Proposal: Effective Web-Based Computing Education System

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ABSTRACT

With the incredibly extensive and growing use of computers around the world, the importance of proper and effective education in terms of computing has grown in importance as well. Computer science topics have always been regarded as difficult and even foreign, which can be discouraging for many people who may be interested in the field. This study hopes to implement a simple, effective, web-based education system to improve the computing education experience for the majority of users. To accomplish this, a variety of web-based computing education systems are analyzed in terms of simplicity and feedback quality. A new online education system is then implemented based on these results for users to further test its simplicity and feedback quality. In the comparison between the analysis of existing systems and the analysis of the newly implemented system, the newer system is expected to have stronger effectiveness in providing accessible web-based computing education.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous; See http://acm.org/about/class/1998/ for the full list of ACM classifiers. This section is required.

Author Keywords

Web-Based; Online; Computing; Education; Computing Education; Feedback; Progress; Assessment; Accessibility

INTRODUCTION

Creating a system that allows for effective education techniques in the discipline of computer science has always presented difficulty due to the foreign nature of the field. Unlike many educational systems that can utilize lectures and examples to teach subjects, computer science requires a change in how a student actually thinks about a problem. Rather than considering a solution on its own, students must also learn how to think about a problem and the issues that come with a solution to it. Looking at examples of this in code snippets can assist, but it does not actually teach the thought process required to create those solutions. Many current educational systems that aim to teach programming and other computer concepts to students fail to teach this or utilize complicated interfaces that confuse students and inhibit learning. We believe that a tool may be designed that can allow students to effectively learn the necessary material without being distracted by ignorance on how to do their task on the specific platform they are using. Research examining effective e-learning, as it is called, has increased within the last decade as more institutions begin to utilize the advantages offered by online interactions. Our goal with this project is to synthesize that research into a functioning product specifically built to assist in the education of computer science students.

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PROBLEM

Most web-based computing education systems tend to be convoluted and cluttered, with a large majority of users spending majority of their time searching for ways to practice code than actually practicing. Furthermore, many traditional computers require users to download a large variety of programs and compilers to legitimately practice code, which can be inconvenient for some users. As a result, online computing education comprises mostly of reading text with very limited user practice, which leads to complicated and ineffective methods for computing education.

PROPOSED SOLUTION

In the hopes of improving the computing education experience, this study will be investigating the strongest characteristics of many existing educational systems to implement a new computing education system in a web-based environment. From analyzing a variety of existing systems, a new implementation for an online computing education system will be created to provide a much more simple and accessible method for users to learn a variety of computing techniques. This new system will hopefully provide a straightforward education system that allows for users to practice computing concepts in a way that greatly improves upon many existing methods for learning computing. Users will be given lessons and examples where they will be required to practice the concepts before moving on to other topics. This is intended to provide a much more effective educational experience by providing a way for users to receive hands on experience with computing topics without the need for using additional software. The web-based environment can also allow for an additional level of feedback between admins and users for comments and recommendations on practice submissions and additional questions

