Using Appropriate E-learning Systems to Optimize Teaching and Learning

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Abstract—The aim of this systematic research project was to determine the utility of various learning management system tools and correlate them with known factors of student success. Three distinct principles were assimilated to derive a framework for using web-based modes to improve student success. This framework was then supported via evidence found in the literature and practical experience. The three principles, or statements, were: 1) "Five factors are found to play a significant role in student achievement: high expectations, demonstrated concern, structure, information, and collaboration." 2) "It is widely agreed that student engagement and active learning play a major role in student success." 3) "Learning management systems are known to be good administrative tools and information repositories, but the question is whether they actually improve student learning." Specific tools, such as forums, quizzing, and simulations were correlated with various predictors of student success. The framework was applied and demonstrated effective for improving student success.

Index terms—E-learning, Learning Management Systems, Teaching and Learning

INTRODUCTION

A. *Background*

Distance education has been around at least since Isaac Pitman taught shorthand in Great Britain via correspondence in the 1840s [1]. By 1858, the University of London had created an international distance learning program [2]. Australia's Department of Correspondence Studies was offering programs by 1911 [3]. With the advent of audio and other multimedia in the 20th Century, distance learning programs flourished.

Today, the Internet is extending the reach and options of distance learning. Technology now enables schools to offer online programs with better student and instructor collaboration, flexible (asynchronous) learning, problem specific feedback, automated interactive lessons or presentations, and simulations of almost anything conceivable. In reviewing literature for online delivery, statistical trends show an increase in the percent of online courses, as well as a larger diversity in the types of courses

being offered online and in the types of organizations offering online courses.

What is the driver for delivering courses and programs online rather than face to face? Is it cost? efficiency? better learning outcomes? The purpose of this study was to identify or develop a framework that could produce favorable results in terms of student outcomes and success, whether by using strategies known to be effective via face to face instruction that are still effective when used in the online deliver mode or by adapting new strategies for the new medium.

B. *Overview*

In this systematic research project, the researcher reviewed literature in three areas: factors in student achievement, the role student engagement plays in student success, and utility of learning management systems.

These three distinct concepts will be presented and supported by existing literature before discussing how they are relevant to the intended research goals. Specifically, the concepts or statements used are: 1) "Five factors are found to play a significant role in student achievement: high expectations, demonstrated concern, structure, information, and collaboration," 2) "It is widely agreed that student engagement and active learning play a major role in student success," and 3) "Learning management systems are known to be good administrative tools and information repositories, but the question is whether they actually improve student learning."

Each of the three concepts will then be assimilated as components of a framework developed from the research and practical experience. Support for the framework will be demonstrated as specific learning management system tools are correlated with various elements of the investigated concepts found to be predictors of student success.

FRAMEWORK COMPONENTS

The three aforementioned components were each investigated to verify their validity and appropriateness for inclusion in the framework. The components summarized as: student success factors, student engagement, and online learning management systems, are relatively independent. For example, it is possible to employ a web-based learning management system that does not foster student engagement and that does not implement the student success factors.

Similarly, one could develop a course where students are engaged, but not learning the intended material (i.e., have low student achievement) and not using a learning management system. This, in fact, is one of the fears of allowing iPads or other mobile devices in the classroom. Students report being engaged, but not necessarily learning the course material.

And it is also possible to not be using a learning management system, not engage the students, but to provide many of the factors that allow the students to succeed. This last independence is the least observed, as one of the factors of student success is collaboration. However, collaboration in it's simplest form is basic communication and not necessarily student engagement.

The components will now be presented individually, with literature support and discussion of how each may be appropriate as a component of the optimized framework.

A. *Component One: Five Success Factors*

While there are several factors at different levels of abstraction that play a significant role in student success, the following five factors were found to be widely accepted. It is important to note that some factors the reader may be considering, for example "parental involvement", would be accounted for in one or more of the more general factors presented. The factors are: high expectations, demonstrated concern, structure, information, and collaboration.

