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Bridging the Gap: Preparing Computing Students for Successful Career Transition

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Abstract

Students studying computer science must gain relevant abilities for their future employment due to the rapid evolution of technology. This study fills in the knowledge gap about how well universities prepare these students for the demands of the industry. The main goals are to assess the level of assistance universities provide computing students with the necessary skills, pinpoint areas needing development, and extract knowledge from industry best practices. A mixed-methods approach used surveys and interviews with four university computer science students. The results show that although the institution offers a solid basis in knowledge, there are plenty of chances to improve industry partnerships, soft skill development, and experiential learning. In order to integrate courses with changing business requirements, the study emphasizes the significance of integrating real-world experiences, fostering diversity, and promoting continuous learning. The necessity for a multimodal approach to curriculum design that takes into account input from business partners and prioritizes the development of both technical and soft skills is one of the implications for higher education institutions.

Keywords: Computing Education; Experiential Learning; Soft Skills; Industry Collaboration; Curriculum Development; Higher Education

1. Introduction

The rapid development of technology and its integration into various industries necessitate that student pursuing computer science be prepared for their future careers. Computer studies is a popular major among university students, and as such, the school should provide practical, real-world learning opportunities. The higher education system needs to expand in order to prepare students for a digital future, which is an essential part of graduate skills given the significance of digital skills to a country's economy (Eskandari et al., 2022). This study examines the various strategies, challenges, and recommendations for equipping computing students with the knowledge, skills, and abilities required for success in the field. A significant amount of literature highlights the importance of aligning computer curricula with industrial demands. According to Cai and Zhu (2020), courses should regularly integrate new techniques and technologies. Employers strongly value graduates with practical experience in domains such as artificial intelligence, cybersecurity, and cloud computing (Akinnuli & Onashoga, 2019). Thus, in order to create programs that are contemporary and relevant, collaboration between the academic community and business is vital. It is well known that project-based learning, cooperative education, and internships are examples of experiential learning that is essential to preparing computer science students for problems they will encounter in the real world.

In addition to enhancing technical skills, practical experience fosters the development of critical soft skills including teamwork, problem-solving, and communication (Litzler and Young, 2012). Capstone projects give students great opportunities to apply their theoretical knowledge in practical settings by having them solve real-world problems. According to Paretti (2008), success in the computing business requires more than just technical proficiency. The study

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highlights the importance of soft skills including teamwork, adaptability, and communication. According to Shuman, Besterfield-Sacre, and McGourty (2005), integrating soft skills training into computer programs can be accomplished through group projects, discussions, and interdisciplinary collaborations. Professional development classes that prioritize ethics, professional conduct, and lifelong learning are also essential components of a well-rounded education (Georgiev & Georgieva, 2015). To foster creativity and close the skill gap in the industry, inclusion and diversity in computing education are crucial.

Sax et al. (2018) found that diverse teams are more innovative and effective. Initiatives to support underrepresented groups in computers, like women and minorities, include mentoring programs, fellowships, and inclusive curricula that represent a range of perspectives (Margolis & Fisher, 2003). All students need to feel valued and encouraged in order to thrive both academically and professionally. This can only be achieved by creating an inclusive environment. The emphasis on flexibility and continuous learning is necessary given the explosive rise of computing technologies. The paper claims that incorporating cutting-edge technology into the curriculum helps students stay current with business trends. According to Pappano (2012), MOOCs (Massive Open Online Courses), industry certifications, and seminars are all efficient means of providing ongoing education. Students must be encouraged to learn independently and stay up to date with technology changes if they are to thrive in their careers in the long term (Jones, 2019).

The achievement of the desired learning objectives by students necessitates the application of effective techniques for assessment and feedback. Formative assessments, such as quizzes and peer evaluations, provide students with instant feedback and highlight areas for improvement (Nicol & Macfarlane-Dick, 2006). Summative assessments, such as exams and final projects, measure students' overall knowledge and proficiency. Business colleagues' ongoing feedback can help ensure that courses adhere to professional standards and offer suggestions for curriculum improvements (Biggs & Tang, 2011). Therefore, preparing students for careers in computing requires a multimodal approach that includes curriculum alignment with industry needs, promotion of continuous learning, development of soft skills, diversity and inclusion, and experiential and practical learning opportunities. By focusing on these areas, educational institutions may provide students with the abilities necessary to thrive in the quick-paced, ever-evolving computer sector.

1.1. Research questions

- To what extent is the university preparing computing students for their future journey?
- How do computing students feel the university could further enhance this provision?
- What are the lessons to learn from other good practices across the computing sector?

