Transforming a large-lecture course into an active, engaging, and collaborative learning environment

Transforming a Large-Lecture Course into an Active, Engaging, and Collaborative Learning Environment

Sharon Stoerger, Ph.D.* and Denise Krieger, M.Ed.

Rutgers, The State University of New Jersey, School of Communication and Information, Rutgers University, 4 Huntington Street, New Brunswick, NJ 08901-1071, USA

Corresponding Author: Sharon Stoerger, Rutgers, The State University of New Jersey, School of Communication and Information, Rutgers University, 4 Huntington Street, New Brunswick, NJ 08901-1071, USA. Email:

Abstract: Traditionally, a large lecture hall course follows a teacher-centered approach to instruction. This was the case for the "gateway" course in the undergraduate Information Technology and Informatics (ITI) major in the School of Communication and Information at Rutgers, The State University of New Jersey. This paper describes the journey and collaboration between the course instructor and the instructional design/technology specialist to transform a large lecture hall course (with up to 450 students) into an active, collaborative learning experience – one that engages students in learning, emphasizes higher-order thinking skills, and creates a sense of community that can be lacking in such a format. This transformation was realized when the boundaries of the classroom extended into the "online" environment.

Keywords: collaboration, community, emerging technology, online learning, pedagogy, student-centered learning, virtual teams

1. Introduction

Large lecture hall courses run the risk of lapsing into what Paulo Freire [11], noted Brazilian social activist educator, referred to as the "banking" concept of education where the all-knowing teacher deposits knowledge into the minds (empty receptacles) of students who passively receive the information, primarily through lectures in the classroom, and then restate the information on tests and papers. Moreover, higher education institutions that continue to follow a model put forth in the 1800s – one that focuses on the teacher, rote learning, memorization, and high-stakes testing, and is no longer relevant in the 21st century work environment. Scholars such as Brynjolfsson and McAfee [4] contend that new educational models are needed that offer more self-initiated, exploratory, and independent learning opportunities for students.

Rhetoric associated with the need to rethink learning structures is not new. Scholars such as Piaget [24] and Vygotsky [32], for example, pointed to the challenges associated with 'teaching by telling' years before digital labor. As the need to prepare students to acquire skills that complement computing capabilities continues to rise [4], "radical" ideas for different educational models are being proposed [31] such as self-paced education, competency-based learning, and life-long learning. Some forward-thinking higher education institutions such as the Stanford Design School have moved in this direction and have started to implement these alternatives.

Despite strong evidence demonstrating the effectiveness of active learning approaches [28], a passive learning process is often regarded as the norm. In fact, there are instructors

who continue to defend the lecture as an effective pedagogical practice [5]. Claims in support of this practice suggest that lectures provide students with models on how experts approach problem solving [29], as well as assisting students as they grasp key points from the assigned readings and other class materials.

Yet, lectures as an instructional approach are often associated with activities that require lower-order Bloom's Taxonomy thinking skills [1] from students, such as remembering and understanding. An example is the memorization of facts that are commonly regurgitated via exams and then quickly forgotten. In this type of scenario, it is more difficult, if not impossible, for students to take ownership for their learning to shape their experience and apply and synthesize what they have learned in innovative, real-world contexts. However, it is challenging for instructors to move away from the lecture approach, especially when working with 100 or more students in the classroom. To do so requires advanced planning, significant effort, and instructional support (e.g., instructional designers/technologists, teaching assistants, graders, etc.).

This paper will describe the transformation of the "Information Technology and Informatics" course for undergraduate students at Rutgers, The State University of New Jersey, from a passive learning experience to one where students are actively engaged in learning by extending the classroom "online."

2. Information Technology and Informatics

The Information Technology and Informatics (ITI) major is the undergraduate program in the Department of Library and Information Science (LIS) at Rutgers. One of the requirements to apply to this major is the successful completion (i.e., obtaining a C or better) in the gateway course to the major, which is also called "Information Technology and Informatics." In the ITI course, enrollment figures often exceed 400 students. Students enrolled in the course are comprised of not only prospective ITI majors at the School of Communication and Information but also students Rutgers-wide who are looking to fulfill interdisciplinary and core curriculum requirements. This results in a diverse set of students in terms of their interest in the course topic, with some less interested than they would be if this were their declared major. Students also take the course at different points in their academic trajectory, ranging from their first year at Rutgers to the second semester of their senior year.

The ITI course meets two days per week in a large auditorium. The classroom is in a fixed auditorium seating configuration, which logistically does not facilitate active student learning. Also, while the course is offered face-to-face, students may never interact or get to know their peers due to the large size of the class. As a result, the lecture format has been the norm, with traditional assessments such as computer-scanned multiple choice exams and an individual term paper.

