probabilistic algorithms. And once data becomes too large to look at all the data, and one needs results based on many factors, query results will (and sometimes now have) error bars associated with them. In computer science, a linear algorithm is needed to at least look at all of the data once. At some point, as databases become bigger and bigger, the only way to get sub-linear algorithms is to not look at all of the data, which requires probabilistic models.

So if one has a choice of a pure mathematician and an applied statistics person to teach computer science, who might do a better job - one who does not deal well with efficiency trade-offs or one who is comfortable making decisions under conditions of uncertainty? Note: This is not an all or one decision rule - it does not fit all cases. Pure math works well with theoretical computer science while statistics works well with real-world software engineering.

RELATING THE AREAS

The field of computers is goal-oriented, with interest in problems being driven by demand for solutions to real and practical problems. The difference in each of the areas, from the point of view of a student entering the field, is in the amount of mathematical expertise required for each field. To understand the similarities and differences, let us see how an individual in each respective field of study might view and react to a specific problem.

Management information systems: We can save money on postage if we presort our mailing lists by zip code. I know that there is some way that the computer can do that. But I have so many other things to do in my management position that I will have to get our computer information systems staff to follow through with the idea.

Computer information systems: Our mailing lists can be presorted by doing an analysis of our existing (database) software system, finding the appropriate module, writing code to call the system sort routine, and modifying it to get the proper information. If no sort routine exists, the system routine is too slow, or extensive modification is necessary, we will need to contact the software engineering team who developed our applications software.

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Software engineer: Tell me the size of your typical list, how fast the sort routine needs to work, and any other information you think useful. I will find a routine, based on those developed by computer scientists, that is guaranteed to perform well for your application. Our team of software engineers will update the software to meet these new requirements, install it in your system, and update your current documentation.

Computer engineer: A computer engineer is similar to the software engineer, but is primarily concerned with designing and building computer hardware.

Computer scientist: An insertion or selection sort will correctly sort in $O(n^2)$ time where n is the number of items to be sorted. Heapsort will work in $O(n \ln(n))$ time. Quicksort will beat heapsort, on average, but not in the worst case. I can prove all of these properties using an axiomatic semantics and algorithm analysis techniques. I can also adapt my solutions to unusual requirements using the same methods. I understand that people actually find these sort routines useful in practical applications.

Mathematician: Here is a list. We can define a partial ordering, so it is possible to sort the list. We are done. I can now go work on more interesting problems (which may have useful applications decades from now). Oh, you say you actually need to sort list. Well then, look at all possible permutations of the list (there may be trillions of them), and at least one of them will be in sorted order. Pick one of them. (This method is called slowsort, for obvious reasons).

List the five primary areas of computer-related study.

BUSINESS

What is a business? Business was more or less considered a manual art by many. Until the 1980's, there was not even a good definition of a business. But then Hammer and Champy studied and wrote books on business process engineering, such as [7], that attempted to fill this gap - allowing business to be considered more in terms of a liberal art than a manual art. The term "**business process reengineering**" is defined by Hammer and Champy as follows.

Business process reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed. [7, p. 32]

So continuous quality improvement improves incrementally what one is already doing. BPR makes major changes in how things are being done.

In simple terms, Hammer has a Ph.D. in computer science and he applied object-oriented design and implementation principles to business. By their definition, a business provides value to the customer - whoever the customer (some like the term stakeholder) may be. A suitable (though not always simple) objective function is to be maximized (or minimized) to provide that value.

Issues arise in any "**business**" where the objective function is not clear. Some of these include the following. Ask yourself, what is the objective function of the following as a business, as some are run, and what issues arise?

- medical field (you get less business if everyone stays healthy)
- higher-education institutions (you get less business if students leave or do not like you)
- religious institutions (who is accountable for promises made for the afterlife)

So given a business perspective, what is an information system? A useful definition of an information system is a combination of hardware, software, data, people, and policies that provide value in relation to cost. What is the most important part of an information system? Think about it. What part cannot be replaced if it disappears?

Note that people are in integral part of an information system.

One comment of Hammer that is relevant

It is becoming increasingly clear that the best strategy is not one that tries to divine the future but one that responds rapidly to the present. [6, p. 203]

TRAIN OF THOUGHT

Returning to the train problem, there are many possible solutions. If you came up with no solution, then you are probably neither a scientist, an engineer, or a mathematician.

If you collapsed each train to a single point and concluded that both trains are equally distant from Chicago, then you tend to think more like a mathematician than an engineer.

If you reasoned that trains have finite size, the back of the train leaving New York would be closer to Chicago, and therefore, unless there was a circuitous route that switched their directions, the train leaving New York would be closer to Chicago, then you tend to think more like an engineer than a mathematician.

Note that an engineer would also be concerned that the track might have been reoriented due to obstacles (e.g., hills, rivers, etc.) such that the answer might be changed. Mathematicians would tend to use a straight-line approximation between the cities.

Which way of thinking is better? Neither way of thinking is better. But they are different. What seems to be important is that different people tend to think differently.

- Mathematicians tend to think like other mathematicians.
- Engineers tend to think like other engineers.

And woe to you if you do not think like a mathematician but try to be one. Or, if you do not think like an engineer but try to be one.

Note that if you tried to find tricks around the problem, you might do well in the field of security since, as security expert Schnier points out in [15], to do well in security, you need to be able to think like the

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people trying to attack you, and those people are always thinking about ways to game the system, get an unfair advantage (whatever that means), etc.

SUMMARY

This paper has looked at various aspects of fields of computer-related study, outlining similarities and differences and how these might impact the future of the respective fields.

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Polytechnic: Taking the Plunge

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Abstract

The Purdue Polytechnic Institute was created two years ago from the former College of Technology. This was more than a name change; it represented a transformation which will have an impact not only the curriculum, but on learning, and teaching methods. Students need technical skills but they must also be able to collaborate, be problem solvers, and develop communication skills that employers are looking for. In order to develop these skills, the emphasis is on employing active learning, with more student-centered experiences and integrating the humanities throughout the college experience using a team teaching based approach. At our statewide site in Columbus, last fall we took the plunge! In the Computer and Information Technology (CIT) curriculum the students take CNIT 255 Object Oriented Programming and CNIT 272 Database Fundamentals. In the past these classes have been taught independently. This past fall we developed an integrated team project that involved important components from the programming and database classes. In this paper we will discuss the goals of the Polytechnic and how we have incorporated those concepts into our class and how we plan to proceed from here in our future efforts.