2. Literature Review

2.1. Incorporate Emerging Technologies

This study examines how emerging technologies might be implemented into educational curricula, with a focus on key technologies such as gamification, artificial intelligence (AI), virtual and augmented reality (VR/AR), and adaptive learning systems. While AI can provide customized learning experiences and automated administrative tasks, VR and AR can provide immersive learning experiences that help students better understand complex subjects (Holmes Bialik & Fadel, 2019). However, challenges including prohibitive pricing, technology limitations, and teacher preparation must be overcome if they are to reach their full potential in education. It has been discovered that gamification—the application of game design features in non-gaming contexts—is an effective strategy for increasing student motivation and engagement. Empirical studies have demonstrated that gamified learning environments can enhance student engagement, especially in subjects that are perceived as complex or laborious. However, for gamification to be successful, game elements need to be thoughtfully created to make sure they complement learning objectives (Young, Jouneau-Sion, & Sanchez, 2020).

Adaptive learning systems, which employ algorithms to adjust the complexity and substance of learning materials based on student performance and needs, offer a tailored learning experience that is responsive to individual advancement (Radanti et al., 2020). Learning outcomes are enhanced by this. According to a study by Holmes Bialik & Fadel (2019), adaptive learning can be especially beneficial in subjects like mathematics, where students commonly have varying amounts of prior knowledge. In order to ensure the effectiveness of adaptive learning, however, a substantial financial investment in technology as well as ongoing support are required.

2.2. Project-Based Learning

Students can explore problems and challenges from the real world while obtaining greater understanding through a dynamic teaching technique called project-based learning (PBL) (Mergendoller, Maxwell & Bellisimo, 2006). It is based on constructivist learning theories, such as those put out by Piaget, Dewey, and Vygotsky.

Deeper learning, better critical thinking, greater student involvement, and the development of collaboration skills are all advantages of project-based learning. Implementation problems include, however, a lack of resources, challenges with assessment, and teacher preparation. According to a 2009 study by Strobel & van Barneveld, PBL has shown promise in STEM education, where students have designed and built solar cars, and in the humanities, where students have researched historical events and created multimedia presentations. When given the proper resources and support, PBL can alter students' educational experiences and outcomes.

2.3. Soft Skills Development

2.3.1. Communication and Teamwork

Good collaboration and communication are necessary in many social and professional contexts. While the Systems Theory views teams and organizations as complex systems, the Social Exchange Theory contends that interpersonal relationships are formed and maintained via the sharing of resources. The Media Richness Theory states that the mediums used in communication have an impact on its effectiveness.

Certain communication styles, such as frequent, honest, and balanced communication, are associated with productive teams, according to a study (Smith, 2015). Feedback is essential to team success in two ways: it clarifies expectations and encourages continuous learning (Carless & Winstone, 2020). The growing trend of working remotely has highlighted both the benefits and drawbacks of virtual communication. Diversity and inclusion are essential for innovative and successful teams, just as trust and cohesion are for open communication and collaboration.

Effective leadership is one of the most significant variables impacting team communication. Some practical ramifications include investing in training programs on communication and teamwork, establishing a culture that encourages candid communication and cooperation, and using appropriate communication methods and technologies. Understanding and enhancing the connection between cooperation and communication will be essential for long-term success in an environment that is more interconnected and dynamic (Zorlu & Korkmaz, 2021).

2.3.2. Problem-solving and Critical Thinking

The ability to think critically and solve problems is a cognitive skill that is necessary for both innovation and making wise decisions. They are related to each other and can be applied in many contexts. Problem-solving includes identifying, analyzing, and overcoming obstacles, whereas critical thinking requires objectively studying and evaluating problems (Razak et al., 2022).

Problem-solving involves two cognitive processes: Polya's four-step model and the IDEAL model. Critical thinking includes interpretation, analysis, assessment, inference, explanation, and self-control. Creativity, strategic planning, and decision-making in the workplace require the use of critical thinking and problem-solving techniques. To develop these abilities, training programs make use of mentorship, case studies, and simulations. Effective leaders possess strong critical thinking and problem-solving abilities (Fitarahmawati, & Suhartini, 2021).

2.4. Industry Collaboration

2.4.1. Internships and Co-ops

According to NACE (2021), co-ops and internships are essential components of higher education because they provide students with practical experience to augment their academic learning. Liu et al. (2018) claim that these programs offer enhanced academic accomplishment, professional readiness, skill development, networking opportunities, and job market advantage.

Other challenges include time commitment, irregular supervision and quality, disruptions to the academic process, and issues with equity and access. Unpaid internships may put students from lower socioeconomic backgrounds in financial difficulty, even when regional restrictions may limit opportunities. The lack of adequate control and the broad variability in the quality of these programs may reduce their educational utility.