In an attempt to add much needed student interaction to this large lecture course, a student response system (i.e., SRSs; "clickers") was implemented. Recent reports indicate that the use of SRSs have transformed passive lectures into interactive classrooms [2, 3,

10]. Additionally, the research indicates that SRSs have a positive impact on student engagement and learning [15]. However, the SRS was not adequate to sustain ongoing student participation beyond the classroom with such a large student population in the class (450 students) throughout the semester.

The Sakai learning management system was used as a "web component" that was more or less a repository for course readings, instructor lectures, and a dropbox for an assignment submission. It was not used as a teaching and learning platform that integrated in-class and post-class course materials, activities, and assessments. The Sakai site also did not include any elements of student engagement and/or collaborative activities.

Moreover, as the class grew in size, the opportunities for engagement and active learning were decreased and became more challenging to incorporate. By the end of the course, students had for the most part demonstrated lower-order thinking/skills that had been directed through a teacher-centered model. Students had not been given the opportunity to work hands-on with the technologies they had learned about in the readings and class lectures. On the whole, student learning in this course had been largely a passive learning experience and solitary endeavor. It became clear that a redesign was needed to transform the course into a student-centered model that would provide a richer and deeper learning experience.

3. Course redesign

Over a six-month time period beginning in Spring 2014, the course instructor and the instructional design/technology specialist in the School of Communication and Information at Rutgers undertook an intensive redesign and development of the Information Technology and Informatics course. The overall goal of the course redesign was to move towards a student-centered model that would increase student participation and engagement, encourage deeper learning and development of higher-order thinking skills, and provide students with a sense of community – opportunities typically afforded smaller classes – while maintaining the large-lecture hall format for the "gateway" course to the ITI program. Traditional individual assessments (i.e., tests and papers) were evaluated and redesigned to add authentic assessments and opportunities for hands-on experience using digital technologies and collaboration.

3.1 Learning Theories

The course instructor and instructional design/technology specialist conducted a literature review to further explore learning theories that supported the new course goals. The course redesign was informed by the following learning theories: transformative learning, community of inquiry framework, and social learning theories.

The transformative learning theory [8] posits a transformation of "our taken-for-granted frames of reference" to make the work in the classroom more meaningful [22, p. 7]. Transformative learning theory includes characteristics that are aligned with constructivism [24] and social constructivism [32]. Yet, transformative learning theory takes a broader approach to ideas associated with these theories. These approaches

include active learning, student engagement, and collaborative learning, just to name a few.

According to Merriam, Caffarella, and Baumgartner [20], there are four main components to the transformative learning process: experience, critical reflection, reflective discourse, and action. Meyers [21] identifies pedagogies that are aligned with transformative learning ideals creating small groups that interact online, encourage students to reflect on social issues and course materials, utilize teaching strategies that include collaborative learning, online discussions, and wikis. These activities are also noted in the work of Slavich and Zimbardo [28] as core methods of transformative teaching. Together, this literature helped shape the activities and assessments in the redesigned ITI course, as well as guide the researchers in identifying the data to collect to evaluate the results of this transformation.

The Community of Inquiry (CoI) framework theory consists of three essential elements that shape the educational experience: cognitive presence, social presence, and teaching presence [12]. Through cognitive presence, students are able to construct meaning through sustained communication and information exchange. The text-based communication typically afforded through discussion boards can foster higher-order cognitive learning because students are given sufficient time for reflection before writing. Through a social presence, students are able to project their personal characteristics into the community through their real identities, which facilitates critical thinking, open communication, and group cohesion among the community of learners. Through the

teaching presence, the course instructor serves to support and enhance the social and cognitive presence to facilitate meeting the educational outcomes and is responsible for design of the course (course content, learning activities, and assessments).

Vygotsky's [23, 32] social development theory promotes a student-centered learning environment in which students play an active role in learning; and the roles of the instructor and student are shifted as the instructor assumes the role of facilitator. Learning becomes a reciprocal experience for the students and the course instructor. Learning occurs through interactions and communications students have with their peers, teachers, and other experts through discussion, collaborative learning and group work, and developing a community of learners.

These theories help to shape the direction of the course redesign. While the course maintained a face-to-face large lecture hall format, a technology-mediated environment and new instructional strategies would be instrumental in fostering a more student-centered learning environment.

