

6.5 Longitudinal Study: Efficacy of Online Technology Tools for Instructional Use

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Michael D. Uenking
Thomas Nelson Community College
uenkingm@tncc.edu

Studies show that the student population (secondary and post secondary) is becoming increasingly more technologically savvy. Use of the Internet, computers, MP3 players, and other technologies along with online gaming has increased tremendously amongst this population such that it is creating an apparent paradigm shift in the learning modalities of these students. Instructors and facilitators of learning can no longer rely solely on traditional lecture-based lesson formats. In order to achieve student academic success and satisfaction and to increase student retention, instructors must embrace various technology tools that are available and employ them in their lessons. A longitudinal study (January 2009-June 2010) has been performed that encompasses the use of several technology tools in an instructional setting. The study provides further evidence that students not only like the tools that are being used, but prefer that these tools be used to help supplement and enhance instruction.

1.0 INTRODUCTION

Technology is becoming more prevalent in our society and our regular day-to-day activities. With online chat, video, and other tools, we are bridging the gap between peoples of different cultures, ethnic backgrounds, and languages without having to spend thousands of dollars to travel to foreign countries. With tight budget constraints, businesses are choosing to conduct meetings using these and other tools instead of sending their employees overseas to have face-to-face conferences.

Even children of today are able to fight a "virtual" war or play "virtual" sports using an online gaming system (i.e. XBox, Playstation, Wii, etc.) and team up with people all across the world to accomplish their various tasks and missions. But as time progresses, as these children are growing up in their respective countries using these and other computer technologies, they are becoming increasingly more technologically savvy. But is this possibly creating a paradigm shift in the way these children are learning? Are educators encountering difficulties teaching children of the 21st century especially if they do not use technology in their classrooms? Could this possibly be contributing to some of the behavioral problems that educators are facing? The answers to all of these

questions are not entirely clear. But what is clear is that students enjoy having technology as part of the learning experience and educators also find that technology provides them with a rewarding experience as well. In the very least, according to Reference [17], learning in an online environment has been overwhelmingly proved to be just as effective as that in traditional classrooms (Tallent-Runnels et al., 2006, Spring, p. 116).

The following report encapsulates a longitudinal study that occurred from January 2009 to June 2010 in which an online tool (Adobe® Captivate®) was used to conduct a mechanical engineering technology lesson. Quantitative data was collected from the students and qualitative data was collected from fellow instructors during this timeframe. The next section will provide the body of this report.

2.0 BODY

The first main section is a literature review that imparts the background for this study. This section will be broken down into the following sub-sections: effects of online gaming, characteristics of an online student, advantages of online learning, and issues that exist with online learning tools. The second section will discuss the method used in the study. The third section will

provide a brief description of the participants used during the study. The fourth and fifth sections will introduce the reader to the quantitative analysis and results, respectively. Finally, the sixth section will provide some qualitative comments provided by the instructors who were given a chance to review the modules.

2.1 Literature Review

2.1.1 Effects of Online Gaming

As mentioned previously, there are children across the world who are engaged in various forms of online gaming. They use various forms of gaming devices to include their personal computer and/or some or other commercially available gaming console such as XBox Live, Playstation, Wii, or others. Whenever a child engages in these forms of online gaming systems, it is obvious that learning is also occurring. Not only do the children have to learn how to use the system, but also embedded within the individual games are certain techniques, skills, and strategies that must also be learned in order for the student to become proficient in the game and be more competitive with and against other players who are in the system. So, if learning is truly occurring in the gaming world, then how is that being translated to the real world; more specifically, how is it being translated in the educational environment of these students?

Reference [15] provides a detailed study that addresses this very question. This study provided the following results, in that online gaming:

- provides learners multiple avenues of support and communication;
- provides learners opportunities to access vital information via social networks and construct knowledge as the result of social collaboration;
- promotes deliberate, functional epistemology toward the acquisition of knowledge and the development of performance;

- affords various degrees and types of interactivity, each supporting the development of expertise in unique and interesting ways;
- and provides a structured context intended to promote the necessary skills to accomplish complex, goal-based tasks (Schrader & McCreery, 2008, December, pp. 570-571).

