

**Creating a new curriculum to address disconnect between CS in
higher education and the technical interview**

Organizational and Cultural Barriers of creating a new curriculum in computer science

A Thesis Prospectus

In STS 4500

Presented to

The Faculty of the

School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Computer Science

By

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October 27, 2021

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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Introduction: What are the issues with the current computer science curriculum in higher education?

For computer science students, there is an additional element in the interview process that is the technical interview, which is intended to test the potential hire on their technical skills. The technical interview can according to Behroozi et al. 2019 is “a problem-solving form of interview in which candidates write code” (pg15). However, computer science in higher education does not directly help students prepare adequately for the technical interview. Some feel that technical interviews are “an ‘antagonistic’ form of higher pressure ‘whiteboard algorithm hazing’ that have ‘nothing to do with real day-to-day developer work’” (Behroozi et al. 2019 pg16).

To show that higher education is not helping students enough with its current curriculum, Ehaliyagoda, R. H. A. D. H., & Sitbon, L. (2018) discovered a majority of students who were surveyed, about 80%, felt that they were not prepared for interviews based on what they were exposed to in their university. There is a discrepancy between skills learned from a [software engineering] university education and those needed in [software engineering] employment” (Garousi et al. 2019 pg1). In this prospectus, I will address the discrepancy between the computer science curriculum in higher education and the technical interview by designing a curriculum and exploring the barriers of such a design. The motivation for this prospectus is that there seems to be a growing sentiment that higher education is not necessary to getting a software engineering job because the technical interview does not require a bachelor’s degree (Burke et al. 2018).

In order to address the disconnect between the computer science curriculum in higher education and the technical interview, the technical topic will explore what exactly is missing from the computer science curriculum in higher education, what to potentially do about it, and the logistical challenges associated with creating a course or new curriculum that addresses the issue.

In addition to the logistical challenges that a possible curriculum might have, there are also cultural and organization barriers which may pose an obstacle. In the STS research, I will focus on the role of faculty and how students would view the change in curriculum proposed in the technical outline.

Technical Topic: Creating a new curriculum to address disconnect between CS in higher education and the technical interview

The current computer science curriculum does not adequately prepare students for technical interviews that they will encounter. In the computer science community, it is well known that the curriculum in higher education needs to change as expressed by Lie et al. (2009): “current computer education mode does not fit IT talent demands” (pg1). The reason that the current computer education mode is not meeting the demand is because computer science curricula “still focus on theoretical and technical computer science topics as well as mathematical foundations. Garousi et al. (2019) puts it clearly by stating “many recent software engineering graduates often face difficulties when beginning their professional careers, due to misalignment of the skills learned in their university education with what is needed in industry” (pg1).

The issue of not being able to meet demand from industry is detrimental to the future economy of the United States because from 2020 to 2030, employment in the computer science field is projected to grow by 13% meaning there will be a labor shortage similar to what I occurring right now as we come out of Covid-19 (*U.S. Bureau of Labor Statistics*). It was estimated by the U.S Bureau of Labor that by 2020, there would be over 600,000 jobs that would be unfulfilled (Burke et al. 2018 pg1). Reflecting this increase in demand in industry, there has been increase in students majoring in computer science (Roberts et al. 2018 pg1). Figure 1 below shows the increase in computer science undergraduates. However, despite “an increasing number of first-degree

graduates”, there is also a “decline in hiring of manpower by companies” which contradicts the ever increasing demand for new talent (Harun et al. 2017 pg3).

The Growth Rate of Undergraduate and Faculty in Computer Science

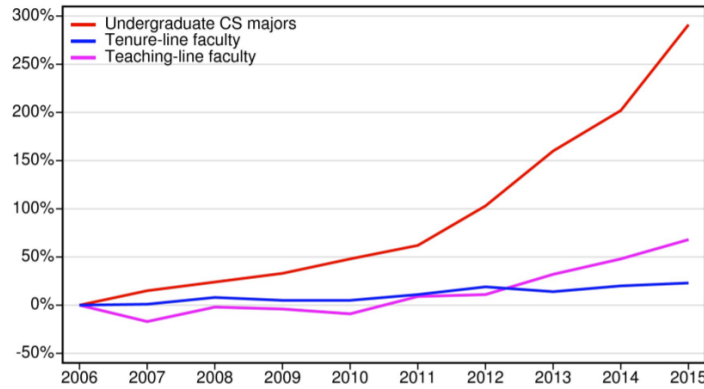


Figure 1. There has been substantial growth since the 2000s in the number of computer science undergraduates (Roberts et al. 2018)

Unfortunately, there are not many studies done on technical interviews. According to Wyrich et al. (2019), there are only two sources relevant to the technical interview. Using what is present, I will attempt to design a curriculum to address the disconnect. Based on experiences from friends and acquaintances, I gathered at the University of Virginia (UVA) that CS4102, Algorithms, is by far the closest to what UVA has to offer in terms of preparing its students for technical interviews as it presents new algorithms that students previously were not exposed. But it does not address the interpersonal side of the technical interview where it involves the applicant speaking aloud and walking through their thought process as they solve the problem. Currently, UVA does not have any course that handles this side of the technical interview. I plan on exploring further this discontentment with current CS curriculum at UVA by conducting surveys on bigger sample size.

