Curriculum Leadership Statement

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Abstract

Computer Science is a rapidly growing field in which studies have found students are less prepared for upon high school graduation. Furthermore, the gender and racial underrepresentation within this field is unacceptable. Through the adoption of computer science standards, funding for devices, and ongoing teacher development, teachers will use a variety of methods to ensure students are prepared for computer science related careers.

According to Computer Science (CS) for All, an estimated 500,000 jobs in the field of computing will be created between 2014 and 2024, with 40,000 students graduating with a bachelor's degree in computer science. This leaves a deficit of 10,000 jobs unfilled annually in the United States. This issue stems back to how students are being prepared through formal education in their primary and secondary school. Currently as of June 1, 2016, five states have adopted computer science standards as part of their core curriculum, 25 states have set certification pathways for computer science teachers, and 30 states count computer science toward student graduation requirements; yet only six states have dedicated funding toward professional development and course support to prepare students and teachers for computing jobs, which are "projected to double over the next decade" (Tilley-Coulson, 2016). The lack of computer science education is rapidly being recognized by all stakeholders in children's education because "… educators and parents recognize computer science as a key skill for career readiness, few states have adopted learning standards in this area, and only one in four schools teach computer science at all" (Tilley-Coulson, 2016).

Historically, the reformation of academic disciplines in 1892 by the "Committee of Ten" designed the five core academic disciplines which would be taught for centuries to come. This began the movement of the Scholar Academic Ideology, which is still present with the adoption of new standards, based on the needs of our ever growing, progressive society. Academic Scholars "see the school as an 'ideal' institution whose primary purpose is the acculturation of students into the world of knowledge and not as a social institution functioning within the sociopsychological, socioeconomic, eco-environmental, and politico-administrative structure of its society." (Shiro, 2013) I believe the world of education is at a precipice of a technological age where learning about the science of computers and other technologies is no longer an option, but

an obligation to become a valuable member of society. Since most high schools are on the path to offering at least one CS course at each school, a subtle way teachers can embed the computer science standards within elementary and middle school curriculum is through a constructivist approach to teaching and learning. “Constructivism sees learning as a process of constructing or making something. Constructivism says that people learn by *making sense out of the world*; they make meaning out of what they encounter.” (Reiser and Dempsey, 2017)