The study also states the individual learners “are empowered through a dynamic, interconnected process that scaffolds both technological skills sets and content knowledge [which, in turn,] provide substantial support and developmental tools for focused goal oriented learning at all levels of expertise” (p. 571). So, it is easy to see how students of today are using technology to not only provide cognitive engagement, but how that same technology also enhances their higher order thinking skills. What characteristics are then commonplace in these types of students who are now becoming online learners and are engaging in online learning environments?

2.1.2 Characteristics of an online student

References [2], [3], [11], and [17] all agree that a successful online learner is one that is already proficient in the basic use of a computer and has either prior online learning experience or is fluent/proficient with using the Internet and various online tools (Cramer, Cramer, Fisher, & Fink, 2008, p. 35, December; Dabbagh and Bannan-Ritland, 2005, p. 39; Menchaca & Bekele, 2008, pp. 246-249; Tallent-Runnels et al., 2006, Spring, p. 116). But reference [3] provides an even more detailed description of the ideal online learner:

- Exhibiting a need for affiliation
- Understanding and valuing interaction and collaborative learning
- Possessing an internal locus of control
- Having a strong academic self-concept

- Having experience in self-directed learning or the initiative to acquire such skills (Dabbagh and Bannan-Ritland, 2005, p. 39)

With these skills being applied in the online environment, there are definitely some advantages of learning online.

2.1.3 Advantages of Learning Online

There are many advantages to learning online which are as follows:

- References [4], [8], [9], [10], [11], [13], [14], and [19] all show that online learning contributes to not only higher achievement rates, but also to higher satisfaction levels, and higher levels of engagement (D'Arcy, Eastburn, & Bruce, 2009, Winter, p. 62; Jackson et al., 2006, May, p. 433; Krentler & Willis-Flurry, 2005, July/August, p. 319; Lim, Kim, Chen, & Ryder, 2008, June, p. 119; Menchaca & Bekele, 2008, pp. 246-249; Rogers and Cox, 2008, January/February, p. 38; Saadé & Kira, 2004, Winter, p. 362; Wang & Reeves, 2007, p. 190).
- Reference [2] states that students may feel "more connected, more challenged, and more engaged in learning than ever before... self-confidence [can also be developed as well]" (Cramer, Cramer, Fisher, & Fink, 2008, December, p. 35).
- From a more learning theory-based approach, online learning also, according to Reference [7], helps to support the "constructivist learning" modality "which encourage, and are focused on, users creating, or constructing, their own content" (Hsu, 2007, p. 71). These tools also "emphasize student interaction, group learning, and collaboration, rather than the more traditional classroom mode... [especially] where the emphasis is on student communication, where students have access to technology, and where creative output and thinking

is encouraged" (p. 85). Reference [5] also points out the need for this "constructivist learning" environment to be more "learner-centered" as well (Hannum, Irvin, Lei, & Farmer, 2008, November, p. 223).

- References [6], [11], and [20] also address the fact that learning online provides more flexibility of where and when the learning will occur (i.e. home, work, vacation, or on travel for business) and more specifically, for rural areas where a traditional instructor is hard to acquire (Hannum, Irvin, Banks, & Farmer, 2009, pp. 13-14; Menchaca & Bekele, 2008, pp. 246-249; Zhao, Alexander, Perreault, Waldman, & Truell, 2009, pp. 210-211).
- References [1], [4], and [14] address the efficacy of using online quizzes in that not only do they provide repetition, but also instant feedback to the students and, in turn, they better prepare the students for unit exams. Faculty and students are also able to focus on discussion and hands-on activities (Bartini, 2008, p. 10; D'Arcy, Eastburn, & Bruce, 2009, Winter, p. 57; Saadé & Kira, 2004, Winter, p. 361).