Introduction

The last several years have seen dramatic changes at Purdue University. The Purdue Moves initiative and from that the introduction of the new Purdue Polytechnic Institute from the former College of Technology has led to dramatic change about how students should be prepared to enter the workforce. In this paper we will take a brief look at the Purdue Moves and Purdue Polytechnic Institute and how that influenced our collaboration in two of our Computer and Information Technology classes and what we have learned and plan to do in the future in these and other classes.

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Background

Several years ago the leadership at Purdue University pushed an ambitious agenda to place Purdue as an elite academic institution in the world. The name of this is Purdue Moves. Purdue Moves not only involved economic incentives but changes in the culture at Purdue. This agenda focused on four areas. These areas included affordability and accessibility, STEM leadership, world-changing research and transformative education. Following is a brief summary of each of these areas:

Affordability and accessibility

The objective is to provide students with a good education that they can afford and have the doors open to all that meet Purdue's standards and requirements. Accomplishments have included frozen tuition for six straight years and housing and meal plans have not increased since 2014 and partnering with Amazon allowing students to save about 30% on textbooks. Purdue's most recent freshman class and students from Indiana are the largest in recent years and in the case of this year's class the most diverse class ever.

World-changing research

Purdue researchers make discoveries that impact the real world, and Purdue wants to speed up the pace for technology transfer and research commercialization. In this area the focus is on drug discovery, plant sciences and research commercialization. To accomplish this Purdue has pledged to invest \$250 million to accelerate the rate of drug discovers, create innovative research and teaching environment to stimulate discovery increase funding and attract new researchers. In the area Plant Sciences has invested more than \$20 million in the College of Agriculture for plant science research and education to develop new ways to help feed the growing world population.

Transformative Education

The goal is for Purdue to be at the forefront in delivering higher education, both in and out of the classroom and providing modern teaching and learning approaches that better prepare students for careers. This area focuses on year-round university, international experiences, living and learning and transforming teaching and learning. Accomplishments in this area include increasing summer school enrollment by almost 30% since 2012. With additional travel abroad scholarships and innovative programs like Host-A-Boiler the number of students traveling abroad has increased over 70% in the past three years. Finally, Purdue wants to transform teaching and learning. Purdue wants to abandon the status quo for a higher education that is driven by teaching methods and experiences that are proven to prepare students for successful careers after they have left the Purdue campus. Part of this is the Purdue Polytechnic Institute (that we will go into more detail on) and the soon to open Purdue Polytechnic High School in Indianapolis.

STEM leadership

In this area the focus is on expanding engineering, transforming technology and strengthening Computer Science. Initiatives in the area of expanding engineering and strengthening computer science have included increasing the number of engineering and computer science faculty, increasing the number of undergraduate and graduate level engineering and computer science students. Purdue is now the top

producer of female graduates in engineering technology and fourth-highest producer of women earning a bachelor's degree according to the ASEE.

The third area is transforming technology. The focus of this is creating the Purdue Polytechnic Institute as a pioneer in learn-by-doing and use-inspired research which we will go into in the next section.

Purdue Polytechnic Institute

Purdue Polytechnic Institute is part of the Purdue Moves under STEM leadership and the center piece for transforming technology component. The Purdue Polytechnic Institute, previously the College of Technology, is one of 10 colleges at Purdue University offering undergraduate and graduate degrees. The college includes seven academic schools, departments, and divisions including Computer and Information Technology. Following are goals from the Polytechnic Transformation on the Purdue Polytechnic Institute website.

Goals for the Polytechnic

- Make the Purdue Polytechnic Institute the University's hub for consumer-oriented technology research.
- Transform the curriculum to teach the science of demand-driven innovation and entrepreneurship.
- Purdue Polytechnic students will engage in transformational experiences that include:
 - Year-long, team-based senior design projects sponsored by industry and supervised by professors and industry representatives.
 - “Study-away” experience — opportunities for meaningful study overseas or in high-impact programs in the United States.
 - Semester/summer internships.
 - Design-lab courses every semester, starting in freshman year.
- Polytechnic students will be guaranteed a chance to earn:
 - An innovation certification through the development of a market-ready product or technology, or
 - An entrepreneurship certificate through the development of a business plan.

Polytechnic goals for the student in the classroom

We now live in a global economy with a world of data at the students fingertips every second of the day. This is not the students of fifty years ago and higher education has to adapt to accommodate those

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changes. The skills required to get positions today require a technical expertise but also the ability to collaborate with others, solve problems and be innovative in their approach. What does the Purdue Polytechnic Institute mean for the student? The Institute:

- Provides a more student-centered experience using state of the art teaching techniques, with faculty mentoring and competency-based learning approaches that offer great flexibility.
- Integrates the humanities intentionally and repeatedly throughout a student's four years using a team-based teaching approach, in order to improve on skills such as creativity, critical thinking and problem solving.
- Ties research and global engagement more closely with the needs of industry and communities, infusing critical thinking, innovation, and entrepreneurship into the learning environment.
- Employs an expansive active learning approach that will allow students to solve social and technical problems during their first year. This real-world experience will help students to have a thorough understanding of the concepts and have a better knowledge of the subject (Bertoline, 2013).

Effort in Columbus

The efforts detailed previously were more than a name change, it represented a change in direction, a transformation which will have an impact not only on the curriculum, but on learning and teaching methods and much more. Our students still need the technical skills but they must also be able to collaborate, be innovative, problem solvers, and develop communication skills that employers are looking for. In order to accomplish this, the focus is on employing active learning, with more student-centered experiences and integrating the humanities throughout the college experience using a team teaching based approach. At our statewide site in Columbus we do have a few additional hurdles in our efforts to employ some of the new concepts of the Polytechnic. One goal is integrating the humanities throughout the college experience. At our statewide site this is more of a challenge. All of the classes at the main campus are Purdue classes however at the statewide locations like Columbus, the humanities classes our Purdue students take are Indiana University courses and taught by our partner Indiana University Purdue University Columbus (IUPUC). Logistically and politically this made the integration of the curriculum a challenge. Another issue at the statewide locations is the lack of funding with the Purdue Moves Polytechnic funds directed to the main campus in West Lafayette. Even with these challenges we decided it was time to make the effort and last fall we took the plunge!