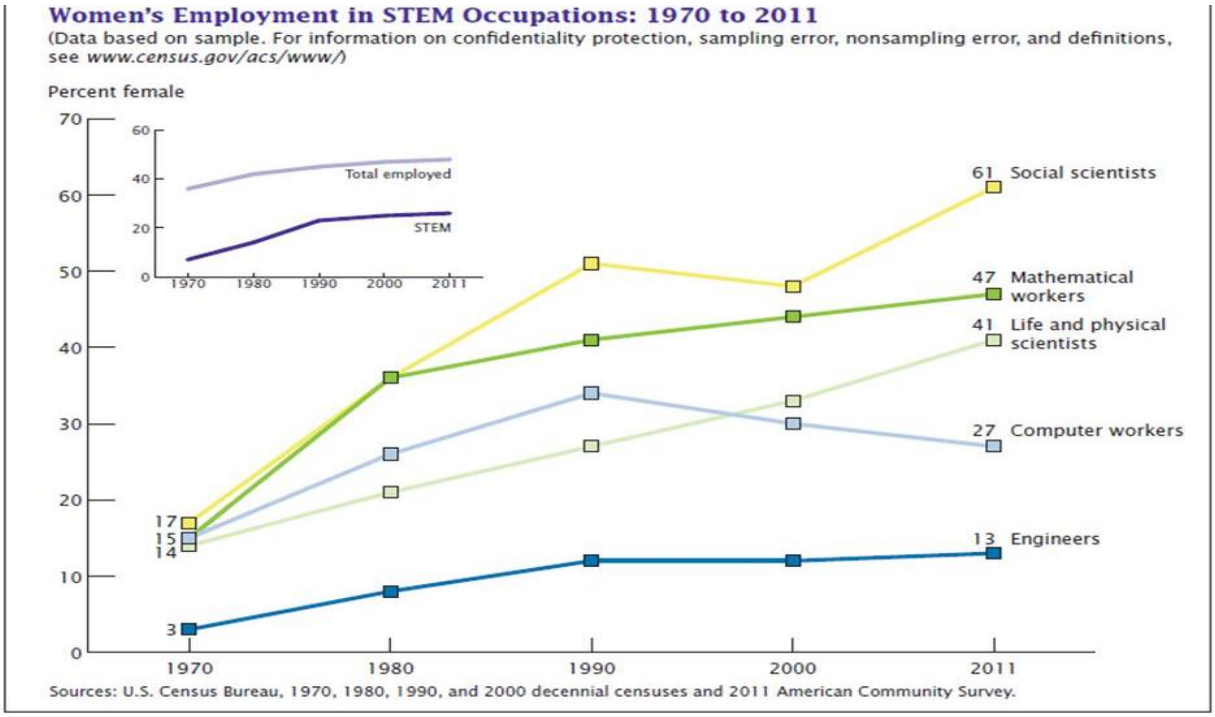
Technology is the manner in which our students function and interpret the world and its infinite information. The need for computer science education and curriculum is a result of the continuous increase in computer science jobs left available each year. Infants appear to be born with the innate ability to manipulate a smart phone or tablet because there is a natural curiosity and value added to the user’s life. Therefore, how can we begin to inform all students of computer science disciplines in all classrooms K-12? To abide by state and federal mandates, instructors must marry the best of both the Scholar Academic Ideology and Constructivism. In order to accomplish this with fidelity, teachers can utilize various instructional models. One approach is a flipped classroom is “A method to maximize the use of teacher-supported face-to-face classroom-based sessions towards delivering hands-on activities and individual scaffolding” which can students can easily show mastery of computer science standards through online programs and applications (Kostaris, Sergis, Sampson, Giannakos, & Pelliccione, 2017). Through this “at home” approach, students can complete computer science tasks using their own devices from the comfort of their own homes. Another instructional model would be the Social Inquiry Learning in which students identify a social issue that they follow the Stripling Model of Inquiry to Connect, Wonder, Investigate, Construct, Express, and Reflect upon the issue. The student’s learning inquiry can easily integrate technology to enhance research and delivery of

computer science standard assignments *(*Morris Siu-Yung Jong, 2017). This method is similar to the commonly known Problem based learning and Project based learning. Lastly, the Interactive Learning Environments model is an online environment for collaborative problem solving, reasoning, and argumentation based on evidence primarily relying upon the use of technology (Scardamalia & Bereiter, 1991).

In my ten-year experience and in reflecting with teachers of varying years' experience, one of the largest barriers to overcome when adopting and implementing the Computer Science standards is teacher apprehension and discomfort. I believe this can be improved by effective ongoing professional development. I do not just teach 4th grade math and science, I am the chair of my school's technology and STEM committee, which allows me to research, plan, and implement professional development to meet educator's needs. When I am working with teachers to find innovative ways to enhance their instruction, I suggest a technological application or program which would benefit the students, as well as ease the delivery of instruction or grading for the teacher. Most often, I am met with statements of resistance such as "I can't do that, I am not techy like you", or "my students can't 'handle' technology". I empathize with educators who feel this way because I once had those same feelings of resistance- not for a personal lack of interest or passion for instruction technology, but I felt overwhelmed with the requirements of my job and lacked the time to explore the resource. According to my observations, teachers who graduated from university 10, or more, years ago feel ill-prepared for teaching CS standards with confidence to their students because it was not considered a core academic discipline during their own schooling. The unfortunate effect of this is lowered morale, additional stress at the work place and home, and instructors ineffectively

teaching the CS subject matter due to the lack of training which causes a ripple affecting student learning and knowledge.