RELATED WORK

In regards to web-based computing education, there have been a variety of studies conducted in the hopes of renovating and improving the system. One attempted study involves adaptive and intelligent web-based education systems [1]. In this study, the researches run a series of experiments to determine design paradigms for web-based education systems that utilize artificial intelligence and machine learning to provide an adaptive and interactive experience for users. First researchers used a variety of user studies to gather data on the designs for older, existing web-based education systems to establish similarities and differences between them. This data was then used to create a general design paradigm for these systems. The same procedure was then used to analyze more contemporary, newer systems to establish a second general design paradigm. The older and newer design paradigms were then compared to find that newer systems have greatly improved upon the older designs by moving away from interactive classroom aids to a more independent entity that adapts and customizes the learning experience for users on their own [1]. Similarly, a study on educational game design for online education attempted to establish an effective and reliable form of web-based education using games as the framework [2]. The study analyzed a variety of web-based educational games to implement a new game in the hopes of establishing a reliable paradigm for creating fun and interactive gaming oriented educational systems [2]. The newly implemented game was then tested by users to measure its educational effectiveness, adaptability, and accessibility. The study found that adventure based games with multiple user interactions served as an effective form of online education, providing users with a level of adaptability and interaction that many other educational system designs lack. Another study related to the analysis of the adaptability of e-learning platforms focused on open-source projects and rated them based on various metrics. The purpose of doing this was to analyze how closely these platforms could meet the needs of its students and was necessary due to the relatively small amount of coverage this topic receives [4]. To undertake this study, researchers took nine of the most prominent open-source e-learning platforms and rated them based on such criteria as available tools, usability, adaptability, manageability, and technical aspects. The strategy used to evaluate the platforms was the qualitative weight and sum approach, which is a well established method of evaluating software products [4]. Results indicated that the most effective platform was Moodle, making that a focus of our project to examine how to improve on their design. Additionally, in this modern age of advancing technology, the traditional classroom has lost much appeal with both younger generation traditional students and older, life-long learners. More and more students are turning to secondary methods for learning material than they typically would have in the traditional classroom [6]. Over a period of 51 years, studying the educational system has shown that students learn best through classroom engagement, as shown through their increased gpa and ability to apply what they learned [6]. The use of classroom response systems over the past several years has also demonstrated that classroom involvement can provide significant improvements in learning [3]. However, we still face a harsh fact that even with improved technologies, there are still many students who do not participate and the end result is not only a lower gpa, but more difficulties and a longer learning curve after entering the workforce. Fies and Marshall have shown that less than 25 percent of the student classroom will participate and less than 10 percent will participate on a regular basis [3]. Rocca demonstrated several techniques for encouraging student participation, such as having smaller class sizes and setting the classroom up to be U-shaped to improve communication, but none of these fix the big class problem that is typical of todays schools [6]. Increasing engagement in our platform will require an ability to evaluate how effective our e-learning platform was, a task that will be far easier with the research done in Noesgaard and Orngreen [5]. In this study, the authors sought to answer the question of how to define effective e-learning, how to measure it, and what constitutes an effective e-learning solution [5]. To answer these questions, the study aggregated much of the recent research answering similar questions and analyzed it to find common answers between sources. In doing so, it was found that most e-learning studies use learning outcome as a metric to determine effectiveness by use of quantitative data, allowing for a better definition of effective e-learning as well.

METHODOLOGY

Our work is a two part system, first we will be creating a web based interactive system that will allow instructors to create slideshows on the web. Unlike the tradition powerpoint system that is most commonly used, our web system will incorporate practice and test slides. These will allow instructors to provide an example that the student can copy onto an input box where it will be evaluated to ensure correctness. The test box will provide a quick test of their learning by having the student complete an exercise that will be tested against a hidden correct answer. The test slide is designed to check if students understand the information currently being taught and receive help from teaching assistants should the student not understand the information. This will provide a high level of student participation that can ultimately be tracked by the instructor so that students having difficulties in class and receive the help they need before they fall too far behind and without singling out individuals. Our current plan is to gradually build an interactive website that will allow us to test if students are able to learn faster with the system as compared to traditional classes. We will create a makeshift computing language along with a teaching lecture that will last approximately 30 mins. The computer language will be significantly different from modern computing languages, such as Java and C++, to ensure that previous knowledge of computer languages does not impact the study. Two sessions will be conducted, one with the website, one without. At the end of the lectures, a quick 10 question quiz will be provided to the participants. The quizzes will be scored and averages will be compared between the two groups to determine if there is a significant difference. Currently, based upon the finding of our research reviews, the increased involvement in student participation, by using the web based interaction, should allow us to see an increase in average scores on the quiz. The current time frame for our research project is listed below. Responsibilities are as follows, but open for change: the web based system will

be designed as a collective group. The design build will be lead by Keith Francis with regular inputs from the remaining team. Construction of the makeshift computer language will be conducted by Cam Nagel with regular inputs from the remaining team. The instructional class build will be conducted by Jewett Lane based on the makeshift computer language. The final quiz will be built as a team once all other objectives have been completed. Decision of who will lead the teaching during the experiment and who will be the teaching assistants will be decided at a later date.

TIMELINE

February 25th - Github Established March 8th - Finish Research On Existing Education Systems April 10th - Web-Based Education System Created April 26th - Testing With System Completed May 10th - Poster Presentation May 12th - Final Project Completion