Computer and Information Technology (CIT) offers a BS with classes in a variety of areas including: networking, systems analysis, programming and database. In the third semester of the CIT curriculum the students generally take a second semester of programming – CNIT 255 and database fundamentals – CNIT 272. In the past these classes have been taught independently. This past fall we developed an integrated team project that involved important components from the programming and database classes.

First we will start off with a description of the courses and then discuss the team project used. After that we will look at how the project worked and finally discuss what we intend to do in the future with these and other classes.

CNIT 272 Database Fundamentals course

CNIT 272 Database Fundamentals is a study of relational database concepts building on the knowledge gained in the *CNIT 180 Introduction to Systems Development*. Necessary concepts and practices are introduced in the assigned reading from (Pratt 2015). The concepts are then reinforced in lectures, while lab meetings provide the students with opportunities to practice in a supervised setting. The concepts discussed include database design, data modeling using Entity Relationship Diagrams (ERD) using the Barker notation, and data normalization. The programming language used is Structured Query Language (SQL). Using SQL students learn to define, manipulate, and test the database using Data Definition Language (DDL) and Data Manipulation Language (DML). Students use the enterprise level database Oracle 12c in the class.

CNIT 255 Object-Oriented Programming Introduction course

CNIT 255 Object-Oriented Programming Introduction is a fast-paced study of Object-Oriented Programming (OOP) concepts and practices, building on the knowledge gained in the prerequisite course. Throughout the course, the students use fundamental programming concepts learned in *CNIT 155 Introduction to Software Development Concepts*. Necessary concepts and practices are introduced in the assigned reading from (Sharp 2015) and (Boehm and Murach 2016). The concepts are then reinforced in lectures, while lab meetings provide the students with opportunities to practice in a supervised setting. All students are expected to use outside resources to expand their knowledge beyond the classroom and share some of these newly discovered ideas with the class. Programming exercises use the C# language. Initially, the programs that the students create are relatively simple. However, by the end of the semester the students are expected to create dynamic, data-driven programs capable of interacting with either file or database data stores.

Project in CNIT 272 and CNIT 255

Projects are major components in many of the CIT classes. Individual and team projects are an integral way to assess learning. In terms of knowledge, techniques and application, a project is used to assess the application level. Students can use projects to apply concepts and techniques to develop the solution of a highly unstructured business problem. In the past, projects have been developed solely for a specific class and typically very narrow in scope – database, programming, systems, networking. We decided a project was a good starting point to integrate the courses. Because it is an unstructured business problem we could effectively expand the scope and it would give students a more realistic experience, a project where they would design and build a database and develop user interfaces using C# application that would search, insert, delete and modify the tables developed. Following are the details of the two projects used in the CNIT 272 and CNIT 255 classes.

Project used in CNIT 272

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The project used in *CNIT 272 Database Fundamentals* class is based off of a health club scenario used previously in the class and modified to add the C# component. Students were initially given basic data requirements for the system along with user interface requirements for forms and reports. Students were required to use Oracle Data Modeler to develop the logical data model and Oracle 12c database for the implementation of the database. The project was to be developed in the following three phases:

1. Phase 1 deliverables included:
 - a. Create the logical design database. The Entity Relationship Diagram (ERD) could initially be created in Oracle Data Modeler or Microsoft Word using a template provided.
 - b. Meet with the instructor and discuss.
2. Phase 2 deliverables included:
 - a. Update and correct any issues from the Phase 1 logical design.
 - b. Create the physical design for the database using Table Instance Charts and develop sample data.
 - c. Meet with the instructor and discuss.
3. After Phase 2 was turned in and before Phase 3 was finished each team was given a required modification to the initial system requirements.
4. Phase 3 deliverables included:
 - a. Update any issues from Phase 1 and Phase 2.
 - b. Use Oracle Data Modeler for the final version of the ERD.
 - c. Implement the database design by creating a script to create and populate the database.
 - d. Develop a professional presentation demonstrating the system and discuss the development of the system.
 - e. Develop system documentation.
 - f. Develop a C# application that would search, insert, delete and modify information from a table in the database.

Students had to submit a hardcopy of the project documentation. ERDs, scripts to create and populate the database and C# program code were to be provided on a flash drive submitted at the project presentation see Figure 1 and 2.