3.2 Extending the Classroom Through a Blended Web-Enhanced Component

A major aspect of the course redesign included creating a blended web-enhanced component to the course. Blended learning in the context of this paper is defined as a combination of face-to-face instruction found in traditional classrooms with a web-enhanced component delivered through a learning management system (LMS) to provide access to in-class and post-class learning materials and to provide support for post-class

online interactions among the instructor, students, and their peers [26]. Other benefits associated with a blended learning environment include increasing the flexibility of students' access to learning, reinforcing students' autonomy, and providing a space for student reflection. This blended approach also enables students to take co-ownership of their learning, provides opportunities to embrace technology, and encourages a sense of community [26].

A major aspect of the course redesign was to create a student-centered online learning environment to complement the classroom. LMSs are available to instructors at Rutgers University. The course instructor and the instructional design/technology specialist collaborated together to create a new web-enhanced blended learning component using the Sakai LMS that extended the classroom beyond the walls of the large lecture hall auditorium.

Before building the new course site in Sakai, the course instructor and instructional design/technology specialist began the redesign process by redefining the learning objectives, identifying new assessments that align with the learning objectives, and preparing a detailed course outline with a week-to-week schedule that included all activities and assignments with due dates. This served as the "blueprint" for not only the course syllabus but also guided course development in the LMS.

After the course design was completed, development in the Sakai LMS began. A new course site was developed in Sakai to create an online learning environment that

integrated the in-class and post-class course materials, activities, and assessments. A web-enhanced component commonly found in smaller, blended courses served as a model for this large lecture hall course. Next, the course instructor and the instructional design/technology specialist developed a new course structure in Sakai to provide a well organized and easy-to-navigate learning environment. Then, the course instructor and the instructional design/technology specialist uploaded and/or created new course content, materials, activities (including readings and lectures), and assessments into the Sakai site. Finally, a gradebook was created in Sakai to facilitate students being able to monitor their progress throughout the semester. Ultimately, the goal of the course site was to facilitate independent learning among students and provide a one-stop resource to guide students' learning experience.

"Virtual" teams (30 groups for 450 students) were created in the Sakai course to facilitate post-class work online for participating in discussion boards, working in groups on projects, and submitting papers to the dropbox. Social technologies (i.e., Wikispaces, Twitter, Diigo) were integrated to support group collaborative activities and assignments. These technologies also provided students with opportunities for hands-on experience with new tools.

3.3 New Instructional Strategies for a Student-Centered Learning Environment

The Information Technology and Informatics course retained some traditional assessments such as a midterm exam but no longer included a final term paper, but instead added authentic assessments and activities into the web-enhanced component [9].

The instructor continued to lecture during the in-class sessions in the large lecture hall, and clickers were used again to encourage in-class discussions to supplement the online interactions. The in-class sessions also introduced students to key assignments and pointed students to the activities, assignments, and group projects that were located in the web-enhanced component in Sakai.

Several new instructional strategies were implemented in the course redesign. The course instructor and instructional design/technologist specialist created small "virtual" teams in the Sakai course. These virtual teams were established to facilitate completing post-class work online and to create a sense of community, as well as to encourage critical thinking and higher-order learning [14, 25], through discussion boards and a group "wiki" project. Social technologies, including Diigo, Twitter, and Wikispaces, were integrated into assignments to foster collaboration and create socially-connected learning experiences. By working with these technologies, students were able to obtain hands-on experience with tools to demonstrate digital fluency skills such as designing content, constructing knowledge, and communicating ideas [16]. Previously, students' only exposure to the concept of digital fluency was through class discussions and readings.

Course assessments were redesigned to provide opportunities for students to synthesize and apply higher-order thinking and skills through online discussions, project-based learning, peer review of students' work, and self-reflection to encourage deeper learning. New assessments were added including a "Google's Gotcha" online discussion board, a Hashtag Activism Collaborative Wiki group project with peer reviews and reflections,

and an individual Emerging Technology Innovations Infographic project (discussed below).

In the "Google's Gotcha" activity, students searched the Web to investigate a contemporary high-profile individual with a controversial background. Students were provided with a list of 25 individuals in which to choose for this assignment. In the online discussion board in the Sakai course, students reported their findings and discussed the ramifications and implications of having an online presence – not just for high-profile individuals but also for themselves. Detailed criteria for this assignment, including a Discussion Board grading rubric, were provided in the Sakai course site, and students were instructed to not only report the findings from their Web search but also incorporate required class readings into the discussion. Scheduled early in the course, this was the first opportunity where students were able to critically discuss relevant issues and exchange ideas towards creating a sense of community with students who have never spoken or met each other.