Figure 1.



An additional barrier that I believe can improve with the implementation of nation-wide computer science standards is the division of ethnic and female representation in the field of computer science. Although females consist of half of the U.S. workforce, and women employed in a STEM career has increased since the 1970's, the number working in the computer science field has decreased since 1990, as seen in Figure 1. Analyzing the reported data, I begin to wonder why and when does this disparity truly begin? As discovered in the psychology review of Patterns of Gender Development, children as young as 10-17 months begin gender labeling items such as toys. Most children between the ages of 5-7 years old begin to develop stereotypes with further solidification for the next two years. No longer can we sit idle and wait for the

solution to be made by law-makers, or simply say someone more tech savvy will teach "those skills" to my young students. Educators must contest gender and racial bias by providing more equitable computer science educational opportunities for our students. Could Computer Science for All break the barriers between what a boy and girl either Black, White, or Hispanic should be interested in beginning in kindergarten sending the message of importance through grade 12 by assessing and requiring CS standards to be met for graduation? According to the article, Disparities in STEM Employment by Sex, Race, and Hispanic origin and research from the U.S. Census Bureau in 2011, about 67 percent of the U.S. workforce was Non-Hispanic White, holding 71 percent of STEM jobs with Blacks and Hispanics being highly underrepresented. Blacks held 6 percent, American Indians and Alaskan Natives held 0.4 percent, and persons identifying as 'other races' held 1 percent of STEM jobs. Also in 2011, statistics showed that only 11 percent of the workforce was Black, with 6 percent of them working in the STEM field- this is only a 2 percent increase since 1970. "Although the Hispanic share of the workforce has increased significantly from 3 percent in 1970 to 15 percent in 2011", Hispanics were still only 7 percent of the STEM workforce in 2011 (Landivar, 2013). The solution is straight forward, all states must adopt and properly fund Computer Science education in order to overcome these statistical discrepancies.

With the increasing number of states adopting computer science standards to combat the underrepresentation both by specific genders and races, all educators are now going to be held accountable for teaching and preparing our students for life. I, a ten-year veteran teacher in the Hillsborough County FL School District, have recently been selected to participate in a Digital Literacy Task Force because of my passion for instructional technology and utilizing computer science within my every day instruction. Elementary school, Middle school, and High school

teachers will spend from October 2017 to May 2018 alongside community partners and stakeholders creating a proposal for our school board and Superintendent, Jeff Eakins, to review. This proposal will include solutions of how to initiate Obama's 2016 Computer Science for All (#CSforAll) in our district as Florida has adopted Computer Science standards such as

- informing and collaborating to support a common vision amongst schools, universities, local communities, and cultural institutions for the need of computer science education;
- aligning goals and collaborating with Tampa Bay community partners to create a more robust technology sector and computer science talent in our region;
- plan and implement professional development which will create a digital literate society and the next generation of computer scientists; and
- identifying the needs of the local technology industries and post-secondary institutions to best align the skills needed for students to graduate.

According to Dickey, 2017, federally, Trump's memorandum in September 2017 called for the Department of Education to allocate $200 million per year toward the implementation of Computer Science education, which does not break down to much monetary support for the districts within each state. As stated in the HCPS NewsDesk article, The Digital Literacy Task Force is funded by a CODE.org grant of $250,000, partnered with USF, Florida Aquarium, Tampa Bay STEM Network, Moffitt Cancer Center, and more, with the ambition of individual solution labs handling components of a district-wide computer science implementation plan.

Through proper federal funding of devices and well developed ongoing professional development such as the Digital Literacy Task Force funded by CODE.org, educators can better prepare students for life through the implementation of computer science standards. The

requirement of computer science standards in all states in order to graduate will help lessen the gender and racial gaps within the field of Computer Science because all students will have a proficient computer science skill set upon graduation.

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