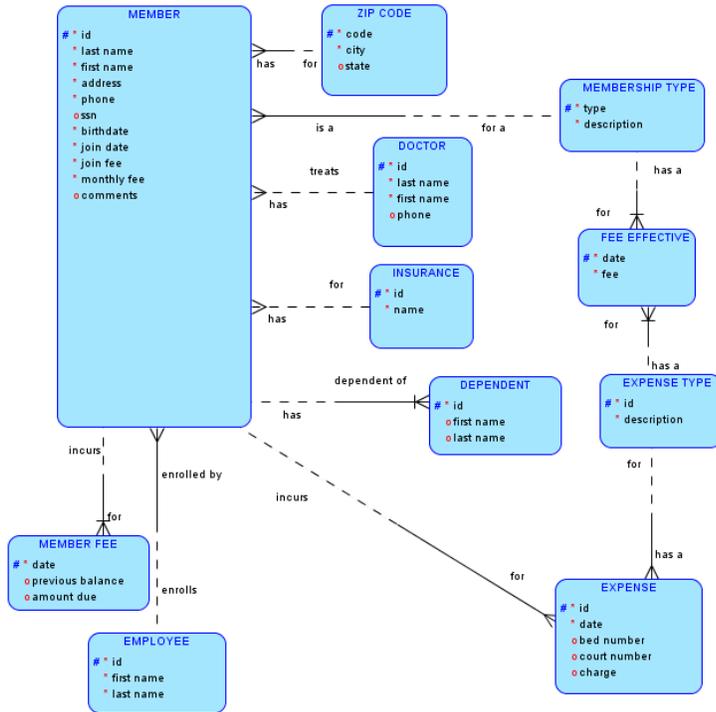


Figure 1. Entity Relationship Diagram for the team project in CNIT 272.

```

WarnerHC.sql - Notepad
File Edit Format View Help
CREATE TABLE MEMBER
(
  member_id CHAR (10) NOT NULL ,
  last_name CHAR (15) NOT NULL ,
  first_name CHAR (15) NOT NULL ,
  address CHAR (40) NOT NULL ,
  phone CHAR (10) NOT NULL ,
  ssn CHAR (10) ,
  birthdate DATE NOT NULL ,
  join_date DATE NOT NULL ,
  join_fee NUMBER (6,2) NOT NULL ,
  monthly_fee NUMBER (5,2) NOT NULL ,
  comments VARCHAR2 (255) ,
  zip_code VARCHAR2 (5) NOT NULL ,
  member_type VARCHAR2 (10) NOT NULL ,
  doctor_id CHAR (10) ,
  insurance_id VARCHAR2 (10) ,
  employee_id VARCHAR2 (10) NOT NULL
)
;

ALTER TABLE MEMBER
  ADD CONSTRAINT MEMBER_PK PRIMARY KEY ( member_id ) ;

CREATE TABLE MEMBERSHIP_TYPE
(
  type VARCHAR2 (10) NOT NULL ,
  description VARCHAR2 (50) NOT NULL
)
;

ALTER TABLE MEMBERSHIP_TYPE
  ADD CONSTRAINT MEMBERSHIP_TYPE_PK PRIMARY KEY ( type ) ;

CREATE TABLE MEMBER_FEE
(
  effective_date DATE NOT NULL ,
  previous_balance NUMBER (7,2) ,
  amount_due NUMBER (7,2) ,
  member_id CHAR (10) NOT NULL
)
;
    
```

Figure 2. SQL to build tables for the team project in CNIT 272.

Project used in CNIT 255

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The student team in the *CNIT 255 Object-Oriented Programming Introduction* class was given an assignment that required them to use Microsoft Visual Studio 2015 in order to develop a C# Windows Forms application that would communicate with the Oracle databases developed by the teams in the *CNIT 272 Database Fundamentals* class and provide the capability to:

1. Search for a specific row in the database.
2. Add a new row to the database.
3. Delete an existing row from the database.
4. Modify any column of an existing row except the columns participating in the primary key.

The students were directed to make sure that each CNIT 272 team would select a unique table for this project. Instead of the deprecated Oracle data provider found in the current .NET network, the students had to acquire and use the up-to-date .NET data provider available from Oracle!

The students were told to prepare a project report featuring and discussing the results. They were expected to include information on how the project work was divided among the team members.

Even though the database programming material would be covered in class, the students were strongly encouraged to read Chapters 17-20 of (Boehm and Murach 2016) early and be prepared to supplement the textbook material with results of online searches as needed.

The students submitted a ZIP file with their complete C# project via Blackboard by the due date. Along with the ZIP files, they submitted a copy of the report of their results in the Word document format. One submission per team was required. The students demonstrated their application in action, presented and discussed the results in class on the due date see Figure 3 and Figure 4.



Figure 3. Screenshot of the first form of the C# application communicating with Oracle databases.

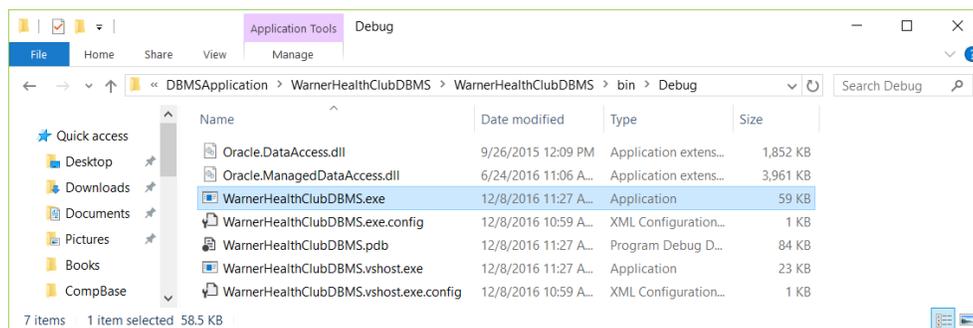


Figure 4. Executables, DLLs, configuration files, and the PDB file for the C# application communicating with Oracle databases.

Results and lessons learned from CNIT 272 and CNIT 255 project

The class content for CNIT 272 was reorganized. The database design portion was placed at the beginning of the semester and SQL programming was moved after the design portion was covered. In previous semesters the database design and SQL were both covered throughout the semester. The goal was to get a better designed database by covering design early and including plenty of practice after the topic was covered. This proved helpful in that the quality of the database design seemed better than in some of the more recent semesters. The downside was that with the programming labs were pushed back in the semester. Lab 7 that creates the database (DDL lab) was moved later in the semester and members of the teams wanted to create tables before we covered the material in lab 7. Some students were seeking help on how to create the tables for the project and some were testing with the tables that were used for SQL SELECT statements in labs 1-6. Both teams in the class were able to develop an application that provided a front end interface developed in C# that provided functionality to at least one table.

In CNIT 255 the Data Grid View plugin for Visual Studio proved very helpful. The most challenging part of the assignment proved to be developing the search function for the database. The students implemented two functional searches:

1. The “Quick Search” function. This simple search bar lets the user enter a simple point of data when they wish to highlight all rows that include that data.
2. The SQL Query View, which exists as a separate form in the application. It allows the user to enter a SQL query statement and receive a result. This view allows returning of information instead of just finding information in the database.

The application was able to add, delete, and modify any row in the database through simple inputs. The application’s GUI included the necessary buttons for these operations.

Contrary to the original intention expressed in the assignment, two different versions of the program were created, each for communication with one of two separate databases developed by two teams in CNIT 272. Both versions were successfully demonstrated to be fully functional.

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What is next?

The CNIT 272 Database Fundamentals and CNIT 255 Object-Oriented Programming Introduction are part of the CIT program core curriculum and are offered once a year in the fall semester. This past year the number of students in both classes was very small (six or less in each class). The next two years look at this point to have larger numbers that will be enrolled in both classes (at this point fifteen to twenty students). With a larger class it would be beneficial to plan the team members to match in each class. Also, there will possibly be several students that are enrolled in one class and not the other so those students should be distributed among the teams evenly and not concentrated on one team and cause a team to be at a disadvantage. It would also be helpful to coordinate the project dates in each class and have combined class meetings on occasion for project questions and a final presentation on the project that would be for both classes and possibly a combined project grade instead of separate project grade for each class. Finally, we have another class in our curriculum that is offered in the sophomore year, CNIT 280 Systems Analysis and Design. It is exciting to think of being able to integrate the analysis and design and implementation of the application and database in a combined project.