The Hashtag Activism Collaborative Wiki group project is a multi-stage project that spanned several weeks in the semester. Students worked in small groups to examine a contemporary social activism 'movement' and the impact of social networks on contemporary protests and revolutions. This project was referred to as the "Hashtag" Activism Collaborative Wiki Project because social media sites have been instrumental in raising global awareness and proliferating a 'call to action' in many contemporary social

activism movements. At the time these movements occurred, much of the conversation surrounding these movements went "viral" on the Web through Twitter hashtags.

Research indicates that wikis support collaborative learning and promote higher-order thinking [13]. For the Hashtag project, students worked collaboratively online in small, assigned groups to create a group "wiki" page using Wikispaces (a free web-based collaborative technology tool designed for educational wikis). The instructional designer/technology specialist created this "large scale" wiki project in Wikispaces with 50 groups (for the 450 students) – each with a different Hashtag activism event – and created a "template" for each group's wiki page to guide students as they worked on their wiki, as well as provided scaffolding for students through step-by-step instructions, resources, and grading rubric to communicate expectations. The course instructor sent email invitations to students, generated through Wikispaces, to join their wiki project. As students worked on their wiki project, they were able to also send each other comments on their wiki page, which provided a history of students' collaboration efforts during the wiki project. Students peer-reviewed group wikis and reflected on this collaborative experience, as well. Through this project, students gained first-hand experience in using a wiki and gained experience collaborating with fellow students to research, co-create content, and share knowledge.

The "Infographic" project, which was the culminating course project, afforded each student the opportunity to work with new technology tools to create a digital infographic. An "infographic" blends text, statistics, illustrations, and other visual images to tell a

data-driven story. This form of information dissemination has been successfully used across industries for different purposes such as increasing public awareness, marketing, and tracking trends [7]. For the Emerging Technology Innovations Infographic project, each student worked independently to create a unique digital infographic using the Piktochart web-based tool (free version). Students selected an emerging technology, a target audience, and identified an overarching question for inquiry. This project required students to research, analyze, and synthesize information to effectively communicate their story while also meeting the assignment criteria. The instructional designer/technology specialist created the infographic project in the Sakai course, providing scaffolding through step-by-step instructions, models and resources for using Piktochart and designing infographics, and a grading rubric, to guide student learning and promote successful outcomes.

Grading rubrics were custom designed for each major assessment to communicate the instructor's expectations and how students would be graded on each assignment. In addition, the rubrics ensured consistent, objective grading among the instructor and the five graders who assisted the instructor in grading due to the large class size (450 students). To prepare the graders, the course instructor and instructional designer/technology specialist held training sessions so they could practice using the rubrics on actual work submitted by students. These sessions gave the graders hands-on experience with the grading process and provided them with an opportunity to ask questions.

4. Methods

The design and structure of the redesigned course was important. Ultimately, though, it was critical to evaluate the effectiveness of this change to the student experience and their learning. The overarching questions guiding our research included the following:

1. Do students report that there is an impact on their learning outcomes and increased rigor/higher-order thinking/skills as a result of incorporating new instructional strategies (virtual teams; collaborative activities and assignments through online discussions, peer-reviews, collaborative wiki)?

2. Do students report that there is an impact on student engagement and overall satisfaction as a result of incorporating new instructional strategies (virtual teams; collaborative activities and assignments)?

3. Do students report that independent learning was facilitated through the web-enhanced component through the course management system (integrated course structure with in-class and post-class course materials, activities, and assessments) and deconstructing projects into stages with scaffolding and grading rubrics?

4. Is there evidence of deeper learning as a result of incorporating higher-order thinking/skills and academic rigor into activities and assessments? (group wiki projects, discussion board analysis and reflections, group peer-reviews, and infographic projects)

To learn more about the learning experience, students enrolled in the ITI course were invited to participate in the research study, which consisted of students completing an IRB-approved Consent Form and end-of-course anonymous 40-question survey in Qualtrics, described in the "Findings" section in this paper. In Fall 2014, the number of students who were given the opportunity to participate in this study was approximately 450. These students represent a convenience sample [6], as the researchers were not able to randomly assign them to this course. Instead, the students choose the course and the particular section. All students in the course were informed that they could decline to participate without affecting or benefitting them in any way. Students who declined to participate were still allowed to complete the course, as well as the class activities and assessments without penalty.

A review of the literature on student engagement and learning theories was conducted prior to the development of the survey instruments. For the most part, survey questions were selected from the National Survey of Student Engagement (NSSE) created by Kuh [17, 18]. Based on questions that had been tested in those studies, a 40-question, anonymous survey was developed and administered online via Qualtrics. A link to the survey instrument was made available through the LMS. The purpose of these questions was to explore general education, personal and social development, practical competence, and higher-order learning.