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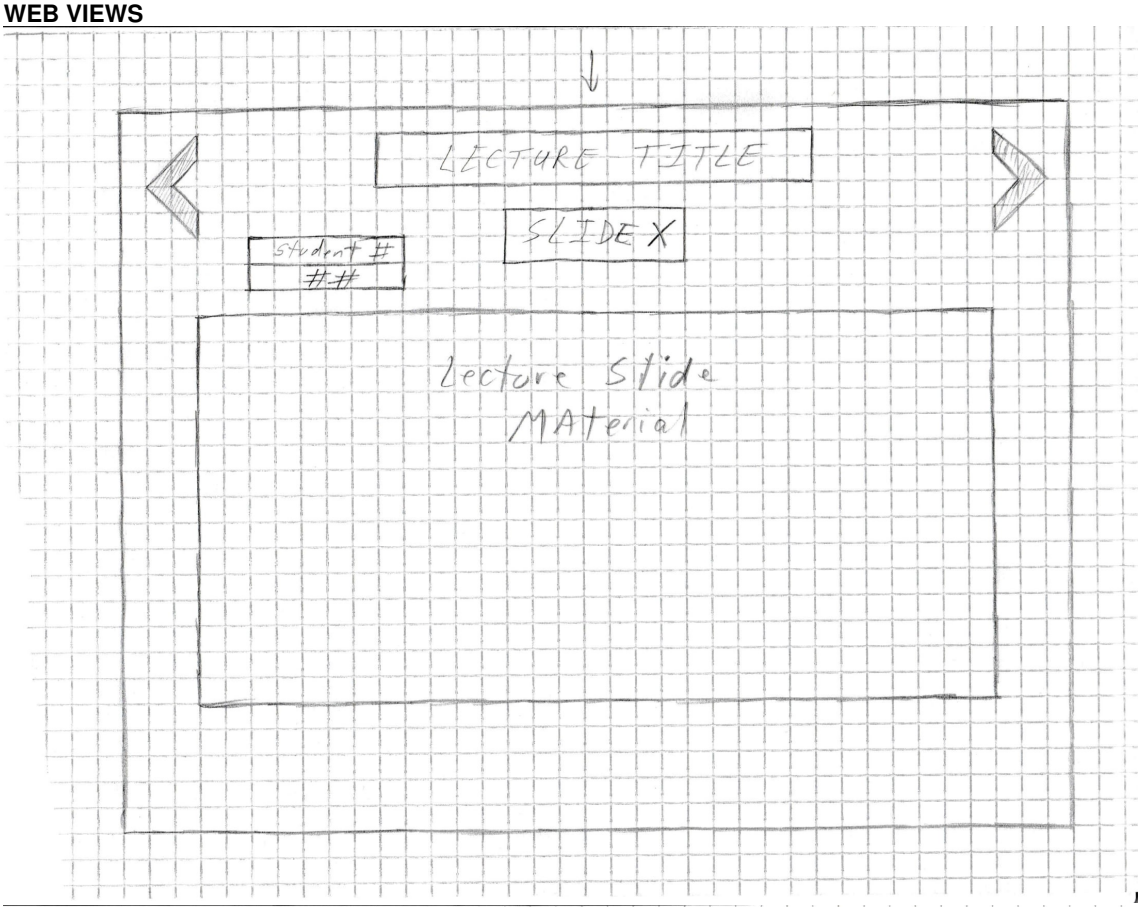
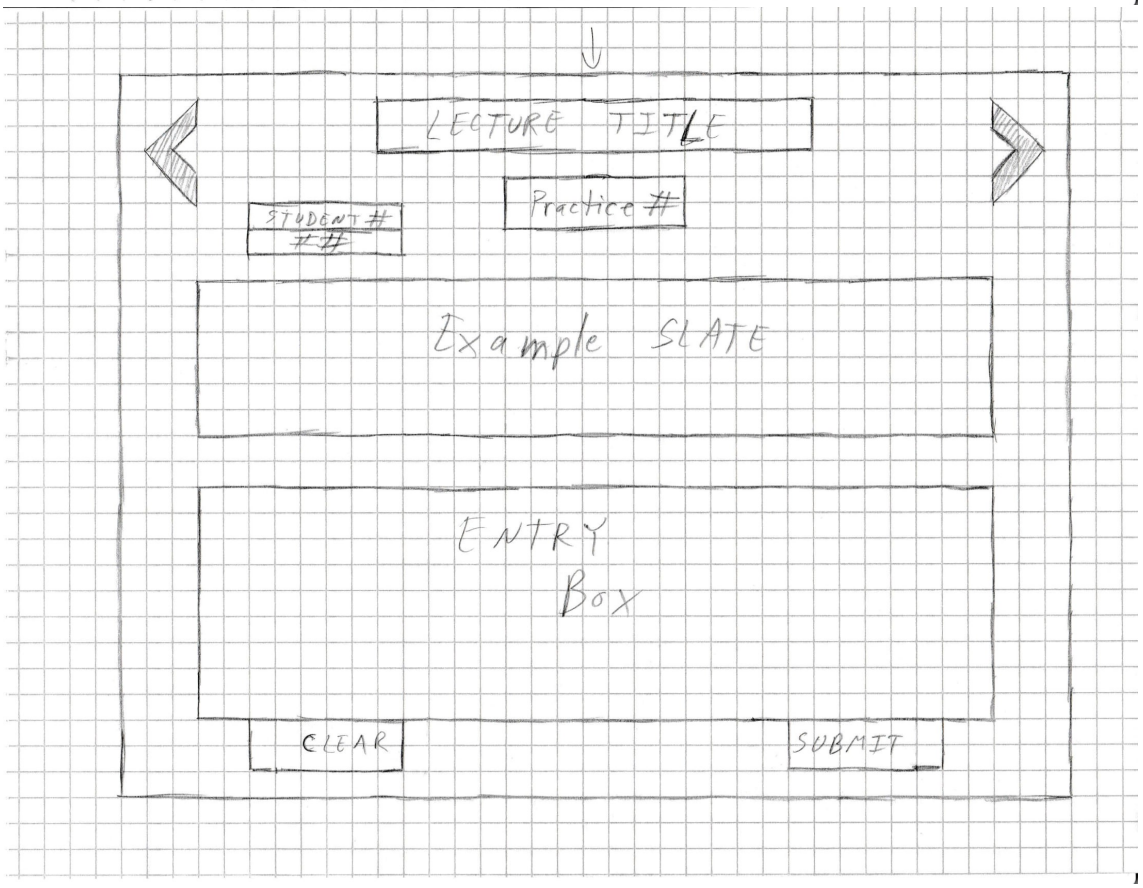