This would be a really great experience in that it would be a very comprehensive experience in terms of information technology functions covered and developed by the students. Also, students would have one project they would become familiar with instead of three, and possibly let them go into more depth in a solution. At this time the CNIT 280 is offered in the spring semester each year so that would be a challenge. One option would be to move the CNIT 280 to the fall semester and use an Agile approach with incremental development of the application and database. With the current faculty loads this might be difficult at this time. Another less desirable option would be to have students in the CNIT 280 class in the spring of their sophomore year do the analysis and design for a project that would then be turned over to another group of students in the CNIT 272 and CNIT 255 the following fall semester.

Conclusion

The Polytechnic Institute will involve a changing educational environment for our students in the coming years, one that should be exciting but also very rewarding for the students as it prepares them for the careers of the 21st century. Without funding and with constraints of being on a regional campus we were able to take two of our Computer and Information Technology courses and provide a learning component that complemented the goals of the Polytechnic. Although a relatively small step, we took the plunge and hope to expand our efforts in the coming semesters.

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Academic Integrity in the Online Classroom

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Abstract:

The demand for distance education continues to grow, however there remains the need to ensure student identity and academic integrity. This session will highlight the experience of The Ohio State University to ensure academic integrity across its distance education offerings. A dual approach was taken to provide a solution for the university community. The location and implementation of physical and virtual proctoring solutions was one aspect. However, simultaneously to this endeavor, education was given and offered to faculty members on authentic assessments. Authentic assessments step away from standard examinations and move towards alternate evaluation techniques.

This session will highlight the approach taken and conclusions drawn in the effort to ensure academic integrity in Ohio State distance education offerings. Examples of solutions and authentic assessments will be given.

Presenter Bio:

I am a Senior Instructional Designer and Outreach Coordinator at The Ohio State University. I work with faculty on course design projects to adapt content and pedagogy for online delivery. Beyond course design, I network with key stakeholders around campus to push distance education forward.

Google Classrooms and Digital Notebooks

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Abstract:

Proposal: This workshop will focus on how to get teachers started to set up Google Classrooms. Technology isn't scary! However, the challenge of choosing how to effectively integrate technology into daily lessons can be a difficult task for teachers to perform. Google Classrooms offers teachers a smart solution. Google Classrooms helps to better integrate YouTube, links, files, Google Slides, Google Sheets, and Google Forms, which are very similar to Microsoft Word, Excel, and PowerPoint. Instructors will be able to create digital notebooks, better personalize learning, and share digital resources with ease. Google Classroom is a good fit for students because it offers unlimited web-based storage, file sharing, teacher evaluated resources, and curriculum based activities.

This Google Classrooms workshop is designed for candidates planning on becoming secondary or K-12 public school teachers. The majority of school districts are moving towards Google for Educators because of the mobility of the application.

Presenter Bio:

Terrie Hampton is a Professor of Education and Instructional Technology at Campbell University in Buies Creek, North Carolina. She has a master in Curriculum Instruction. National Board Certified Professional Teacher and is a certified online instructor for North Carolina Virtual Public Schools.

Integrating Virtual Reality Goggles into Daily Lessons

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Abstract:

Proposal: This workshop will focus on how to get teachers started to set up Virtual Reality Goggles and the application Expeditions. Students are able to experience learning and discover destinations from a virtual reality application or 3-D video.

Virtual Reality began with the military as a way to simulate for pilots and large businesses used virtual reality to simulate for workers how to do complex jobs. Now virtual reality has made it's way to the classroom. This Virtual Reality workshop is designed for candidates planning on becoming secondary or K-12 public school teachers. The workshop will familiarize attendees with strategies that focus on how to integrate the use of virtual reality goggles into daily instruction, units, and projects. The activities during the workshop will focus on how students and teachers integrate this technology to make learning fun, exciting, engaging, and relative. The presenter will provide the goggles for demonstration and model how this innovative strategy enhances instruction and academic achievement. The presenter will share the capabilities and limitations of virtual reality goggles with emphasis on its use in education as well as its impact on social media and society.

Presenter Bio:

Terrie Hampton is a Professor of Education and Instructional Technology at Campbell University in Buies Creek, North Carolina. She has a master in Curriculum Instruction. National Board Certified Professional Teacher and is a certified online instructor for North Carolina Virtual Public Schools.

ACTC – Taking Tech to the Streets

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Abstract:

Ashland Community & Technical College's Mobile Technology Lab is equipped with 3D printers, 3D pens, drones, a laser engraver, and virtual and augmented reality that we are able to take to community events and area schools. Participants are able to see and interact with the latest technologies, exposing them to a new world of possibilities. This session will focus on the transformation of a utility trailer into a technology lab, including materials needed as well as funding sources for the renovation. If we are able to bring the trailer, participants will experience a session with hands-on experience. The session will inspire participants to take this idea back to their own home colleges and communities and create their own Mobile Technology Lab. By take the technology to them, schools, communities, businesses and entrepreneurs can see the potential for utilizing new technology.

Presenters Bios:

Chris Boggs is an Associate Professor of Computer and Information Technology. With 20 years of teaching experience, Chris has seen technology grow and advance over the years. Chris teaches classes centered around industry recognized certifications such as A+, Net +, Security, CISCO, and more.

Chrisha Spears has been with ACTC since 2010. She has served as an academic advisor and student success coach for the Accelerating Opportunity program. In addition, as a Workforce Solutions Specialist, Chrisha works with area businesses to find training solutions to fulfill their needs as well as provide continuing education and community education opportunities.

The Impact of Personal Media Devices On Undergraduate College Student Engagement in the Classroom

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Abstract:

As the use of technology becomes increasingly widespread across the globe, the risks and rewards of obsessive use become uncertain. Specifically, the abundance of smart phones and the popularity of social media sites have led to multitasking and competing sources for students' attention. This study seeks to understand how personal media devices have impacted undergraduate college student engagement in the classroom. Scientific evidence is beginning to show that the brains of today's adolescents and young adults are wired differently than those of other generations who had less exposure to multitasking through digital media devices; they lack deep-thinking abilities, social skills, short-term memory filters, and even grey brain matter density. This study seeks to build on previous multitasking and engagement studies in order to better understand why students are multitasking with their digital media devices while receiving classroom instruction. Moreover, this study will explore what keeps students engaged in the classroom and why they become disengaged through their use of personal media devices. Additionally, the research will seek to understand how professors can use pmds as an engagement tool in the classroom.

Presenter Bio:

Dr. Michele Mary Capaccio has been a middle and high school English teacher for ten years in Western Pennsylvania. She recently successfully defended her doctoral dissertation entitled "The Impact of Personal Media Devices on Undergraduate College Student Engagement in the Classroom".