5. Findings

A large corpus of data was collected, and the researchers continue to analyze that information, particularly the qualitative student peer-reviews, reflections, and comments. However, preliminary findings from the quantitative data in the end-of-course surveys provided student feedback that suggest the changes to the ITI course were positive ones. The tables included in this section highlight the findings most directly associated with the new assessments – online discussions, the wiki project, and the infographic project.

5.1 Online Discussions

Three questions related to the online discussion board activities were included on the survey.

Q1: The discussion boards in this course promoted analysis of course concepts, peer-review of classmates' work, and an opportunity for an exchange of ideas.

Q2: The discussion board activities motivated me to participate online more than I would have in the large lecture hall class.

Q3: The discussion boards helped me to socially connect and communicate with my peers, exchange ideas, and created a sense of community that otherwise would have been difficult to do in a large lecture hall course.

As Table 1 illustrates, almost 75% (n=246) of students agreed or strongly agreed that the discussion boards promoted analysis, encouraged peer-review activities, and provided

them with an opportunity to exchange ideas. The majority of students (68%; n=229) also indicated that the discussion board activities motivated them to actively participate in class; more so than in other large lecture hall courses. Participation in the discussion boards also helped the majority of students (59%; n=201) socially connect with their peers to the extent that they felt as if they were part of a community. Because students in this course may never physically meet or get to know their peers, the agreement with Q3 is telling. This suggests that participating in the online discussion groups as an extension of the classroom helped these students create a sense of community, which is otherwise not possible in a large lecture hall. On the whole, a little over 65% of students agreed or strongly agreed to the three questions when considered together.

[Insert Table 1 about here]

5.2 Hashtag Activism Wiki Project

As was the case with the online discussion board activities, three questions were directly linked to the Hashtag Activism Collaborative Wiki Project (Table 2).

Q4: In the Hashtag Activism Group Wiki Project, I learned to analyze social networks and their implications to society in social, cultural, economic, and/or political environments using collaborative technologies (wikis) to research and construct content with my peers.

Q5: The Hashtag Activism Group Wiki Project helped me to learn to work as a member of a team.

Q6: Because we worked as a team to complete the group Wiki project, I tried to do my best regarding group work responsibilities to meet the project goals and deadlines.

Prior to the course redesign, students in a large lecture hall course did not have the opportunity to work in virtual teams to complete a group project. The hashtag activism wiki project was an attempt to change this norm. Based on the survey comments and conversations with students during office hours, this was stressful for those students who were expecting a passive learning experience. Nevertheless, almost 75% (n=251) of students reported that they learned about the use of social networks using wikis to construct knowledge with their peers.

In class, students made comments suggesting that working virtually with their peers was not a popular activity. Students indicated in-class, as well as through email exchanges with the instructor and survey responses, that collaborating with people they did not know was challenging; and perhaps more importantly, there were strong concerns about the impact of the work contributed (or lack thereof) by unknown individuals on their grade. These informal reports were supported by the response to Q5 regarding their views on working as part of a team member. Here, a smaller percentage (55%; n=189) of the students agreed or strongly agreed that virtual team membership skills were acquired through the hashtag activism assignment.

Even though working collaboratively in small groups to produce a wiki page was a new activity for many students, their final products were impressive in the content they produced, including APA citations from their research. Students took responsibility for dividing up the project and completing their part in the assignment. Interestingly, while students were not instructed to adopt roles in the project (e.g., leader, editor, etc.), many students demonstrated initiative and took on roles in order to ensure the wiki would be successfully completed and submitted by the deadline. Responses by 80% (n=274) students support the notion that they did try to be a responsible team member.

Based on the end-of-course survey, the majority of students found the wiki project to be a valuable experience. When compared to the percent of students who agreed or strongly agreed to the questions related to the online discussions, the total figure for the hashtag wiki assignment was slightly higher at 70% for the three questions.

[Insert Table 2 about here]

5.3 Emerging Technology Innovations Infographic Project

Only one survey question focused solely on the infographic project.

Q7: In the Emerging Technology Infographic Project, I learned to analyze an emerging technology innovation by researching relevant data sources and evaluate its opportunities, challenges, and implications for target audiences and illustrate findings (text, images, and statistics) in a digital infographic format.

As students conducted the research, created their infographic, and submitted the final product, anecdotal evidence suggested that this was a popular assignment. They would attend office hours to show off their creations, discuss their work, and marvel at the technology skills they were acquiring. Their enthusiasm for the assignment was supported by the favorable responses to the survey question related to this assignment. In terms of learning how to analyze, evaluate, and present research findings on an emerging technology topic in a visual manner, 83% agree or strongly agreed that this goal was accomplished.