Time commitment could interfere with education and possibly delay graduation. Career outcomes include things like higher employment rates, higher starting salaries, faster professional advancement, and long-term job satisfaction. In order to maximize their usefulness, future research should focus on developing ways to overcome these challenges and ensure that every student gets the opportunity to benefit from these valuable experiences.

2.4.2. Guest Lectures and Workshops

Guest lectures and workshops are essential components of educational institutions because they provide professionals and students with the opportunity to learn from experts outside of their own academic or professional circles. Research shows that guest lectures and workshops can significantly enhance learning outcomes by exposing participants to a range of perspectives and real-world applications of academic knowledge (Serhan, 2020).

Workshops not only facilitate the rapid application of knowledge and provide hands-on experience, but they also encourage critical thinking, active learning, and problem-solving skills. Benefits from guest lectures and seminars include exposure to business practices, networking opportunities, and career inspiration (Alebaikan, 2016). Through the integration of contemporary developments and specialist expertise into the curriculum, educators can tailor learning experiences to each student's needs.

However, there are some challenges, such as scheduling conflicts, organizational issues, and ensuring the quality and relevance of guest content. To maximize the impact of guest lectures and workshops, the best practices are to schedule pre-lectures in advance, include students in pre-lecture assignments or discussions, provide interactive components during sessions, and follow up with students after the lecture.

2.5. Career Services

2.5.1. Resume Building and Interview Preparation

The subject of how important it is to polish your resume and prepare for interviews in the competitive job market. A CV with good writing, contact information, a summary, work history, education, and skills increases a candidate's chances of being invited for an interview. Resumes must be customized to specific job needs and made to seem good, as recruiters spend an average of six seconds reviewing applications.

Resume optimization has become crucial due to the introduction of applicant tracking systems (ATS) and other technical advancements. Interview preparation involves the use of situational and behavioural interviews, which are reliable measures of job performance. It is imperative to prepare psychologically for interviews because nervousness can negatively impact performance. This involves reducing nervousness and increasing self-assurance. Nonverbal indicators including attire, eye contact, and body language have a big influence on interview outcomes (Haimann, 2020).

The COVID-19 epidemic has accelerated the use of virtual interviews, resulting in new requirements for interview preparation and the need for specialized knowledge of technology management and virtual environment setup. Future research should look more closely at how resumes and interviews are changing, particularly in light of new technological advancements.

2.5.2. Networking Opportunities

Networking is essential for personal and professional development since it provides opportunities for collaboration, knowledge exchange, and career advancement. This is particularly crucial for business owners since they rely on their networks to provide them with resources, expertise, and support (Douglas, 2020).

However, there are barriers to networking, such as unequal access, requirements for time and effort, reciprocity, and trust. The benefits of networking include advancement in one's career, knowledge exchange, support, and success in entrepreneurship. Strong ties can transcend different social groups, while informal networks facilitate cooperation and communication. Networks also provide emotional and professional support, both of which are critical for one's growth (Arasti, Garousi & Jafarpanah, 2022).

3. Methodology

The research utilized a descriptive design methodology. Based on three study topics, we developed a questionnaire: In order to accomplish this, we posed a series of fifteen questions, each about one or more of these research topics. The major goal was to get students ready for careers in computing. How much is the university helping students studying

computers get ready for their future? What more could the university do to improve this provision, in the opinion of computer students? What might be inferred from other commendable practices in the computing industry? Eighty students in total answered our survey. Each of them was a university student specializing in computer science. Each person gave their permission to participate in the research. Every participant was an adult.

There were only four university students in the computer science department who took part in the interviews as participant-1 to participant-4. Every interview was recorded, and each one was separately transcribed, allowing us to draw our conclusions. Following the transcripts, the three research questions served as the basis for the coding used in the theme analysis. It took three months to administer the interview and questionnaire tools. SPSS 23.0 was used for the analysis, with a focus on descriptive and inferential statistics.

4. Analysis and Results

- RQ1: To what extent is the university preparing computing students for their future journey?

Table 1 Response to Research Question One

	Frequency	Percent	Cumulative Percent
Agreed	60	75.0	75.0
Disagreed	20	25.0	100.0
Total	80	100.0	

When asked 'To what extent is the university preparing computing students for their future journey?' 75% of participants agreed, while 25% disagreed.

- RQ2: How do computing students feel the university could further enhance this provision?

Table 2 Response to Research Question Two

	Frequency	Percent	Cumulative Percent
Agreed	30	37.5	37.5
Disagreed	50	62.5	100.0
Total	80	100.0	

When asked 'How do computing students feel the university could further enhance this provision?' 37.5% of the students agreed while 62.5% disagreed.