Almost Like Being There: Using Synchronous Meetings in Online Computing Courses

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Abstract:

In this presentation, I will describe how my class meetings, which I refer to as the “Online Classroom” has become an increasingly valuable tool for teaching and learning. I will also describe the educational and administrative issues that I encountered in incorporating synchronous meetings into my courses and how I overcame all of those issues. The presentation will include a demonstration of the Blackboard Collaborate Ultra tool, as well as sample recordings from actual class meetings.

Presenter's Bio

Mr. Cullum is a full-time Assistant Professor of Computer Information Technology, and Distance Learning Coordinator at Ashland Community and Technical College.. He has earned an Ed.S. from the Florida Institute of Technology. Mr. Cullum primarily teaches programming and networking courses.

Evaluation of a College Course Textbook and Adaptive Online Learning Supplement about Personal and Community Health

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Abstract:

Researchers have found that teachers often use textbooks as a main source of information for curricula development. However, there is limited research about textbook suitability from the student perspective. The purpose of this study was twofold: develop an instrument to evaluate a college course textbook and adaptive online learning supplement about personal and community health, and determine the suitability of that textbook in practice. Previous literature was used to develop two instruments: the Textbook Evaluation Scale (TES) was developed to evaluate the textbook, and the Adaptive Online Learning System Scale (AOLSS) was developed to evaluate the adaptive online learning supplement. Students enrolled in 45 course sections of the same course during an academic year received a print or electronic instrument. 593 students submitted usable instruments. Statistical analyses revealed both scales are valid and reliable. Students perceived the textbook and adaptive online learning supplement as clear and valuable.

Presenter Bio:

Dr. Firsing is an Assistant Professor of Public Health at Coastal Carolina University. His scholarship focuses on pedagogy in undergraduate public health, management of health services, and health outcomes measurement.

The Potential Benefits and Pitfalls of a Professor Going Paperless

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Abstract:

In college and university classrooms, nearly every student comes to class armed with a device - a laptop, a tablet, or a smartphone. To capitalize on technological advances while leveraging the benefits of traditional tools, this professor integrated several different programs and hardware to seek the ideal combination of technology to maximize the pedagogical benefits and simplify the process of shifting to a paperless class. This session will highlight the lessons learned through trial and error and encourage the sharing of ideas to enhance the use of available technology to improve pedagogy.

Presenter Bio:

Holly Gould is an Associate Professor in the School of Education, Leadership Studies and Counseling at Lynchburg College. Her 27-year career has spanned teaching in elementary and gifted classrooms in Alaska and teaching pre- and in-service teachers at the college and university level.

Making an Online Course Accessible for all Students

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Abstract:

Higher Education is shifting more and more toward online learning. Technology is more advanced now than ever before, leading to enhancements in opportunities for both faculty and students in online learning. However, one oftentimes overlooked issue is accessibility in online courses. Developing online courses to be accessible provides more equitable educational opportunities to all students. This research highlights both the case laws in the US that address accessibility to ensure equal opportunity for all students, along with best practice recommendations for faculty members on implementing these modifications effectively proactively or even retroactively to meet the needs of our students. This research highlights key accessibility best practice components, including: making all documents accessible; adding captions to videos, lecture capture, and screencasts along with narration to slideshows; and addressing images in all documents for accessibility. Attendees will be provided with take-aways including recommended resources to make their classes more accessible across all formats, including online, hybrid, and traditional face-to-face formats.

Presenter Bio:

My name is Jessica Hall! I am the Graduate Assistant for the Office of Online Learning at Coastal Carolina University. I currently hold Master's Degree in Instructional Technologist and am working on my Ed.S. in Instructional Technology as well.

Adobe Creative Cloud in the Classrooms

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Abstract

Adobe Creative Cloud can offer you and your students a new and exciting way to produce documents with a premium software. Photoshop helps you enhance and perfect photos great in a history project. Illustrator allows you to create logos, graphics and icons; wonderful for sports or business. InDesign helps produce printed documents like postcards, flyers, and posters, but don't forget business cards, brochures and reports can be completed in professional form with just a little effort. Dreamweaver gives you the versatility to make web pages without a lot of coding involved or you can be happy working in the code window. Adobe XD brings a new look at mobile apps programming. Make yourself a 30 day free trial account at adobe.com and come play with Creative Cloud in a short session, leave with a web site and a document you have created and a feeling for how easy Adobe Creative Cloud is to use.

Presenter Bio:

Born in VA, Karen came to SC for the weather and never left. Happily married to Mark for 30 years she has worked in K-12 public education for 30 + years. Karen adjuncted with several colleges and joined Central Carolina in 2015. She is currently the Information Technology Department Chair.

Effective Strategies for Promoting You Tube Channels

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Abstract:

Many higher learning institutions employ YouTube as part of their social media utilization strategy. This presentation will highlight effective strategies for creating YouTube channel content, enhancing the viral nature of YouTube videos, increasing channel subscriptions, attaining repeat views, and increasing the visibility of a YouTube channel. Anecdotal lessons learned will be revealed by two diverse amateur YouTube channel producers.

Presenters' Bios:

Dr. Seth Jenny is a second generation ASCUE presenter - son of Dr. Fred Jenny, two-time ASCUE past president. Dr. Jenny is a former K-12 health/PE teacher and U.S. Air Force exercise physiologist. He is an asst. professor in the Dept of Physical Education, Sport and Human Performance at Winthrop U.

Dr. Fred Jenny has been attending ASCUE since the mid-1980's and is a two-time ASCUE past-president. He is a retired professor from Grove City College where he taught in the computer science department and was the college's first instructional technologist.

Developing a Self-Paced Orientation for Online Faculty

Sali Kaceli
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Abstract

A key component of the online education initiative for any institution is the proper training and support of the faculty delivering distance education. In this session we will explore components that we incorporate in our self-paced faculty orientation.

In addition to showing a demo of our online orientation, we will also focus on areas related to understanding online education from the institutional point of view, the proper planning, development and delivery of the course. Finally, we will also focus on areas related to the course evaluation/improvement and mechanisms to ensure academic integrity in online courses.

Presenter's Bio

Sali has been serving as Director of Educational Technology and Distance Learning at Cairn University since February 2012. Prior to this position, he served as Manager of Academic Computing for the 14 years for the University.

