

Surveying the Importance of Integrating Technical Interviews into Computer Science Curriculums and Increasing Awareness in the Academy

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Abstract

Technical interviews are undeniably a vital element when it comes to the successful employment of new grads and can be attributed to the disparity of employment of computer science (CS) majors. Due to a variety of factors, the preparation and the general importance of technical interviews tend not to be emphasized in many CS curricula and academic institutions at large. For this reason, many CS majors are unfamiliar with the technical interview process, which could decrease their success during official interviews.

Some CS departments and institutions have identified the need to educate and prepare their students for technical interviews. Yet, there exists a greater disparity for awareness and preparation when observing many other CS departments and institutions. This disparity represents an opportunity to promote the importance and need for technical interview preparation and awareness across the CS spectrum and academy.

The nature of this article is to provide a survey of literature reflecting current efforts pertaining to technical interview preparation initiatives and overall awareness in CS curriculums, CS departments, and institutions at large. Key findings reveal that more institutions are beginning to implement technical interview practices into the classroom as assignments, group projects, warm-ups, class exercises, and dedicating a class to the topic. For instance, literature shows that exposing students to technical interview exercises in their Data Structure course(s) is one of the most effective methods. One reason being that students are exposed to the process early on but it becomes natural for them to think as interviewees based on the construct of these particular courses. Likewise, literature suggests that introducing the technical interview process early in a student's computational development could better gauge the overall effectiveness of this employed initiative. Yet, the number of studies that reflect such exposure at earlier stages in the CS pipeline are minimal.

This survey-based article will also discuss potential opportunities to enhance the overall impact and awareness of the technical interview process in academic settings. One example of opportunity being the provision of systematic studies to assess the overall impacts of technical interview preparation initiatives in academic settings. Another example reflects the employment of longitudinal studies on CS majors as they matriculate through a curriculum to gauge the impacts of such initiatives as they approach graduation. Moreover, infusing initiatives to increase faculty awareness and engagement with the technical interview process so they can effectively assist in the students' interview preparation would be impactful.

TECHNICAL INTERVIEW INTEGRATION

1. Introduction

The typical interview process for a software engineer/developer role involves two interviews, a technical interview and the typical behavioral interview. Between the two, students find the technical interview to be the most cumbersome. This is due to the stress of solving coding problems on a whiteboard, verbally communicating their problem-solving process, and being directly observed by an interviewer/hiring manager throughout the technical interview process. Presently schools like Stanford University, which offer a CS class devoted entirely to coding interview preparation are outliers in academic institutions [20]. Whether (or not) the technical interview process is the most efficient or fair is another discussion entirely. The matter of fact is technical interviews are a primary determinant used by many tech companies to select candidates for employment. To increase the success of the average college student, computer science curriculums and institutions at large must consider introducing coding interview preparation mechanisms as part of their students' matriculation.

1.1 Technical Interview Barriers - Prior Knowledge & Expectations

Lack of knowledge of technical interviews existence is a huge dilemma faced by computer science graduates. For instance, a study at the University of Florida revealed that out of 279 students who were enrolled in its CS Data Structures and Algorithms (DSA) course [13], 59% were unfamiliar or had no knowledge of the existence of technical interviews. Likewise, 90% of those students had never participated or prepared for a technical interview [13]. It has been noted that the passing rate of technical interviews correlates directly to the number of practice interviews completed by a candidate [15]. Thus, initiatives maximizing students' practice hours could result in the highest rate of success. FreeCodeCamp.org [12], a platform used to teach people how to code, performed a study to determine if the tier of the school a student attended directly impacted their coding interview performance. Upon completion of the study, no correlation was discovered between an institution's prestige level and its students' success rate. From the candidate's standpoint, familiarity with the technical interview process and comfortability with demonstrating one's knowledge verbally and under the watchful eye of an observer during this process are vital for success. From the interviewer's standpoint, assessing their candidates' problem solving skills, communication, and confidence are the measured determinants for success [9]. Behroozi et al.'s work [3] concluded that technical interviews inaccurately assess a candidate's capability because of the added component of anxiety prohibiting them from demonstrating their abilities to the fullest. Specifically, the cognitive load of whiteboard interviews highlighted these three elements as primary defects in the interview process: medium and affordances (no syntax highlighting, etc.), stress, and interruption [3]. The objective of this article is to provide a survey of literature that shows current efforts that have addressed the need to showcase the importance of the technical interview process in academic