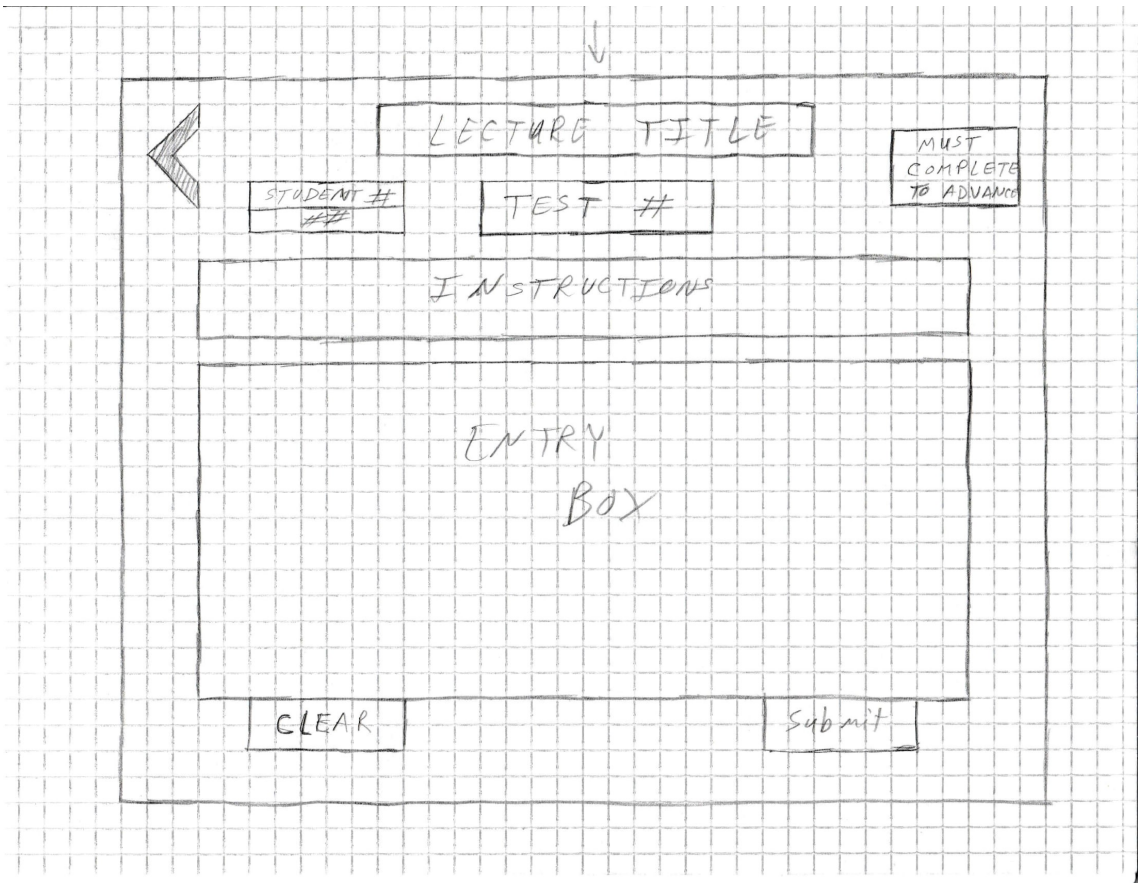
APPENDIX

WEB VIEWS






LECTURE TITLE
MUST COMPLETE TO ADVANCE
STUDENT #
TEST #
INSTRUCTIONS
ENTRY BOX
CLEAR
Submit