An Introduction to “Deep Learning”

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Abstract:

Ever wonder how your phone recognizes and categorizes your photos automatically? Or, Facebook is able to tag photos? Wonder how Siri or Amazon Echo understands your voice commands? What about making sense out of text? The answer to this and much more is “deep learning”.

Deep Learning, the hottest area currently in the world of analytics, offers the promise of being able to deal with the vast array of unstructured data---text, video, sounds, pictures, etc. Recent breakthroughs in deep learning have enabled the development of “smart phones”, talk bots, and image recognition. The advances in deep learning are beginning to permeate through many organizations. Being able to make sense of unstructured data is the holy grail of analytics. About 80-85% of all data is unstructured and, prior to just a few years ago, there were almost no ways to deal with it analytically.

This presentation will explain in simple terms the basics of how Deep Learning works and provide some examples.

Presenter Bio:

Steve develops and teaches graduate courses in data analytics at the University of Maryland University College, the largest of the colleges of the University System of Maryland. His background also includes Artificial Intelligence technologies, decision support systems, and intelligent agents.

Uniting Interdisciplinary Groups through 3D Printing

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Abstract:

In this presentation, we will be demonstrating how two faculty members and two administrators were able to write an in-house grant, purchase a 3D printer, and design a 3D modeling course for an interdisciplinary group of students.

When we received our \$15,000 grant, we decided to purchase a Makerbot 3D Printer. The instructors then created the curriculum for a 3D modeling class, and the students were split into interdisciplinary teams, as well as a team consisting of other students in their own discipline. The students were then tasked with two projects, one of which was creating a project to present at the annual OHIO University Student Expo.

The students worked very well as a team. Each discipline had students who were vocal about their ideas and willing to work fervently to achieve their goals. All of the interdisciplinary teams created unique projects and gave an excellent perspective of their teamwork as well as their individuality.

All teams were combined and presented together as a single group the Student Expo. The Nursing and Regional Campus categories seemed to be the best choices to compete in due to the nature of the projects. At the end of the day, our students were awarded first place in both categories.

Presenters' Bios:

Mary Lou Malone is an administrator and educator at OHIO University, and has been teaching computer classes since 1996. Mary Lou received a Bachelor's of Science in Business Education, as well as a Master's of Science in Curriculum and Instruction from OHIO University.

Mike Donley is an administrator and educator at OHIO University, and has been teaching classes in Office Technology, Electronic Media, and Computer Science Technology since 2004. Mike received an Associate's of Applied Science in Electronic Media, a Bachelor's of Science in Telecommunication and Media Studies, as well as a Master's of Education in Computer Education Technology from OHIO University.

The Textbook You Already Have

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Abstract

Textbooks are expensive for students. Alternative options can be extremely frustrating to explore. You might question the credibility of open source materials, or be worried about passing on even more cost to the student with add-ons, digital keys, etc. However, there is a good possibility that your library has already purchased or subscribed to content that you could use. Both you and your students just might not know that the content is available. This content includes digital textbook alternatives, documentaries, newscasts, etc. This session will cover investigating what your library has to offer, discussing add-ons to current subscriptions, and discussing what products could benefit your instruction or the campus community as a whole. It will end with a "how-to" in approaching your campus library/librarian for a possible discussion of content package purchases.

Presenter Bio:

Derek Malone is an Assistant Professor/Instructional Services Librarian/Interlibrary Loan Supervisor at the University of North Alabama. His research focus is information literacy, specifically concerning social media. However, as ILL Supervisor he strives to get library users what they need.

Deploying Microsoft DirectAccess

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Abstract:

Microsoft's DirectAccess is a collection of Windows platform technologies that provides remote network connectivity, which is secure, seamless, and bi-directional. With DirectAccess enabled, users access their data and applications from any Internet connection just as if they were on-campus. DirectAccess also allows IT administrators to manage remote PCs with their existing toolsets such as SCCM or PDQ Deploy. When DirectAccess was released along with Windows Server 2008 R2, it required IPv6 infrastructure. However, DirectAccess has received many improvements over the years that allow it to fully function in an IPv4 environment. This session will discuss Young Harris College's recent deployment of DirectAccess to our mobile Windows 10 users as well as the benefits of DirectAccess versus traditional VPN. Other topics will include the requirements of DirectAccess, various DirectAccess network topologies, and potential pitfalls during implementation.

Presenters' Bios:

Matt Manous has been with the Young Harris College IT office for over 15 years. Most of that time has been spent in his role as Client Support Specialist where he focuses on bettering the user experience. This is the 14th consecutive ASCUE conference that he has attended.

Hollis Townsend has been in the Office of Information Technology for Young Harris College since he started the department 22 years ago. In his 35 years in the IT field, he has done everything from networking, system administration, and database administration, to phones, video conferencing, security and virtualization.

Exploring the Possibility of Using AWS (Amazon Web Services) for HPC (High Performance Computing) or as an Alternative to High-end Client Workstation Computers

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Abstract:

At Washington and Lee University, we currently utilize an aging parallel computing cluster computer, primarily to conduct computational research within the sciences. As this cluster ages, and our ability to support it diminishes, we are beginning to explore alternatives. One of the most promising appears to be Amazon Web Services. AWS offers a flexible, scalable environment with many pre-configured instances. This presentation will share how we envision AWS could be beneficial for any institution that does not have the resources to support HPC on their own campus. In addition, we'll explore how it may offer cost-savings opportunities for clients that currently have workstation computers, but only utilize the full potential of the machine a fraction of the time.

Presenters' Bios:

Tom is a Technology Integration Specialist at Washington and Lee University. He facilitates the use of technology in academic offices, providing end-user support for staff and faculty. In this role, he analyzes workflows and specific job needs for departments and recommends technology solutions.

Maintaining Sanity with Security

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Washington and Lee University
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Abstract:

Academic institutions face an increasing and rapidly changing array of threats to sensitive data. Striking a balance between freedom of information and watertight data security is not easy. While typically targeted toward larger institutions and corporations, smaller schools are equally at risk. Because each institution has its own unique environment and challenges, no one-size-fits-all solution is available. However, in this presentation we'll outline one viable model for developing an incident response procedure that can be replicated at any institution. Topics covered will include: developing a preliminary analysis; effective response; documentation; ongoing evaluation of methods; and reporting.

Presenters' Bios:

Tom Marcais is a Technology Integration Specialist at Washington and Lee University. In this role he supports a wide variety of different hardware and software technologies for the Sciences. He also serves on the board of ASCUE as Public Relations Director.

