Undergraduate Thesis Prospectus

Supplementary Online Learning Tools and Course Gamification

(Technical Research Project in Computer Science)

Detracted Development: Getting Educational Technology into Classrooms

(STS Research Project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem

How can universities better prepare students professionally and personally for life after college? 73% of employers in the United States believe that colleges and universities play a major role in the nation's ability to compete in the global economy (Hart, 2006). Despite this, 63% of business executives believe that recent graduates do not have the needed skills to be successful, with 87% of employers agreeing that universities need to raise the quality of student achievement before graduation. Many believe that certain "soft skills" are being neglected in favor of more technical skills, with 44% of employers agreeing that teamwork skills are most important to look for in new graduates. Critical reasoning and communication, both oral and written, are the next most important skills to employers. Improving the percentage of students that graduate with these "soft skills" should be a priority for universities.

Supplementary Online Learning Tools and Course Gamification

Our client is Mark Floryan, a Computer Science professor at the University of Virginia. He is dissatisfied with the way classes are currently taught, believing that strict deadlines and assessments detract from students' ability to learn effectively. Floryan seeks to understand the efficacy of gamification as a tool for learning. In his proposed system, students advance through a course as they advance through a video game: at their own pace, with deliberate practice and immediate feedback. Course material will be organized by topic, visualizing student's progress. The system will accelerate quiz administration and increase classroom transparency; the extent to which instructors can gauge students' understanding of the class material.

Current solutions to this problem are a lecture-based exam model. In this model, lectures are the foundation of the course; quizzes, homework, and exams are all contingent on the lecture material, or any material the professor labels as important. This current solution forces students to be present in lecture both physically and mentally and learn at a controlled pace.

Requirements are important because they enable clients to express their desires in a clear and unambiguous way. By converting client wishes to requirements and reviewing those requirements with customers, software developers can confirm that the product they will create matches the client's needs.

Based on several meetings with the client, we assembled this list of requirements, separated by importance:

Minimum Requirements:

- The professor must be able to access all functionality of the system
- The professor must be able to arrange topics to follow their syllabus
- The system must prevent student data from being accessed by anyone other than that student or course staff

Desired Requirements:

- The system must be able to display and automatically grade multiple choice questions
- The system must be able to display and automatically grade "Parson's Problem" questions
- The system must be able to generate quizzes from a professor-specified bank of questions
- The system must display course grades based on a topic-competency metric
- The system must be immediately responsive to students submitting assignments and viewing grades
- The system must be able to handle the uploading of large data sets by the professor in a reasonable time period
- The Professor must be able to give Teaching Assistants access to student grades and assignments
- Students should be able to view their own data and grades.
- Students should be able to view only topics which are currently unlocked.

Optional Requirements

- The professor must be able to set automatic grading procedures to match the grading system for a syllabus
- The system must be able to serve and grade (run) short-answer coding questions
- Graders must be able to manually assign grades to long-answer questions.

Figure 1.

Detracted Development: Getting Educational Technology into Classrooms

How do proponents and critics of educational technology use in classrooms advance their respective agendas? New technologies for optimizing education are constantly created and marketed to schools. Do these technologies improve students' learning capabilities or hinder them?

Teachers arguing for further integration of educational technology in classrooms are spreading the word all over the country. Heather Wolpert-Gawron (2009), a middle school teacher and author, encourages people to lobby for educational technology funding by directing them to Ed Tech Action Network's page that sends letters to local and state representatives. She states that any teacher that "believe[s] that technology integration must be included in the future of education, you can no longer be 'just a teacher.' You are now a member of a special-interest group." Unorganized groups of teachers like this one contribute to the integration of educational technology in classrooms by making themselves heard.

Despite many pushing for faster integration, some teachers such as Terry Heick propose it's not easy to change the infrastructure of teaching. In his article, "Why Some Teachers Are Against Technology In Education" (2015), he argues that by changing the underlying system every few years with new technology, teachers don't have enough time to readjust. Drew Perkins' article, "5 Problems with Technology in Classrooms" (2019), lists the problems many teachers face. The change of pace and the cost of integrating new technology strain the already limited resources of schools. With such schools struggling to provide classroom necessities, the new technology is seen as wasteful and unnecessary. The social dynamics of the classroom change with technology as well. Students taking digital lectures miss out on face-to-face time with teachers and have fewer in-person chances to form friendships with other students. Perkins

believes that when using technology, it becomes difficult to prevent students from distracting themselves with unrelated apps or websites. The technology can also become a crutch for bad students, similar to how calculators impact their basic math skills.

While technology can assist comprehension, students disagree about technology in the classroom. Some view it as distraction, while others find it helpful. Most students would welcome guidance in effective technology use (Marcus, Tugend, & Mongeau, 2019). Berry & Wintle (2009) found that students found a technology-rich science project more challenging and time consuming, but also more fun and engaging than the traditional project. Students assigned to the technology-rich project showed greater retention of information and academic engagement than the traditional science project students.

Educational technology companies, such as SMART Technologies, promote classroom technology, claiming it helps teachers personalize material (SMART Technologies, 2018). These companies are engaged in constant bidding wars to win the favor of technology directors of school systems whether or not the data shows the need for new tech.

Researchers disagree about technology's effects. Beatty (2017) found that in high school classrooms, hand-held personal education technology made no statistically significant difference in student achievement, in students' perceptions of their own devices' values, or in their attitude about the class subject. Glass & Kang (2018) found that while dividing attention between a device and lecture did not reduce lecture comprehension, it did reduce long-term retention of lecture material. Exam performance was significantly worse in the study sample for whom devices were permitted.

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