[Insert Table 3 about here]

5.4 Knowledge and Skills

In addition to encouraging active learning among the students, another goal was to provide them with knowledge and skills that would transcend the boundaries of the ITI course, including work outside the institution. Three survey questions were created to determine the students' reflections on what they gained through the assignments described in this paper.

Q8: This course helped me to identify and evaluate sources for research-based assignments.

Q9: This course helped me to research and construct knowledge using information technologies.

Q10: The course experience contributed to acquiring knowledge and skills that are relevant to my everyday life and/or career goals.

Research was a major component of the online discussions, the wiki project, and the infographic. Thus, it is not surprising that more than 75% (n=263) of students indicated that they learned to identify and evaluate sources. Over 80% of students (n=274) reported that the course helped them to construct knowledge, as well as conduct research. The agreement levels reported for the use of the skills acquired through the course activities and experiences were overwhelmingly positive at 76% (n=260).

During office hours, email exchanges, and post-class conversations with the instructor, students who take this ITI course frequently express concern about life after graduation and the skills they will need when they enter the workplace. Based on the responses to survey question 10, the efforts to incorporate meaningful and real world experiences into the course were successful. Students in this course acquired skills that could help them succeed in the classroom, as well as be highlighted on their resumes. Examples of these skills include working with new technologies, collaborating with peers in online spaces, conducting online research, evaluating data, and creating visual representations of data, just to name a few. Indeed, 76% of students agreed or strongly agreed that the activities were relevant to the everyday life and career goals.

[Insert Table 4 about here]

6. Lessons learned

6.1 The Instructor Perspective

There were several lessons learned when this experience is viewed from the instructor standpoint. First, this course has one instructor and hundreds of students. Managing the logistical issues associated with access to the social technologies, for example, were problematic due to the class size. Whereas a class of 30 students might have six who ask questions, the same proportion of question-askers in a class of 450 is 90 students. This is a sizable difference that can require a considerable amount of time to facilitate and respond to each student's questions and concerns on any given assignment.

One observation by the course instructor pertaining to the students' "mindset" as it relates to large lecture hall courses was somewhat surprising. In fact, some students believed that they could pass the course by only taking the midterm exam. It took time for them to embrace new assignments and activities that encouraged them to become co-constructors of knowledge and co-owners of their learning.

Even though the course structure in Sakai was designed to be easy to navigate to find each weekly/unit of study including the content, activities, and assignments within each unit; nevertheless, some students did not navigate the space in the LMS with ease. Students reported that they did not expect an online component with a face-to-face course even though it was clearly stated in the Syllabus and the first day of class (and beyond). It was apparent that a certain dynamic was occurring: 1) students were not accessing the Sakai course to locate course items (e.g., readings, lectures, examples, resources, etc.), activities, and assignments, 2) students were not attending class to hear the instructor

provide instruction on new assignments in the Sakai course, and/or 3) students were not reading the instructions provided for assignments in the Sakai course before undertaking assignments. This behavior appears to be a "gap" in students' skills set or perhaps their maturity level, although the sheer number of students in the course may have magnified this problem more so than in smaller classes where only a small number of students may have had these issues.

Because they have been viewed by some as "digital natives" [27], young people are thought to be naturally comfortable using technology. This was not the case with many students in the ITI course. The course instructor observed that students' skills gap extended beyond following course instructions (and meeting clearly stated assignment deadlines) to also effectively using technology for academic purposes. Students actively use social media in their personal lives but that "skill" does not always translate into an academic environment. Using social technologies such as Wikispaces, Piktochart, and Twitter to complete assignments was a new experience for many students in the course. As mentioned previously, scaffolding with instructions and resources were provided in the Sakai course (for all assignments and technology used) to help students. In addition, one-on-one training sessions using some of the technologies were needed to help support students as they undertook new assignments.

Despite these challenges due to the large number of students in the course, the new activities and assessments that were designed for real-world experiences, technology use, and collaboration were valuable and relevant to the learning goals of the course. The

course provided a much richer, more rigorous, and deeper learning experience for students.

6.2 The Student Perspective

The students expressed mixed responses to the new activities and assignments as a result of the course redesign. Changing the paradigm from a teacher-centered to a student-centered learning experience was stressful for some students as indicated by informal comments made to the course instructor through email, post-class, and/or at office hours. However, by the end of the semester, students were more comfortable with the format as evidenced by fewer questions asked by students during class, during office hours, and through email. The instructor observed at the end of the course that the students' grades on assignments also improved as students progressed through the different stages of multi-part assignments.

