

Undergraduate Thesis Prospectus

Tracking and Analyzing Test Scores in a Local School System

(technical research project in Computer Science)

The Struggle to Find Educational Technology's Place in the Classroom

(STS research project)

by

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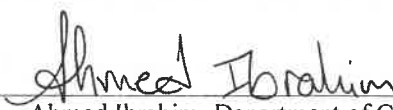
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General research problem

How are school systems striving to use educational technology while protecting student data?

Educational technology can stimulate classroom collaboration and learning (Mostmans, et al., 2012), support instructors' management responsibilities (Sandholtz, et al., 1992), and automate record keeping (Oredein, 2008). However, it can also distract students (Goundar, 2014), induce school systems to increase class sizes (Taft, et al., 2011), and expose students' data to legal or illegal collection by third parties (Rowe, et al., 2011).

Tracking and analyzing test scores in a local school system

How can we develop a system to track and analyze student test scores in a local school system?

The project department is Computer Science and the technical advisor is Ahmed Ibrahim. The project is a capstone, and my collaborators are Preston Troxell, Daniel Hanson, Karan Chawla, Matthew McDonnell, and Omid Khan.

The project we are working on for Mrs. Kimberly Moore is a comprehensive academic progress tracker for students at Community Christian Academy. The web application will allow users (Kimberly) to analyze Stanford 10 test scores of students by viewing raw data and statistics as well as through visualizations tracking progress (on a per - student or teacher basis) through the years.

The current system to track student progress relies on Mrs. Moore logging into the website provided by the makers of the Stanford 10 so she can view the scores of each student on a test for the given year. On each line is the student's name, score, percentile rank, and grade

equivalent for each section of the test. The grade equivalent for a student is a score calculated by the Stanford 10 producer based on the student's test performance. A student with a grade equivalent of X.Y scored what a typical student in the Yth month of the Xth grade would have scored. She also has access to the averages for her entire school and how they compared to schools across the nation who took the same test. What Mrs. Moore is lacking in the current system is the ability to track students over their entire time at CCA and other important data she considers in her administrative decision-making process. She wants to be able to see how an individual student has improved over the years to see if there are consistent struggles. She also wants to be able to relate subjects with the teachers who teach them to evaluate if the teachers are doing a good job. Ideally, she bases her decisions off of more than just scores. She wants to be able to look at the gender, race, socioeconomic status, parental status, and disability status of the students to determine whether or not they need individual help or a staff change.

Ms. Moore has previously asked for the help of UVA to create this system, but previous teams failed in creating an appropriate system to aid in the analysis of Stanford 10 test data; there are many bugs and instances in which the applications fail to meet set requirements - our minimum requirements are as follows. The application will track every student who has attended the school along with their test scores from every year. The user will be able to add student profiles and then upload data for each student. The application will store each student's name, race, gender, English as a second or other language status, socioeconomic status, disability status, parental status, and Stanford 10 test scores from their entire time at CCA. The application will automatically flag students who have scored below grade level. The application will also relate each subject tested by the Stanford 10 to the teacher who teaches that subject at CCA for

the given year. This will enable the user to evaluate teacher performance as well as student performance. With a search functionality, the user will be able to search for and filter students by name, score data, and any of their profile flags.

The primary way the application will let the user analyze the data will be through graphs. The user will be able to select the data they want on both axes and the graph will be displayed. The application will graph student, teacher, and subject performance over the years on both an individual and class basis. For example, the user can view a graph of a student's grade equivalent versus current grade. The user can also graph on the same graph the grade equivalent of the entire class over the same years.

With the web application created, Mrs. Moore plans on analyzing student score and personal data to best determine how to help every student. After she inputs all the student data, Mrs. Moore will more easily identify what areas of the school need improvement based on the Stanford 10 scores. She will be able to quickly find the students who are performing below grade level. If a whole class is struggling in a certain subject, she will find a new teacher. If a student is far behind their class according to the grade equivalent, she will provide the student with extra help depending on their needs. If the student has a disability, she will send them to their special needs education expert. By knowing more about the students and having all of their data readily available in one place, Mrs. Moore will be able to make better informed decisions on how to run her school.