TECHNICAL INTERVIEW INTEGRATION

settings, and highlight the need to further alleviate the awareness deficiency of its overall importance to CS and related majors who aspire to have careers in tech.

2. Literature Review

To better understand the current efforts involving interview preparation in academia, notable activities seen in literature are categorized into four descriptions below (Table 1). The following subsections provide example case studies and initiatives that fall into one of these categories, respectively. Table 2 (next page) lists institutions who are currently active in promoting the exposure of technical interview preparation to their students based on the four categories listed in Table 1. The following subsections detail initiatives at these institutions' that have been designed to help students with their technical interview preparation.

Table 1: Current Technical Interview Preparation in Academia by Categories

Category	Description
1	CS Courses Devoted to Technical Interview Preparation
2	Technical Interview Preparation Integrated into Courses
3	Extracurricular Events that Fosters Technical Interview Preparation
4	Career Center Interventions

2.1 Technical Interview Preparation Courses - Category 1

California Institute of Technology provides student-taught courses (known as *CS 12: Student-Taught Topics in Computing*) as part of their CS course curriculum. One section of CS 12 is a technical interview course designed to assist student preparation for technical interviews [5]. Similarly, the University of Maryland offers a relative student-taught CS course comprised of five sections (known as *CMSC 3890: The Coding Interview*) that provides their students with a comprehensive and practical introduction to the technical interview process [23]. Stanford University also offers a 1-unit CS course (known as *CS 9 - Problem-solving for the CS technical interview*) that acquaints students with the CS technical recruitment process [20]. The course instructors for CS 9, who spent several years at Google as software engineers and interviewers, cover the critical stages of the process, including resumes, interviews, while sharing criteria information from their firsthand experience with the technical interview process.

2.2 Drake University CS2 Data Structures and Algorithms Course - Category 2

In Drake University's CS2 course [25], a study was conducted teaching one group of students (control group) using the traditional long term assignments, and the other group (experimental group) was taught using shorter assignments consisting of published interview problems (either by companies or in preparation books). Exam 1, Exam 2, and the Final Exam were used as the

TECHNICAL INTERVIEW INTEGRATION

Table 2: Example Institutions who Promote Technical Interview Preparation - by Category

Category	Institution
1	California Institute of Technology [5]
1	Stanford University [20]
1	University of Maryland [23]
2	Drake University [25]
2	Institution A [11]
2	University of Florida [13]
3	Harvard University [8]
3	Morgan State University [10, 22, 26]
3	Stony Brook University [21]
4	Cornell University [6]
4	Dartmouth University [7]
4	Massachusetts Institute of Technology [17]
4	Northeastern University [18]
4	Rensselaer Polytechnic Institute [19]
4	University of Massachusetts Amherst [24]
4	Yale University [27]

measurable assessments to compare the impacts of these different initiatives between the two groups. Group one consisted of 33 students, and group two had 24 students. It was found that the difference in performance between both groups grew throughout the semester and by the Final Exam the experimental group, who was instructed through short interview problems, performed better on average by 0.4%.

2.3 Institution A's Advanced Java DSA Course - Category 2

There is a study that showed a collaborative initiative between Institution A and Company B to teach an advanced DSA course with the goal of improving students' coding capability, knowledge of libraries, and the ability to select and implement appropriate data structures [11].

TECHNICAL INTERVIEW INTEGRATION

For confidentiality reasons the collaborating institution and company's name were discussed using the aforementioned aliases. Institution A's pedagogical aim was to prepare students for technical interviews through short assignments similar to those they would be exposed to while interviewing. The course began with a crash course on Java, which for the majority of the students was a new language. Product C was designed to grade students coding assignments and provide instant feedback. The instructors and company reported a positive experience with the partnership and in the future will be surveying students after each assignment to measure their experience.