2.1.4 Issues with Learning Online

References [11], [12], and [17] promote the notion that it is important for students to have some sense of community whether it is a face-to-face contact session or some means to make connections with the faculty and their peers. This, in turn, helps to enhance the learning process (Menchaca & Bekele, 2008, pp. 246-249; Nicholas & Ng, 2009, p. 323; Tallent-Runnels et al., 2006, Spring, p. 116). The main issue that many students have is in how the online course is formatted and designed; so it is important, according to References [10], [11], [16], and [19], that instructors provide means for practice, feedback, and improvement for the course, that technical issues are directly addressed, and that they ensure that the

online tools that are being used are updated and current (Lim, Kim, Chen, & Ryder, 2008, June, p. 119; Menchaca & Bekele, 2008, p. 249; Sitzmann, Kraiger, Stewart, & Wisner, 2006, Autumn, p. 654; Wang & Reeves, 2007, pp. 186-190).

One additional issue that Reference [18] mentions is that there exist "differences in perception about online learning... between faculty students... which may be due to the heterogeneous points of view and motivations for online learning between faculty and students" (Tanner, Noser, & Totaro, 2009, p. 36). The next section will now go into detail about the study that was performed.

2.2 Method

In the Spring 2009 semester, a three-part mechanical engineering technology online module was developed that addressed the three basic methods of truss analysis (i.e. method of joints, method of sections, and method of members). The students were given the module in lieu of regular class meetings over a ten-day period. They were not allowed to obtain any assistance from the instructor during this timeframe nor were they allowed to elicit support from their classmates. The only tools that they were allowed to use during this timeframe included their textbook, a calculator, writing utensils, the module, and their respective computers with Internet access. All student participants were given a pre-test that was comprised of five truss analysis problems and were instructed to not prepare for it prior to the exam. This pre-test provided a baseline assessment score that was compared to a final assessment score in the final analysis component. These two assessment scores, Likert Scale values, and demographical data were the primary forms of quantitative data. A second session was attempted in the Fall 2009 semester, but various college Internet technical issues prevented the students from completing the module, so their data was removed from consideration for the longitudinal study. But the module was also presented to other

instructors via email transfer during the Spring 2010 semester and was also presented at the 2010 Virginia Community College System (VCCS) New Horizons conference. Qualitative data was collected from all of the instructors.

The software program that was used to develop the module was Adobe® Captivate® which enables the instructor to incorporate animation (text and graphic), PowerPoint slides, user-input text fields, instant feedback quiz generation (which can also send the results to the user's email address), music, and recorded voice. The program also allows the instructor to create multiple formats that can be incorporated into various media outlets (i.e. Flash video, HTML, and a standalone executable). A snapshot of the user interface is shown below in Figure 1:



Figure 1. Snapshot of Adobe Captivate User Interface

2.3 Participants

A total of ten students (comprised of three females and seven males whose average age was approximately 25) that were enrolled in MEC131 (Applied Statics in Engineering Technology) participated in the study. There were also five instructors from different colleges across the United States that provided qualitative feedback via email. The last group was comprised of six additional instructors in the VCCS who were given a demonstration of the module, were provided results from the Fall 2009 student

data, and were given an opportunity to interact with the module. Qualitative data was collected for this last group as well.

2.4 Student Quantitative Analysis

The student analysis is provided below:

Hypothesis: The average score of the post-test will be higher than the average score of the pre-test.

Null hypothesis: There is no difference in the average scores of the pre-test and post-test.

Test used: one-tailed t-test

Value for alpha: $p = .05$

Table 1 below provides the data that was collected for the pre-test and post-test data values:

Table 1. Student Pre-Test and Post-Test Data Values

Count:	10	10
Averages:	32.50	55.00
Median:	40.00	58.75
Std Deviation:	25.658007	30.29943
Variance:	658.33333	918.0556
Var/(number-1):	73.148148	102.0062
Total:	175.15432	
Square Root:	13.234588	
estimated t-value:	1.7000907	
Degrees of Freedom:	18	

2.5 Student Quantitative Results

Based on the values shown in Table 1, since the estimated t-value approaches the table value of 1.734, it can be said that the average test scores increased somewhat significantly from the pre-test to the post-test based on the module intervention ($t=1.70, dof=18, p<.05$); therefore, the

students did improve statistically in their test scores due to the module intervention.