High expectations. Students perform better when there are high expectations placed on them by others, whether teacher or parent. Ozturk and Debelak [4] report that setting realistically high academic standards plays a significant role in a student's success. Kinzie [5] lists high expectations and holding students accountable as top priorities in promoting student success.

Demonstrated concern. Mercado [6] (1988) report that demonstrated concern is a predictor of student success. Specific metrics of concern were extra time allotted to student, attention to students as individuals, and statements by instructors indicating a belief that students were able to learn the material. Demonstrating concern not just for the students' academic success, but caring for the student as an individual was shown to have a positive effect on student success. Giving attention to both academic and personal needs enhances classroom engagement [7].

Structure. When there is order to the material and to the learning environment, students will have a better chance of succeeding. In the computing discipline, for example, the accrediting body, ABET, provides a proven structure for academic programs [8]. When students lack structure in the form of objectives or goals it is more difficult to focus on the proper learning content because it is not apparent that the distractions are a lower priority. Structure, among other benefits, provides a means of prioritization that enables students to spend time and effort on what matters.

Information. This may have gone without mentioning, but without information, or content, the entire education process would be futile, even if the ultimate goal is something general, such as "be mature". Information is what receives the structure, what is being expected to learn, and what is being collaborated. Process without content is virtually impossible. Again, [8] provides suggested content for computing programs. In general, having enough content is not the challenge. Narrowing the content down to a realistic level for a course or a program is generally the more difficult task.

Collaboration. Whether working in teams or merely being allowed to share intermediate work, the process of discussing and sharing work has shown to play a significant role in student success. Sometimes referred to as social learning, collaboration improves peer acceptance and provides an environment which fosters behavioral change [9]. Zins, Weissberg, Wang, and Walberg [10] reported that student success improved through social-emotional learning.

A useful framework for optimizing learning management systems would enable the five factors of student success. Building on these factors would be the ability of the learning management system to engage the students.

B. *Component Two: Student Engagement*

Engaging students in the process of learning also plays a significant role in their success [11]. When students are engaged, they are emotionally connected, which has been shown to improve student success [12]. Again, [10] reported that student success is improved through social-emotional learning.

Kinzie [5] reported several methods of engaging students, including, allowing them to think about and apply what they learned in different settings; providing opportunities to teach and learn from each other through coordinated groupwork, peer review and study groups; employing varying styles of teaching approaches; and offering opportunities for service learning, reflection and connecting to realworld issues.

One of the forms of using a variety of teaching approaches is that of technology use. Parker, Bianchi and Cheah [13] reported that increased student engagement and satisfaction was common in environments where technology-enhanced learning was present. One of the ways technology enhanced learning environments increase learning is by facilitating student interaction [14]. As early as 1994, Avali found that students who used technology enhanced decision making strategies perceived enhanced skills, higher learning effectiveness, and more interest in the class [15].

C. *Component Three: Learning Management Systems*

Learning management systems did not immediately emerge from a void, but were developed gradually as technology advanced and as users found ways of using that technology. Originally, Internet-based systems consisted of nothing more than simple content repositories. Email was then used as the communication medium.

More recently, Weller [16] found that survey respondents still perceived problems with learning management systems. They are thought to be only content focused, lack strong pedagogy, based on a teacher-classroom model, combine average tools but not the best ones, do not feature a particular

tool, operate on a lowest common denominator approach, do not meet the needs of different subject areas, and lack interoperability among different systems.

Learning management system analysis. After a thorough analysis of several learning management systems this researcher found that, most, if not all, of the perceived weaknesses appear to have been overcome. The systems investigated included (in alphabetical order) Blackboard, Canvas, Desire2Learn, Moodle, and OpenClass. The investigation of these systems included feature analysis, maintenance and administrative support options, total cost of ownership analysis, extensibility, and ability to evolve over time to maintain pace with new technologies and pedagogies.