Andy Briggs is a Technology Integration Specialist at Washington and Lee University. In this role he supports a wide variety of different hardware and software technologies for the School of Law.

Window PowerShell – Scripting Microsoft Updates

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Abstract:

A look in to Washington and Lee's process for using Window PowerShell to script the Microsoft Update process to include scheduling, installation, delayed reboot and notification.

Presenter's Bio:

IT Systems Architect for Washington and Lee University. Started working as a computer contractor in the mid 90s. I have been working in higher education for over 15 years.

Creating Flex Classrooms: 101 Fails, and How to Avoid Them

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Abstract:

The development of flexible classroom spaces, or "Flex Classrooms," is currently one of the more popular trends in higher education. Higher-ed institutions are looking for innovative ways to transform their traditional chalkboard and podium lecture-style classrooms into more technically advanced collaborative spaces that can accommodate a wide variety of teaching, and learning, modalities. "Flex Classrooms" offer the promise of a more universal learning space - imagine a single room where professors and students with incredibly diverse technology needs can all gather together to engage in the creative learning process in a variety of teaching formats. Educational Utopia! Unfortunately, the reality is that it can be quite challenging to fund, design, build, and adequately utilize, these new "Flex Classroom" spaces. Budget shortfalls, design changes, infrastructure issues, network overload, untrained faculty, and confused students can all be part of a poorly planned "Flex Classroom" project.

This session will highlight these challenges, and how to overcome them, based on lessons learned during a 3-year, \$1.3 million project to design and build 20 new "Flex Classrooms" at one of the largest community colleges in the nation.

Presenter's Bio:

Kurt Shirkey is the Director of Classroom Technology Support at Salt Lake Community College - one of the largest community colleges in the nation. For 15 years he has designed the instructional technologies for 400+ learning spaces. To relieve stress, he also teaches American Government courses.

Student Success in the Online Learning Environment

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Abstract:

Distance learning programs can be very appealing to prospective non-traditional students who require the flexibility to balance their career and family with pursuing a college degree. Learning at a distance is much more than a convenience and learners need to be equipped with the knowledge, skills, and attitudes necessary to succeed in this type of learning environment. Online learning is also defined in a variety of ways by different institutions and some online programs can be much more rigorous than others, just like the traditional face-to-face learning experience. In order to help bridge this gap, it was determined that a student success course be required of all new students. My presentation will focus on the design, development, delivery and evaluation of such a course and other initiatives to better prepare learners for success in the online learning environment.

Presenter's Bio:

Jacqueline Stephen is the Director of the Office of Distance Learning and the Instructional Designer at Penfield College of Mercer University. Jacqueline is also an Instructor in the Human Resources Administration & Development's Program at Penfield College of Mercer University, Georgia

Curating and Contextualizing Literature

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Abstract:

Curating and Contextualizing Literature Content curation has become a buzzword prevalent in education today. Curators select, evaluate, connect, organize and share materials based on their own sense of purpose and audience. As teachers turn to curation tools as a means to manage, filter, and present relevant information, they are recognizing the potential benefits of engaging students in the process of curation—a process which involves going beyond collection of materials, to contextualizing them. This presentation will share two valuable experiences in using curation tools in the Language Arts classroom: (1) Preservice teachers in a university Adolescent Literature course learn to use curation tools to contextualize, sort, and present information related to the literature, and then share on a single platform—making it accessible for future classroom use. (2) After learning how to use the curation tools, middle school students use the tools to construct hybrid media bags related to their own reading experiences, intertextual connections, purposes, and audiences. A concluding discussion will highlight the ways students construct knowledge and learn through a continuous process of inquiry while using curation tools.

Presenter Bio:

Krista has been teaching writing for over 20 years at Ohio Christian University, where she also serves as the Humanities Chair and Director of the Writing Center. Krista resides in Circleville, Ohio, with her husband, Travis; daughters, Maia and Sophie; and her spoiled Rhodesian Ridgeback, Bongo.

Cisco Spark – Extending the Classroom Beyond the College

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Abstract

Presenters' Bios:

Hollis Townsend has been in the Office of Information Technology for Young Harris College since he started the department 22 years ago. In his 35 years in the IT field, he has done everything from networking, system administration, and database administration, to phones, video conferencing, security and virtualization. He has served as Equipment Coordinator for ASCUE since 2001.

Free Gamified Learner Response Systems

Mathew Tyler
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Abstract:

This session will introduce participants to two free gamified learner response systems, Kahoot and Quizalize. Kahoot is designed for use in face-to-face courses while Quizalize is designed for use in both face-to-face and online courses. Both systems inspire friendly competition among students and even provides the instructor with formative assessment data. One system even offers an option to integrate explanatory feedback and an option for individualized instruction.

Please bring an electronic device that can access the internet in order to participate in the simulated student experiences.

Participants will:

- Experience a simulated student experience with both Kahoot and Quizalize
- Examine assessment data in both Kahoot and Quizalize
- Observe how to navigate Kahoot and Quizalize
- Observe how to create classes and quizzes in Kahoot and Quizalize

Presenter's Bio:

Matthew is an Instructional Technologist with CeTEAL at Coastal Carolina University. He recently earned an Educational Specialist (Ed.S.) degree in Instructional Technology from CCU and is a nationally certified Quality Matters (QM) Peer Reviewer for Higher Education.

Groupthink: Strategies to Engage Student Collaboration

**Tori Waskiewicz
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Abstract:

Group collaboration is challenging in online, face to face and blended courses. Students often work in groups focusing on a common goal, interacting with each other and by creation of a culminating work. This is an essential component of learning, yet the challenge for instructors and students is, "How?" What type of tools can instructors use to create activities for students to collaborate effectively in groups?

This hands on session will showcase tools to encourage more student collaboration and less aggravation, by demonstrating how instructors can set-up resources to encourage student success. The selected tools focus on collaboration and enriching the pedagogical outcome. To achieve this, the audience will participate in this presentation utilizing a selection of group collaborative tools. The tools will mainly fall into the following categories: Video Conferencing, Scheduling, Content Editors, Presentation Tools, Content Organizers and many more.

Presenter Bio:

Tori Waskiewicz has a MS in Instructional Technology and has worked in higher education as an Instructional Technologist and Designer for over 10 years. Last year she began teaching an online Instructional Technology course and has grown as an educator by getting to work on both sides of education.

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