A post-test questionnaire was also provided that utilized a Likert Scale format. The significant results are provided below:

Question: What is your overall feeling about the STAMINA modules that you participated in for Chapter 5?

Answer: 70% of the students liked the modules.

Question: Did you like or dislike the addition of music to the presentation?

Answer: 70% of the students liked the addition of music.

Question: Would you consider these modules to be excellent tools as a SUPPLEMENT to your regular classroom time; that is, would these tools be considered a great addition to your regular class?

Answer: 90% of the students would consider these modules as an excellent supplement to the regular course.

Question: If these modules were given as a SUPPLEMENT to my MEC131 course, I would use them to enhance my learning.

Answer: 80% of the students would use the modules to enhance their learning of the content material.

Question: In your opinion, could you use these modules as a STANDALONE learning tool; that is, could these modules be used instead of having a regular classroom environment?

Answer: 100% of the students disagreed that this module can be used as a standalone learning tool.

Question: Was the user interface (Adobe Captivate) in your browser easy to load and navigate?

Answer: 100% of the students agreed.

2.6 Instructor Qualitative Results

Several comments were provided by the instructors in both the email group and the face-to-face group that provide excellent feedback for this study. Some samples of the comments are provided below:

"I commend you for developing the modules listed below and I expect it took you quite some time to complete them. I would be interested to learn what your plans are for the modules going forward. I would also be interested to know what textbook you are currently using for this course."

"I REALLY liked your first presentation!..I'm going to have to learn how to create one like it."

"Great work here! I like the interactive and interesting visual and experiential components. I am developing any helps for my statics classes to make it more interactive."

"Overall you have done well with the presentations. The main benefit to students will be with the ability to review the demos more than once."

"I'm not sure how well the pre-assessment part would work, but the other stuff would be good for students who might want some passive learning experiences."

"Really like the graphics and colors and user interface..."

"Excellent: warm-ups, graphics, music..."

3.0 DISCUSSION

This study was limited in that the study was only administered to one group of students (95% confidence level, confidence interval +/- 30.98). Also, the group was not supervised to ensure that all three modules were fully viewed by each of the students even though the number of times each

student accessed the modules was catalogued electronically. It was hoped that the second group of students in the Fall 2009 semester would have provided an additional set of data to increase the validity of this study, but because of the Internet connectivity problems, this was not possible. Due to other commitments, course scheduling, and time constraints, the study was not able to be administered to other groups of students during the Spring 2010 semester.

Also, an issue that is encountered by engineering technology students is that this particular discipline has been traditionally taught in a lecture format only. Introducing technology into these types of courses creates a sort of paradigm shift in that not only do the students have to learn how to use this technology as an integral part of their learning process, but engineering technology instructors will also need to learn how to incorporate different forms of technology into their curriculum to help make their courses more robust.

4.0 CONCLUSION

What can be concluded from this study is that students not only liked the technology that was used, but prefer to have some form of technology to supplement their learning experience. This agrees with the literature review that was previously provided. Test scores did in fact improve significantly, so it is possible that if an instructor wanted to use the module as a standalone tool for implementation in a distance or hybrid version of the course, then there might be some usefulness in doing so (even though the students who participated in the study were against using it in this fashion). It still may be in the best interest of the instructor and the students to use tools like this to primarily further reinforce concepts taught in the classroom. Giving students the ability to review the video an unlimited amount of times gives them further practice in understanding the concepts that are provided which may, in turn, help better prepare them for unit exams. This definitely

frees up the instructor from having to use additional time in class to go over the same concepts and puts the onus on the student to take more responsibility of their own learning experience (i.e. being more learner-centered).

Fellow instructors also liked how the module was designed and seemed encouraged to want to try implementing some form of online tool in their respective courses. These instructors provided helpful feedback that will be used to revise and/or modify the modules should they be implemented again for future sections of the course.

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