While each learning management system has its strengths and weaknesses, they all have some ability to hold course content and eportfolios, provide chatting and forum discussions, give on-line quizzes, log and summarize grades, provide schedule and calendar reminders, connect with third party applications such as plagiarism detection software or and handle multimedia files such as images, music and voices, Flash presentations, and videos.

Course content is still available via the learning management systems, but in far more variety than originally thought possible. Rather than simple links to static documents, multimedia files and interactive Flash presentations encourage students to be engaged during the learning process. Newer pedagogies involving social and asynchronous learning are becoming the norm for well-designed courses.

Rather than the traditional teacher-classroom model, learning management systems provide an excellent environment for peer teaching and learning. Journal and blogging features provide a means for reflection and idea dissemination.

A relative new standard, Learning Tools Interoperability (LTI), provides a connection between the best third party plugins and applications and the learning management system. This standard allows seamless interoperability. It also provides an effective form of extensibility and ability to dynamically improve the system over time to keep pace with new pedagogies and technologies.

Most of the systems evaluated offer flexibility in theme presentation, color schemes, activity and resource organization, etc., to allow for individual student preference and address accessibility concerns. Moodle appeared to be the most flexible followed by Canvas. In addition to appearance flexibility and extensibility, these two are also the only ones that are available as open source applications, meaning that the computer program source code is available at no charge and may be modified however the institution desires.

Supporting evidence from literature. Evidence is now showing that online and technology-enhanced courses do provide an environment that enables a higher degree of student success. Though, not all studies show this. Because of the mixed results found in literature, it can be inferred that in and of itself, an online learning management system does not automatically provide all that is needed for student success. The next section of this research report will address

this further. Immediately following are examples of how online systems and technology in general *have* shown to improve student engagement and success.

Zimmerman [17] showed that self-regulated learning improves student success. Self-regulated learning has to do with allowing students to have a say in what, how, or when they learn. Online systems allow for asynchronous learning, offering students the flexibility to choose when to take a quiz, submit an assignment, or be involved in a forum discussion.

Students in courses involving technology of some form perceive higher learning effectiveness and more interest in the class [15]. Weigel [14] reported that technology enhanced learning environments increase learning by facilitating student interaction. Active learning, a form of student engagement, increases student learning and is possible via online delivery modes [18] .

Riffella and Sibley [19] showed that utilizing online instruction modes in a course increased the level of learning over the same material presented in a purely face to face mode. Parker, Bianchi, and Cheah [13] reported that both student engagement and student satisfaction increased in technology-enhanced learning environments. And a Department of Education meta-study, which collected research data from online courses taught between 1996 and 2008, reported that online delivery improves student outcomes or fosters a better learning environment than the face to face delivery mode [20].

So for over 20 years, 1990 – 2010, these and other studies have provided evidence that supports the ability for technology and technology-based systems to provide an effective mode of instruction. The next section will complete the assimilation of the three concepts, student success factors, student engagement, and online learning management systems and correlate specific tools with practices that follow the research principles detailed above.

ASSIMILATED FRAMEWORK

The three framework components: student success factors, student engagement, and online learning management systems, are relatively independent. But when one combines them in a purposeful manner, it is possible to synergistically increase student success. And this was the goal of the research. When assimilated, the created framework is as follows.

The base of the framework is the learning management system and associated tools. The remaining elements come from the other two concepts of student engagement and factors of student success.

As introduced in the previous sections, collaboration, student engagement, and technology-enhanced activities each enable student success to some degree. By creating an exercise that includes all three, success should be further improved. The learning management systems reviewed have wikis, chat activities, and discussion forums that could enable student engagement through collaboration.

Optimizing through appropriate use of discussion forums. Simply opening a discussion may not engage students. Rather than assigning students to "discuss the chapter content", it is

more effective to ask a specific question about one of the points in the chapter in such as way as to allow them to collaboratively "solve a real problem." This utilizes several of the five factors of student success and of student engagement. It provides more structure and allows them to work collaboratively. The instructions should be worded to convey high expectations. There is of course information from the assigned reading. Students are engaged in multiple facets: teaching and learning from each other, using technology-based tools, and solving real-world problems. And by actively participating in the discussions and providing meaningful guidance and redirections, the the instructor or facilitator demonstrates concern for the student. In this way one activity or exercise assimilates many of the concepts known to be effective at increasing student success.