Group assignments typically are not popular with students [30]. The wiki project, which was the one group assignment, was no exception. As stated in an earlier section, the students may never know their peers even though they are in the same physical space two times per week. Being a part of a virtual team with people only known through online interactions was a new and challenging experience for many students. The students were anxious about the ways in which their team members would impact their grade, as well. While there were concerns that the submitted collaborative wiki project would be lacking, the final results exceeded expectations in terms of the quality of the submissions as determined through the grading rubric created for this assignment. The student groups

co-authored and crowdsourced rich content about their social activism movement, which included citing sources for their research using APA style, and demonstrated higher-order thinking skills in the process.

The Infographic project, which was an individual effort, was embraced by most of the students. To complete this assignment, the students were instructed to use a free, web-based tool – Piktochart. A few students were skeptical about using an unfamiliar technology and wanted to use PowerPoint instead. Piktochart is relatively easy to use, and scaffolding with instructions, models, and resources was provided for each stage of the infographic creation in the Sakai course. One interesting observation was that students, particularly females, gained confidence in their technology skills through the completion of the infographic assignment. Also, many of the female students indicated that they were not interested in technology as a career option at the start of the semester, but this changed after the infographic project. Like the wiki project, the end results of the infographic project exceeded the course instructor's expectations.

7. Conclusion

An increasing number of institutions have implemented or are investigating undergraduate programs as a place to start preparing the next "generation" of information professionals [19]. It is not uncommon for introductory, survey courses associated with these programs to follow the large lecture, face-to-face model. When confronted with class enrolments of 100 students or more, a common assumption is that a passive experience that includes computer-scanned multiple choice tests as the primary mode of

assessment is the only option. When considering alternative delivery modes to enhance a large lecture hall format, creating a web-enhanced component in an LMS to complement the on-campus class sessions enables instructors to create a virtual learning environment that incorporates active learning, collaboration, and hands-on technology experiences where otherwise might not be possible.

Descriptions of transformative learning theory, community of inquiry framework theory, and social development theory are focused on principles that echo constructivist approaches to learning. Assignments aligned with these theories include experience, critical reflection, reflective discourse, collaboration, and action. Enabling students to make meaning and reinterpret their assumptions about learning can be accomplished in a variety of ways. These include creating small discussion groups, encouraging reflection on issues and course materials, and incorporating collaborative experiences.

Technology provides instructors with tools that can help students move beyond rote learning and lower-order thinking skills. Having a web-enhanced course component along with wikis, online discussions, social media, and web-based software can encourage collaboration, interaction among peers, community building, and student-ownership of learning. This paper reported on the survey results collected in Fall 2014. Based on those results, the majority of students agreed that their thinking about what it means to obtain knowledge and skills was transformed.

References

[1] L. W. Anderson and D. Krathwohl (Eds.), *A taxonomy for learning, teaching and assessing: A revision of bloom's taxonomy of educational objectives,* Longman, New York, 2001.

[2] I. Beatty, Transforming student learning with classroom communication systems, *Educause Research Bulletin* **3** (2004), pp. 2-13. Available from: http://www.educause.edu/ir/library/pdf/ERB0403.pdf.

[3] D. Bruff, *Teaching with classroom response systems: Creating active learning environments*, Jossey-Bass, San Francisco, 2009.

[4] E. Brynjolfsson and A. McAfee, *The second machine age*, W. W. Norton, New York 2014.

[5] M. Burgan, In defense of lecturing. *Change* **6** (2006), pp. 31-34.

[6] J. W. Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches*, Sage, Los Angeles, 2009.

[7] R. Crooks, Are infographics still effective as part of your content strategy?, *Forbes* (2014). Available from: http://www.forbes.com/sites/rosscrooks/2014/01/14/are-infographics-still-effective/.

[8] J. M. Dirkx, Transformative learning theory in the practice of adult education: An overview, *PAACE Journal of Lifelong Learning* **7** (1998), pp. 1-14.

[9] C. D. Dziuban, A. G. Picciano, C. R. Graham, and P. D. Moskal, *Conducting research in online and blended learning environments,* Routledge, New York, 2015.

[10] EDUCAUSE Learning Initiative, *7 things you should know about…clickers*, EDUCAUSE Learning Initiative, Boulder, CO, 2005. Available from: http://www.educause.edu/library/resources/7-things-you-should-know-about-clickers.

[11] P. Freire, *Pedagogy of the oppressed*, Continuum, New York, Continuum, 2000.

[12] D. R. Garrison, T. Anderson, and W. Archer, Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, **2** (2000), pp. 87-105.

