

**Designing a School Related Application that Positively
Affects High School Students' Performance in School**

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Joseph Sanders
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On my honor as a University Student, I have neither given nor received
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Signature  Date 3/24/2021

Joseph Sanders

Approved _____ Date _____

Prof. Jack Davidson, Department of Computer Science

Approved _____ Date _____

Prof. Luther Tychonievich, Department of Computer Science

Abstract

The effects of social media on younger generations is just beginning to be understood, and students' success in school may be influenced by technology that didn't exist 5 years ago. Specifically, school related web or phone applications may be positively or negatively affecting students' performance. Past research has examined various aspects of applications that influence students, however research connecting the influence to specific features has not been found. New findings surrounding the effects of social media are being released each year, so it may benefit social media users to compare the most relevant research to the current popular applications. To accomplish this comparison, a case study of Academic Magnet High School was conducted. By interviewing a computer science and an english teacher from this school, it was found that features encouraging participation, exposing peers' perspectives, providing variety to class, supplying coursework, and allowing students to move at their own pace can benefit students. Finally this knowledge will help in the development of an all encompassing school related application that supports students to perform better in school and have more successful educational careers.

Introduction

Throughout the world students struggle with school. Approximately 1 out of 4 high school seniors in America will not graduate high school (11 Facts About High School Dropout Rates, n.d.). A child's ability to succeed at school helps prepare them for the rest of their life. Today's students face psychological factors unknown to previous generations. Currently 90% of teens ages 13-17 participate in at least 1 form of social media (Kamenetz, 2019 & 2018). Middle and high school students benefit from having positive influences around them from the people

they interact with to the applications on their phone. The primary problem this technical paper addresses is that current school related software applications have flaws, and the beneficial features that help students perform in school are spread across multiple apps. Thus this paper will present the design of a school related software system that encompasses all positive functionalities, which include increasing engagement, exposing students to each other's perspectives, providing variety to class, and allowing students to learn at their own pace, and removes the negative attributes.

Related work

There were four existing software applications that were examined: Flipgrid, Padlet, Code.org, and Projectleadtheway. Flipgrid allows students to record videos of themselves responding to prompts (<https://info.flipgrid.com>). A teacher and other students can then watch and record responses. As stated in my STS thesis, this application was well liked and believed to be beneficial from teachers (Sanders 2021). Its primary drawback is its lack of features. Contrary to Flipgrid's video format, students utilize Padlet by typing posts and writing comments (<https://padlet.com>). An absence of teacher controls for Padlet introduces the possibility of students crashing the application by repeatedly sending the same message, which occurred in one teacher's case. Code.org provides coursework that teaches students many topics (<https://code.org>). In the case of my study, a teacher had his students learn computer science principles from the website. This teacher thought that some students become bored of Code.org because it can be elementary at times. Finally Projectleadtheway lets students practice ethical hacking by supplying guided exercises and virtual machines (<https://www.pltw.org>). The teacher using this software believed the drawback was its rigidity. He reported having little to no control over it.

Application Functionalities

Given the numerous flaws the related school oriented software applications have, a new app that builds upon the positive features and removes the negative features of related work is to be designed. As with many applications, the first step in a typical use case for both teachers and students will be registering for an account or logging in. Students and teachers at schools that have established the ID linking capability should be able to verify their app account to their identity using their student ID. This ID linking capability will be explained more in depth in the next section. After logging in users will arrive at a home page that displays their current classes. If a user's account has been linked to their school then the classes should automatically be displayed. Otherwise teachers will have the ability to manually create classes, and students can manually enroll.

When teachers and students select a class the modules that have been setup for that class are displayed as well as an option to add additional modules for teachers. The modules are the heart of this application; they are the tools that are designed from the results of investigating how software applications positively and negatively affect students' performance in school. The first module is discussion. It allows for teachers to create questions, students to respond to questions, students and teachers to comment on responses. Each of these actions can be done with text or video and can be made public or private. Public posts, responses, and comments are viewable by everyone in the class while private ones are only viewable by owners of the hierarchies above it. That is that a private response can only be viewed by the creator of the question, and a private comment can be viewed by the creator of the response and the creator of the question. Teachers will have the ability to limit the number of responses and comments in order to prevent an issue that a similar application, padlet, had.