Minimum Requirements:

As a USER, I should be able to....

- View student profiles (fields described in admin) through either a dropdown and/or

searching by name (first, last, or a combination)

- View data (student or test) in a table that can be sorted by column headings (ascending/descending order based on a selected attribute)
- Compare sets of students given some attribute(s)
- Filter test data by subject, year, grade level
- View a teacher's categories & associated students and their corresponding data
- Create student profiles consisting of: first & last name, gender (male/female), ethnicity, English as a second language (true/false), single parent family (true/false), special needs (yes/no), low income (yes/no)
- Create test consisting of: grade level, sub-tests (categories), date of test, number of students tested, link to the categories model, number of questions, mean number correct, mean scaled score, national PR-S of the Mean National NCE, mean national NCE, at/above the 50th national PR, Median Grade Equivalent
- Create test data for each student on a given test, including: number of questions correct, scaled score, national PR-S, national NCE, grade equivalent, and a flag of whether they are under grade level
- Edit existing student profile data
- Delete student profiles
- Create teacher profiles consisting of: first & last name and categories they teach
- Add comments to a student's profile

Desired Requirements

As a USER, I should be able to....

- Filter displayed table data based on specific attribute (single parent family, special needs, etc.)
- Modify test fields to: a) swap order of categories, b) add additional categories, c) edit existing categories, d) delete categories
- Stack multiple filters together for a student or category (e.g. filtering by both ethnicity & English as a second language)
- Visualize student's progress through grade levels on specific categories - connected scatter plot
- Compare student's score to average performance on the selected test (broken up based on category) - stacked bar plot
- Dynamically change filters on visualizations

Optional Requirements

As a USER, I should be able to....

- Download student data/visualizations as a .xlsx or .csv
- Upload a scan of student data to automatically be parsed into a new student profile/test

The struggle to find educational technology's place in the classroom

How are educational technology companies, educators, parents, and students competing to draw the line between appropriate and intrusive technology in education?

It is vital to consider the purpose of education to discuss effective educational technology (Biesta, 2008). Education is for teaching one to think critically (King, Jr., 1947), creating lifelong

learners, preparing one to enter the global economy (Sloan, 2012), and producing citizens in a society (E. Roosevelt, 1930).

Technology can improve education or impair it. Internet-connected technologies entail data security risks. Attacks such as the Chinese cyberattack on the University of Virginia or the phishing attack at Lancaster University (Seal, 2015; Lancaster, 2019) can compromise security. In a project to monitor students' emotions (Herold, 2018), user data was accessed without consent. Educational technology companies, educators, parents, and students compete to determine the norms governing educational technology.

Lin (2007) found that professional educational technologists were most concerned about matters of copyright, data ownership, user privacy, and accessibility, and noted new ethical issues in diversity, conflicts of interest, and professionalism. Arpaci et al. (2015) found that better security positively promotes the use of educational technology, recommending that universities provide free, secure cloud services and training. Ifenthaler and Tracey (2016) contend that universities must disclose who has access to what data and what algorithms are used. No definitive standards yet govern educational technology companies' data use and protection practices.

The Association for Educational Communications and Technology is a trade association for educational technologists that promotes the use of technology in the classroom. Members are held to professional standards of "high quality artifacts, ethical conduct, and social consciousness" (AECT, 2019). The U.S. Department of Education's Office of Educational Technology develops national educational technology policy (OET, 2019). The DoE's Student Privacy Policy Office enforces federal laws that protect the privacy of education records (SPPO,

2019). The Parent Coalition for Student Privacy (2019) represents parents who oppose the sale of their children's data to third parties without notification. The PCSP asserts that "no advertising should be allowed on instructional software or websites [...] since ads [...] serve no legitimate educational purpose." Single Grain is a marketing agency that advocates for "freemium" services, advertisements, and the sale of student data in their marketing guide for educational technology (Single Grain, 2016). Blackboard (2019) claims its educational technology offers teachers a uniquely connected experience and serves as leverage to "partner with the global education community to enable student and institutional success". These participant groups and more compete to determine educational technology norms.

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