Undergraduate Thesis Prospectus

Confidence in Computing: A Career Preparation Course for Undergraduate Students

(technical research project in Computer Science)

Digital Learning: Responses to the Rise of Technology in Public Education

(sociotechnical 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 we promote equal opportunities in schooling for all individuals regardless of their background?

Education is important for personal development and career preparation, but access to education and quality of instruction can vary widely. Digital technology can expand access and enhance quality, but it can also impair both. Technology can extend classrooms beyond the confines of school buildings, reduce costs, and personalize the learning experience for students to grasp complex or intimidating subjects. It can close the "educational outcome gap" between races that has historically caused disadvantaged groups less opportunities in the workforce (Kim, 2018). However, technology can also introduce new barriers of cost or usability, serve primarily as an excuse to raise student-to-teacher ratios, or interfere with educationally valuable interpersonal relationships. This also leads to educational technology allocation concerns that prioritize technology in schools with higher levels of funding (Startz, 2019). To improve the accessibility and the quality of education, schools, teachers, students, and IT professionals must manage these hazards.

Confidence in Computing: A Career Preparation Course for Undergraduate Students

What are the effects of a career preparatory course on increasing the self-efficacy and career expectations of computer science students who, prior to undergraduate studies, have relatively low self-confidence, social support and computing experience?

The computer science capstone project associated with the technical research problem revolves around the undergraduate course *CS1501: Tools of the Trade* currently being held in the fall 2020 semester. The student-taught course staff consists of two professors and seven teaching

assistants, three of which are on the research team. Because of the nature of the course, the student staff were selected based on previous internship experience and knowledge of industry tools. Members of the research team, consisting of Mara Hart, Jonathan Gordon, and I, are tasked with measuring the self-efficacy of students in the course before, during, and after completion of the course curriculum. My capstone advisor and Computer Science Department Chair, Tom Horton is coordinating the project with UVA Wise's Computer Science Department Chair Jacob Somervell. The course schedule was drafted during the summer prior to the Fall 2020 semester and the curriculum was designed with the combined industry experience from the staff.

The course objective is to prepare aspiring computer science students at UVA and UVA Wise who lack confidence and technical exposure for a career in computing. To enroll in the course, students from the two schools must apply with prerequisites in a data structures class and an application that requests information about AP classes and previous internship exposure. The applications are then evaluated to admit students displaying signs of low confidence in their computing abilities. Applying the Social Cognitive Career Theory (SCCT) on enrolled students, the research team is interested in monitoring the students' computing confidence through the preparatory content that the course offers (Alshahrani et. al., 2018). This theory was used in a previous study by Alshahrani et al. (2018) that contemplated the decision of a student to choose a computer science degree based on their background. The team can use the framework applied by this research to further study and provide explanations on how influences from "students' prior experience, social support, self-efficacy and outcome expectations" affect the student's confidence in computing (Alshahrani et. al., 2018).

The course content focusses primarily on industry practices that are not directly taught in the undergraduate computing curriculum. The topics included are GitHub, Resume and LinkedIn Profiles, Integrated Development Environments (or IDEs), Build Tools, Database Management, and other essential industry tools useful for software positions in the workforce. Because of the COVID-19 virus restrictions, the course is being taught as a one credit pass/fail class entirely virtually. The additional constraint of a shortened semester also played a factor in designing the course schedule. Adjusting to these unforeseen constraints, the priority of the teaching staff is to introduce topics without overcomplicating the details and retaining motivation in the enrolled students. These materials are broken down into weekly curriculum topics that involve a series of lecture videos publicly accessible on YouTube, and activities relevant to the lesson. On top of weekly materials, the students are required to participate in three professional development activities throughout the semester to reinforce the objective of improving self-confidence in industry knowledge. A study by Kapoor and Gardner-McCune (2019) provided insight on how undergraduate students can develop their "professional identity" through "reflection on their career goals" and "engagement in professional development."

The main responsibility of the research team is to monitor and assess the self-efficacy of enrolled students throughout the semester with the use of surveys. Using the Qualtrics software, the team designed questions that could gauge confidence in students and track their responses from beginning to end. Questions about prior experiences, academic confidence, and technical self-identification were made consistent among all the surveys to maintain consistency in the comparisons. In order to retain the anonymity of student survey responses, each participant was assigned a unique key identifier that they used to answer the Qualtrics survey forms before, during, and after course completion.

The success of the project lies in the data collected from students throughout the duration of the course. The survey responses will hopefully shed light on the issue of self-efficacy in computing undergraduate students through data analysis. The entirety of the course materials will be considered when analyzing the effectiveness of the career preparatory elements as well as the industry tools experience. As the fall 2020 semester wraps up, the research team will continue to monitor self-efficacy of students in *CS 1501: Tools of the Trade* as it brings in new students for the spring 2021 semester. Looking ahead, the teaching staff are looking into making the course a completely public curriculum where students of all backgrounds can attend to learn valuable industry skills and improve their self-efficacy of computer science.

Digital Learning: Responses to the Rise of Technology in Public Education

How have students and teachers responded to the rise of technology in U.S. public education?

In 2016, the U.S. Department of Education spent about 3 billion dollars for high-speed internet and online resources for public schools nationwide (Herold, 2016). Educational technology (edtech) is technology that supports teachers' and students' instructional and educational needs (Earle, 2002).

Keengwe et al. (2012) observe that edtech can boost academic performance and connect students to a wider range of resources on the internet. Selwyn (2016), however, cautions that it can widen the educational access gap associated with the digital divide. Rollins and Bailey (2014) assess the goals of "integrating technology and education" that have been "outlined by the school districts" and reaches out to the teaching staff about the policies' effectiveness. From a survey of 250 teaching staff, Rollins and Bailey (2014) concluded that technology budgets

should be based upon the "technology needs of faculty and students," and that edtech tools should serve school districts' "curriculum goals."

The U.S. Department of Education's Office of Educational Technology (OET) funds edtech public education and regulates policies concerning digital education in the classroom (Steyer, 2014). To reduce access inequities in K-12, OET promotes personalized learning and broadband. The International Society of Technology in Education (ISTE) hosts conferences and sets edtech standards (Tsybulsky, 2020).

Public school teachers disagree about the proper place of technology in education. Many teachers caution that access to web-based educational resources also opens doors to distracting or harmful content, and extends already excessive screen-time (Arnold-Schwartz, 2019). Wexler (2019) opposes edtech, contending that evidence of its value is "equivocal at best" and citing the digital divide. Purcell et al. (2020), however, find that many teachers welcome edtech for its capacity to support various learning styles and promote a "more engaged environment." Albert et al. (2014) propose that edtech developers apply a "Community of Inquiry (CoI)" framework so that their products foster and integrate social presence, cognitive presence, and teaching presence.

Koebler (2011) encourages the use of students' phones in the classroom, stating that, with proper cell phone etiquette, these devices can be a cost-effective and feature-filled asset to the learning environment. Barnwell (2016) contemplates the balance of student's handheld devices between its productive applications in research and its distractive entertainment features in social media. Brown (2020) has a strict "No Cellphones" policy in his classroom because of their disruption to the flow of the class and their ability to distract other students around trying to focus on the course content.

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