[13] S. E. Greathouse and L. H. Rosen, The best post wiki: A tool for promoting collaborative learning and higher-order thinking. *Faculty Focus*, 2015. Available from: http://www.facultyfocus.com/articles/instructional-design/best-post-wiki-tool-promoting-collaborative-learning-higher-order-thinking/.

[14] K. Hamann, P. H. Pollock, and B. M. Wilson, Assessing student perceptions of the benefits of discussions in small-group, large-class, and online learning contexts, *College Teaching* **60** (2012), pp. 65-75.

[15] R. Kaleta and T. Joosten, Student response systems: A University of Wisconsin System study of clickers, *EDUCAUSE Research Bulletin* **10** (2007), pp. 1-12.

[16] G. S. Kirkman, P. K. Cornelius, J. D. Sachs, and K. Schwab, *The global information technology report 2001-2002: Readiness for the networked world*, World Economic Forum, New York, 2002.

[17] G. D. Kuh, Assessing what really matters to student learning: Inside the National Survey of Engagement, *Change* **3** (2001), pp. 10-17.

[18] G. D. Kuh, What we're learning about student engagement from NSSE: Benchmarks for effective educational practices, *Change* **2** (2003), pp. 24-32.

[19] G. Marchionini and B. B. Moran (Eds.), *Information professionals 2050: Educational possibilities and pathways,* Chapel Hill, University of North Carolina, 2012. Available from: http://sils.unc.edu/sites/default/files/publications/Information-Professionals-2050.pdf.

[20] S. B. Merriam, R. S. Caffarella, and L. M. Baumgartner, *Learning in adulthood*, Jossey-Bass, San Francisco, 2007.

[21] S. A. Meyers, Using transformative pedagogy when teaching online, *College Teaching* **4** (2008), pp. 219-224.

[22] J. Mezirow, Learning to think like an adult: Core concepts of transformational theory, in: *Learning as transformation: Critical perspectives on a theory in progress*, J. Mezirow and Associates, eds., Jossey-Bass, San Francisco, 2000.

[23] L. C. Moll, *L .S. Vygotsky and education*, first edition, Routledge/Taylor & Francis, London, 2013.

[24] J. Piaget, *The language and thought of the child*, Harcourt Brace, New York, 1926.

[25] P. H. Pollock, K. Hamann, and B. M. Wilson, Learning through discussion: Comparing the benefits of small-group and large-class settings, *Journal of Political Science Education* **7** (2011).

[26] J. Poon, Blended learning: An institutional approach for enhancing students' learning experiences, *MERLOT Journal of Online Learning and Teaching*, **9** (2013). Available from: http://jolt.merlot.org/vol9no2/poon_0613.htm.

[27] M. Prensky, Digital natives, digital immigrants, *On the Horizon* **5** (2001). Available from: http://www.nnstoy.org/download/technology/Digital%20Natives%20-%20Digital%20Immigrants.pdf.

[28] G. M. Slavich and P. G. Zimbardo, Transformational teaching: Theoretical underpinnings, basic principles, and core methods, *Educational Psychology Review* **4** (2012), pp. 569-608.

[29] A. Small, In defense of the lecture, *Chronicle of Higher Education* (2014). Available from: http://chronicle.com/article/In-Defense-of-the-Lecture/146797/.

[30] A. Taylor, Top 10 reasons students dislike working in small groups…and why I do it anyway, *Biochemistry and Molecular Biology Education*, **39** (2011), pp. 219-220.

[31] K. Vanhemert, Radical ideas for reinventing college, from Stanford's Design School. *Wired*, 2014. Available from: http://www.wired.com/2014/11/radical-ideas-reinventing-college-stanfords-design-school/.

[32] L. S. Vygotsky, *Mind in society*, Harvard University Press, Cambridge, MA, 1978.

Table 1. Discussion Boards

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Q1. Analysis & Idea Exchange	70	176	63	27	2
Q2. Motivation & Participation	70	159	73	32	5
Q3. Social Connection with Peers	54	147	90	38	12
TOTAL	194	482	226	97	19

Table 2. Wiki Project

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Q4. Social Networks & Content Construction	70	181	67	17	3
Virtual Team Membership	54	135	99	37	17
Group Work & Responsibility	112	162	51	11	5
Total	236	478	217	65	25

Table 3. Infographic Project

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Q7. Research & Data Analysis	99	183	52	6	0

Table 4.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Q8. Identify & Evaluate Sources	87	176	61	12	4
Q9. Research & Construct Knowledge	87	187	54	8	3
Q10. Skills Relevant to Life & Career Goals	88	172	63	14	6
Total	262	535	178	34	13