In order to address the disconnect, I plan to design a computer science curriculum that implements courses that addresses both the technical and non-technical aspects of the technical

interview. Carter (2012) proposed something similar where non-technical skills should be taught in a course or for a capstone project. In addition to having a course or curriculum that teaches skills applicable to the technical interview, universities should have the computer science major split into concentrations. Similar to the Civil Engineering major at the University of Virginia that is split into four concentrations, the computer science curriculum should also have concentrations such that a student can choose whether he or she will go into academia or industry. Students in the Civil Engineering major are able to focus on a specific career path by choosing a concentration, so it is the intention of the design to replicate this effect. In the industry concentration, universities should discard the teaching of theoretical topics as required courses as they provide little to no use in an industry setting as stated earlier.

Potential logistical challenges of this design range from minor to obstructive. An issue with creating such a course is standardizing it because non-technical skills are “skills that relate to a person’s personality and ability to work with others“ according to Burke et al. (2018) pg1. This can be subjective as some can feel differently as to what is a suitable level of non-technical skill. Though this design is not complete, the technical topic of this prospectus will address the disconnect between computer science in higher education and the technical interview.

STS Topic: Organizational and Cultural Barriers of Creating a New Curriculum in Computer Science

In addition to the logistical issues that can come with any change in the status quo, there are barriers that involve individuals and how those same people view the change. To implement the design envisioned in the technical topic, the barriers to the design must be overcome or at the very least addressed or acknowledged. Barriers to the design proposed in the technical outline can be divided into two categories: organizational and cultural. The organizational barriers primarily involve the employers and the faculty where there are questions like who pays for the curriculum

change and who teaches it. The cultural involves the students and faculty because why should faculty change the current status quo and do students even want such a curriculum change. In this section of the prospectus, I will explore what organizational and cultural barriers there are through analyzing literature on this issue.

Based on the survey conducted by Ehaliyagoda, R. H. A. D. H., & Sitbon, L (2018), it can be inferred that higher education is not providing what students need to be confident in interviews. Employers these days want their hires to have non-technical skills such as problem solving, communication, organization, etc. (Carter 2012). The design described in the technical topic addresses the request of employers, but the barrier is whether or not students and faculty are willing to take or teach such a course, respectively. According to Carter (2012), students who took such a course thought it was a waste of time because “they are being presented with information that they already know” (pg3). The students’ confidence in their non-technical skills is most likely are not up to scratch as employers are still highly recommending that their applicant have non-technical skills in the job application description (Carter 2012).

In fact, Brown (2013) shows that there is an inverse relationship between Internet use and preference and social skills: “participants with a higher preference for communicating in online settings had lower social skills than did those with a lower preference for mediated communication”. If students were to take courses that developed their non-technical skills, they would become more confident during their interview. To overcome this overestimation in students’ non-technical skills, I will review literature that relates to that of college students’ current non-technical skills, what can be done to motivate college students to take such courses, and what effects does confidence has during an interview.

The organizational barriers involved in this endeavor to change the computer science curriculum in higher education comes down to the faculty. Designing a new curriculum means that someone has to teach it. The barrier to the design laid out in the technical topic is who will teach the curriculum. Faculty activities mainly consist of “teaching hours, academic activities, and publications”, meaning faculty don’t have time to get accustomed to current industry trends (Asmara & Wu 2020 pg2). In Asmara & Wu (2020), faculty participated in an internship program to get familiarized with current industry trends which then could be translated into teaching students relevant and practical knowledge. According to Asmara & Wu (2020), faculty who participated in the internship program had the consensus of an “internship program is great for the faculty member because we gained real experience in the real work environment. Furthermore, lecturers or staff who finished the internship program return to the education environment can implement them in teaching methods” (pg6).

However, there is the issue of the faculty having to deal with academic activities such as lecturing and preparing course content. To remedy this, professors of practice can teach instead. Professors of practice (PoPs) are “employed to do half-time inside the university (that is, work 50% of the time) and another half-time outside the university (that is, 50% in the start-up firm)” (Etzkowitz et al. 2021 pg3). PoPs would have the industry experience while also having the capability to teach students with industry knowledge. I plan to further pursue the idea of PoPs through more research on this topic.

Conclusion: What will be done to address the disconnect between computer science in higher education and the technical interview

In this prospectus, I layout my approach to address the disconnect between computer science in higher education and the technical interview. The disconnect to be addressed is the computer science curriculum not being up to date with current industry trends and not being

flexible enough to change with the aforementioned trends to help students pass the technical interview. The design I am proposing envisions addressing this disconnect by discarding theoretical content for practical and pragmatic content such as teaching the students the non-technical skills employers want and the technical skills needed to succeed in the technical interview. The cultural and organizational barriers are laid out in the STS portion of the prospectus will be explored and addressed. Putting together the research found in both sections, the goal of the prospectus is to help students pass the technical interview that is the gateway to most jobs in the computer science field.

Word count: 1888

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