2.4 University of Florida DSA Course - Category 2

University of Florida's DSA course teaches topics like trees, heaps, graphs, sorting, and greedy algorithms [13]. During Week 2 of this CS course, the students were surveyed to find how many of them already had an understanding of technical interviews. Due to the lack of knowledge relating to technical interviews and exposure the students reported the first five weeks were used to educate students on the process through lectures and panels. Throughout the remainder of the semester in-class practice and homework assignments were given to students in relation to practicing for technical interviews. At the conclusion of the semester, 91.9% of the participants reported their experience as positive and beneficial. The most effective benefits reported by students were awareness of technical interviews, technical interview prep, motivation to apply for internships/jobs, practical application of classwork, confidence to succeed during interviews, less anxiety/fear, opportunity to practice interviews without anything on the line, manageable levels of interview practice, and ability to evaluate one's self.

2.5 Harvard University - Category 3

As part of Harvard University's Introduction to Computer Science course (*CS50*), there is an annual webinar/workshop given to the students in this course to prepare them for the technical interview process [8]. In addition, this webinar assists students with their resumes, provides advice on interview strategies, and details related resources as part of this initiative. The course's webpage also provides links to recommended resources to aid the students in their technical interview preparation.

2.6 Morgan State University's Google in Residency Initiative - Category 3

Morgan State University is one of twelve universities that Google partners with through their Google in Residence program (GIR) [10]. The GIR program is an initiative by Google to diversify the tech field through their partnerships with Historically Black Colleges and Universities (HBCUs) and Hispanic Serving Institutions (HSI's), which allows a Google Software Engineer to spend a semester at one of these institutions as a CS Instructor [26]. At

TECHNICAL INTERVIEW INTEGRATION

Morgan State, incoming freshmen are taught the basics of computer science by the visiting Google Software Engineer in the very first introductory computer science course. The Google Engineer offers office hours, mock interviews, and other out of class interview prep activities. During the actual class there is no interview prep, but the GIR offers after class events to aid students with interview preparation. In addition to the GIR program Morgan's computer science clubs like Society for Advancement in Computer Science (SACs) [22], Developers Student Club (DSC), and Women in Computer Science (WICs) offer events like SAC's Wired Wednesday to host mock interview sessions in which students collaborate to solve interview problems, and assist participants with feedback on their performances.

2.7 Stony Brook University Google Technical Interview Prep - Category 3

Stony Brook University recently hosted an event titled Google Technical Interview Prep where Google recruiters and engineers socialized with students and informed them about what to expect during a technical interview as well as providing them with tips on how to best prepare for these interviews [21]. After the completion of the presentation portion of the event, students had the opportunity to ask the recruiters and engineers questions one-on-one.

2.8 Career Center Initiatives with the Technical Interview Process - Category 4

Cornell University [6], Dartmouth University [7], Massachusetts Institute of Technology [17], Northeastern University [18], and Yale University [27] demonstrate a more indirect approach to technical interview preparation by providing online content and direct links to external sources that can aid in students' preparation. Similarly, the University of Massachusetts Amherst embeds these materials directly on their College of Information & Computer Sciences careers webpage [24]. On the other hand, Rensselaer Polytechnic Institute's (RPI) Center for Career and Professional Development (CCPD) staff offer mock interviews at any point during a student's matriculation [19]. All students have to do is connect with CCPD staff on a platform called Handshake and message to schedule an appointment. The CCPD at RPI ensures that they will help address nerve related issues and helps students set up their technology properly to best prepare for real interviews.