The second module is coursework. It lets teachers setup lessons so that students can learn the material of the class at their own pace. Creating these lessons will be like writing a document with options for formatting, images, and videos. After the lessons teachers can make activities involving questions and answers, free responses, or, for after coding lessons, an in app coding editor. Teachers should be able to see their students' progress through the coursework; likewise students can see their own progress.

System Design

The first consideration taken into account is that the system should include both a mobile and web application. A web application is useful for teachers who may need to design coursework or perform administrative functions while the mobile app will primarily be used by students in class. To simplify building for both these platforms, React will be used for front end web development, and React Native will be utilized for front end mobile development. Not only will React Native allow for simultaneous iOS and android development, it will ideally support code reusability from the web app at times because the two apps will have similar API calls and functionalities. Building a coding editor in React manually could be quite difficult, so the JavaScript project CodeMirror will be implemented (CodeMirror, n.d.). It supports multiple languages and has many CSS theming options. Similarly to the coding editor, a document editor package will be used such as ej2-react-documenteditor for creating the coursework.

The next design decision made was choosing a database solution, and the primary criteria were scalability and flexibility. This app has the potential to be used at schools all across the country and even the world. Therefore as the size of the database increases, speed can not be sacrificed. The amount of data stored may become large for two reasons: user growth and

coursework creation. The servable market is all high schools which includes the students and teachers which potentially means that there may be 18 million users, 15.4 million high school students and .26 million teachers (The NCES..., n.d.). For each user the system will store information such as their name, email, password, classes, completed coursework progress, and potentially an ID link to their school account. The second reason for size is the coursework module. A single teacher's course could be tens of thousands of words long and may include pictures, questions, responses, and quizzes. The app also will store a variety of information in the database. It will have uniform entries such as users as well as non-uniform items such as lessons in the coursework module. The courseworks may, but are not required to, contain many self contained objects such as free response questions, multiple units (entire sections of material), pages, and multiple choice questions. Thus MongoDB's scalability will allow it to outperform SQL's join capability because it offers the ability to store self-contained objects and functions quickly at large sizes (Ramino 2019).

Finally the backend connecting React and MongoDB will be Express.js running on Node.js. Express works extremely well with MongoDB making JSON information transferral easy. Express.js and Node.js also synergize well with React as they keep everything in one programming language, javascript. This entire web stack, mongoDB, express.js, react, and node.js (MERN) is today's web stack of choice, according to one article, and will fit this application well (What is the MERN Stack? Introduction & examples, n.d.). The stack will be hosted on an AWS EC2 instance in order to ensure scalability and to reduce costs compared to buying our own machines to host the system.

If a school plans to integrate this application into many classes, it would be advantageous to them to have the ability to establish account linking by giving the application access to the

school's database containing student id's. This feature would help the school verify identities, and there are two approaches. The first approach is to copy the relevant data into a new MongoDB collection. The second approach is to only store a reference to the original data and lookup the information using an existing API whenever it is needed. Choosing between the options will depend on the school's system, so the application designed in this paper must support both options. If the school's API supports searching their database with ease, then it is better to not unnecessarily duplicate data. Otherwise copying into a new collection is a viable solution.

Results

The objective of this paper was to design a platform that increases students' engagement, exposes students to each other's perspectives, provides variety to class, and allows students to learn at their own pace. The first three objectives are accomplished by the first module, discussion. Encouraging students to respond to prompts and comment on each others' responses with video and text has been seen to achieve all three objectives (Sanders 2021). Finally the last goal, supporting learning at each students' own pace, is realized by the coursework module. Being able to read through a class's material and answer questions on their own time will help both the students that need extra time and the students that feel bored with the current pace of class.

Conclusions

In conclusion, a system has been designed that combines the beneficial features of school related software applications. Furthermore the application incorporates functions to solve problems that exist in related apps. Schools and students that use this app will improve their

educational experience by gaining a tool that can help provide variety to class, expose students to their peers' perspectives, let students learn at their own pace, and give teachers control over their coursework.

Future work

The first goal of future work would be to develop the app based on the design decisions laid out in this paper. Next, the feature to be added first with additional time would be a coding environment that is executed on a virtual machine. While it is a niche feature, computer science students that are trying to learn ethical hacking would benefit greatly from having an environment to practice. Projectleadtheway was a related app that was examined, and it has virtual machines that it allows students to utilize for the same purpose. However, projectleadtheway does not support coursework flexibility which would be solved in my app.

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