Optimizing through appropriate use of quizzing. Another example is the use of quizzing. Online quizzes were shown to be effective as a method for engaging students to read assigned material, but not effective in assessing knowledge of assigned material if given as a posttest. Quizzes can be used, then, not to evaluate or assess whether a student read and learned the material, but to encourage and help the student get through the reading assignment [21].

When single chapter quizzes were given as a means to engage the student in active learning, the unit test scores were on average higher than when the chapter quizzes were available only after the reading assignment was due and students were required to take the quiz without the text or any resources. This means that quizzes must be rewritten to accomplish a different purpose. Assignments must be designed to engage the student—sometimes called the learner—to learn for him/herself and from peer learners.

Optimizing through appropriate use of simulations. Motivation is a proven predictor of success in online courses [22]. Providing the right amount of challenge will help motivate the students to work on the assignments. Most students love playing what they consider to be games, especially computer games. CyberSeige [23] is an effective online tool for teaching computer security. It is a form of simulation training and is structured so as to appear to be a game; but is very educationally oriented.

Wireshark [24], a network analysis tool, is great for both academic and operational environments. It provides real-world experience as well as being a technology-based training aid. While both CyberSeige and Wireshark are oriented toward technology or computing related academic programs, the are simulation programs and educational games that can be found for most disciplines.

Optimizing structure by providing clear assignment instructions. Online or hybrid courses required a significant amount of development time. And if not designed with efficiency in mind may also require excessive amounts of time to teach. Sheridan [25] found that effective use of tools decreases instructor workload and improves student success in online courses. By spending a little more time to carefully word assignment instructions and choose optimum tools to enable learning of a course objective or goal, instructors will save valuable time and be more effective in their work. This principle is that of structure. Structure is especially important

for hybrid or online courses because there is less or no opportunity for the student to ask questions face to face. By providing definite structure to the assignment, in the form of multiple questions parts, or bread crumb instructions, students will be less confused about what they are to produce or learn.

Optimizing through appropriate use of calendars, schedules, and progress markers. Most learning management systems have options for course calendars that automatically post upcoming course activities and deadlines on the main course page. The use of these features keeps students—and instructors—aware and involved in the course. This is is another aspect of student engagement and provides a further degree of structure.

So the framework itself is not a complex one. By systematically combining factors of student success and methods of student engagement with a technology-based mode of instruction, it has shown to increase levels of student satisfaction, student success, and levels of learning.

CONCLUSION

As difficult as it may be in practice, researchers have identified methods and environments that will foster and enable student success. Further, online learning management systems are being employed in ways that extend the effectiveness of known best practices in face to face teaching and learning.

When proper tools are employed, the use of online learning management systems can increase learning effectiveness significantly [26]. Using a learning management system as part of a blended, or hybrid, course has proven to both enhance and expand effectiveness and efficiency of learning in higher education across disciplines [27].

Using the tools and techniques as described in this report will increase student engagement and student success. But which tools and how they are used should be will be specific to the discipline and type of student expected to be in the course. The successful use of tools from this study were based on students and courses within computing and technology programs.

Traditional pedagogies for face to face instruction included memorizing of concepts and facts. Modern perception of learning is less memorizing of facts, since they are usually freely and quickly available online or in digital format. Many academic programs, although it is not intended to be so, have been built around rigid fact gathering, learning to follow over-structured processes and procedures, and developing thinking patterns that are not necessarily creative or innovative.

While it is possible that not quite as many facts or even a few concepts may not be completely understood by students in an online or hybrid course or program, other benefits, such as practical experience with operational applications and services, may outweigh any minor so-called deficiencies in the overall learning of a student [28].

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