3. Discussion: Current Outcomes & Challenges

Even though there are initiatives conducted by various institutions to foster student awareness and preparation for the technical interview process, more work can be done to enhance its prevalence in academia. One aforementioned challenge is to reduce the lack of student awareness of technical interviews. A related challenge is to relay to such students the required time needed to effectively practice and prepare for these technical interviews. Having a competitive gpa and extensive computer science knowledge is futile without the ability to perform while

TECHNICAL INTERVIEW INTEGRATION

interviewing. Even though there are institutions like Stanford University, California Institute of Technology, and University of Maryland, who provide students course options that are tailored to the technical interview, if students do not practice the skills learned in these courses after their conclusion, they may still lack the necessary preparation that fosters success. This problem will be the same for students residing at institutions whose preparation initiatives are considered Category 2, or institutions who integrate technical interview practices into already existing CS courses. The effectiveness of Category 3's type of initiative depends entirely upon student participation. Students must make the time to consistently commit to skill development events outside of class. It has been noted that 70% of college students work while in school thus limiting their time for extracurriculars [14]. Therefore, while these technical interview events are beneficial, their reach is limited to those who have time to consistently participate. Being able to show up to even one event a semester has its benefits, but regular preparation for technical interviews is still imperative to the students' success. Similarly, Category 4's initiative benefits students who intentionally make the time to personally sharpen their skills outside of the classroom and CS department altogether.

Another challenge is the ability to showcase documented evidence that addresses the impact and overall effectiveness of these active technical interview initiatives. Institutions like Stanford University, California Institute of Technology, and University of Maryland offer student-taught courses to prepare students for the technical interview. However, there is minimal documentation that presents the effectiveness of these courses. Harvard University provides an embedded technical interview webinar in one of its courses. There is a lack of disseminated content that showcases this webinar's impact on the students' preparation for technical interviews. Institutions like Drake University, Institution A, and the University of Florida have provided documented evidence on ad-hoc assessments pertaining to student performance after being exposed to technical interview practices. These assessments provide little evidence that demonstrates their impact and overall effectiveness on their students' preparation for the technical interview process. Morgan State University and Stony Brook University offer extracurricular services and events to assist their students with the technical interview process; Minimal documentation has been provided that demonstrates the overall impact of these initiatives. The schools listed in Category 4 tend to rely on their career centers to foster student preparation for the technical interview process. The information offered to the students consists of links to external resources to assist students with this process. Likewise, there is no documented evidence to indicate that this particular format is helpful to the students' success with their technical interview preparation.

4. Conclusion & Future Work

Technical interviews have become common mechanisms used by tech companies to evaluate the overall skill set of their candidates. Increasing awareness and importance in academia to better

TECHNICAL INTERVIEW INTEGRATION

prepare students for technical interviews are vital for success. There are institutions who are making efforts to prepare students for the technical interview process through enhanced courses and preparation initiatives. There is still more work to be done in the academy to address awareness and effective preparation of technical interviews.

One future work will be to conduct a systematic study that evaluates the impact of methods of preparation for technical interviews on students as they matriculate through a CS curriculum. Ideally, evaluating students from a longitudinal perspective that examines the moments of initial exposure to technical interview preparation to the official performance on technical interview sessions with hiring managers could provide potential insight on employed initiatives that influenced success. By teaching students' the skills needed to pass these interviews throughout the entirety of their collegiate experience will reduce anxiety, one of the primary components leading to failure when solving whiteboard problems [3]. As more of these initiatives are utilized, the progression of these students during and after college should be recorded in order to better understand how to prepare students.

Another future work is increasing the general awareness of the technical interview process amongst institutional administrators and faculty. Aforementioned, there are CS courses designed to strictly train students for the technical interview process (referred to as Category 1). Likewise, there is a trend for these courses to be student-taught. This raises the question of how truly engaged institutions and CS departments are when it comes to their students' success with technical interviews. It is one thing for these academic entities to focus primarily on getting their students to the finish line of a CS course curriculum to obtain degrees. It is also important that these students can showcase and transfer their learned technical skills to professional, practical, and/or career-based settings. Demonstrating the importance of the technical interview process to institutional administrators and faculty could improve such initiatives as seen for Category 1 and the other categories alike.

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