- RQ3: What are the lessons to learn from other good practices across the computing sector?

Table 3 Response to Research Question Three

	Frequency	Percent	Cumulative Percent
Agreed	30	37.5	37.5
Disagreed	50	62.5	100.0
Total	80	100.0	

When asked 'What are the lessons to learn from other good practices across the computing sector?' 37.5 agreed while 62.5% disagreed.

4.1.1. Inferential Statistics on the Survey Data

Three study issues were correlated using inferential statistics. "To what degree is the university preparing computing students for their future journey?" was one of the three research topics. What more could the university do to improve this provision, in the opinion of computer students? What more valuable lessons can be drawn from other successful computing industry practices? This revealed a negative linear association with a Pearson's correlation coefficient of -.149, but no statistical significance was found (p =.725) (see Table 4).

Tale 4 Correlations

		To what extent is the university preparing computing students for their future journey?	**How do computing students feel the university could further enhance this provision?**	**What are the lessons to learn from other good practices across the computing sector?**
To what extent is the university preparing computing students for their future journey?	Pearson Correlation	1	-0.149	-0.149
	Sig. (2-tailed)		0.725	0.725
	N	80	80	80
How do computing students feel the university could further enhance this provision?	Pearson Correlation	-0.149	1	0.467
	Sig. (2-tailed)	0.725		0.244
	N	80	80	80
What are the lessons to learn from other good practices across the computing sector?	Pearson Correlation	-0.149	0.467	1
	Sig. (2-tailed)	0.725	0.244	
	N	80	80	80

5. Discussion

The discussion of the findings is analyzed alongside the research questions. To answer the research question that says “To what extent is the university preparing computing students for their future journey?” A higher percentage of the students agreed that university prepare computing students for their future journey than those who disagreed. The percentage of students that disagreed to the statement that computing students feel the university could further enhance the provision and the lessons to learn from other good practices across the computing sector. This implies that students believe that the university could not further enhance the provision and no lesson to learn from other good practices across the computing sector.

Participant 1 expresses that the program offers networking possibilities, fosters creativity and teamwork, and only partially satisfies expectations. He said that the university welcomes guest lecturers and seminars, but they also point out a lack of cooperation between the department and the tech sector regarding coops and internships, as well as inadequate preparation in soft skills necessary for employment in effective modern computing.

Participant 2 found the teaching team adequate, the curriculum updated to meet industry trends, and the department balanced in gender. The learning environment was suitable for learning. However, he noted that the instructional delivery and feedback partially met expectations. He also noted that there was a lot of participation in assignments, but he was not sure about networking opportunities. He also noted guest lecturers and workshops, but no collaboration between the department and the tech industry for internships or co-ops.

Participant 3 agreed that the teaching team is adequate, the curriculum is updated to meet current industry trends, and the department is gender-balanced. Enrolment criteria match the learning environment. However, she disagreed with the department's focus on networking opportunities for future career benefits. She acknowledged guest lecturers, and

workshops, and encouraged students to attend seminars and conferences for future career benefits. She also noted no collaboration between the department and the tech industry for internships and co-ops. Overall, the program provides adequate training for successful modern computing careers.

Participant 4 agrees that there is an adequate teaching team, the curriculum is updated to meet current industry trends, and the department is gender-balanced. She also agrees that the enrolment criteria match the learning environment. She also appreciates the participation in individual and team assignments but disagrees with the department creating networking opportunities for future benefits. She accepts guest lecturers and workshops but disagrees with the lack of collaboration between the department and the tech industry for internships and co-ops. She believes there is enough training in soft skills for successful modern computing careers.

Though it falls short of expectations, the curriculum fosters innovation, teamwork, and networking opportunities. Participants said the department had a gender balance, the curriculum was updated, and the teaching staff was competent. They did see, however, a lack of coordination regarding internships and coops between the department and the tech industry. They also mentioned workshops and guest lecturers, but they saw little cooperation between the department and the tech sector in terms of coops or internships. They disagreed with the program's emphasis on networking opportunities for potential future job benefits, but overall it offers sufficient instruction for successful modern computer careers.

6. Conclusion

According to the report, universities have a significant impact on how well-prepared computer students are for their future employment. However, there are still issues with the gender ratio, curriculum, teaching staff, and admission requirements. The institution should prioritize guest lecturers, workshops, professional associations, networking opportunities, teamwork, feedback, and instructional delivery. Coops, internships, and departmental collaboration with the tech sector are all crucial for putting students on the path to a successful career.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

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