Chapter 5
Teaching and Learning of Computer Science in Higher Education:
A Self-Directed Learning Perspective

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ABSTRACT

This chapter focuses on the evolving landscape of computer science education in higher institutions, emphasizing the need to prepare students for a rapidly changing technology industry. It explores the integration of self-directed learning techniques in computer science courses to enhance outcomes, engagement, and critical skills like problem-solving. The chapter compares traditional instruction with self-directed learning, highlighting the benefits of the latter in terms of motivation, autonomy, and understanding complex computer science concepts. It reviews existing research in this area and introduces a conceptual framework aligning self-directed learning principles with core computer science concepts.

INTRODUCTION

Computer science teaching and learning in higher education have evolved significantly over the years, particularly in the context of self-directed learning (Barnes, 2021). In the ever-evolving landscape of higher education, the field of computer science stands as a dynamic crucible where innovation, adaptation, and lifelong learning are not just encouraged but imperative (Hebda, 2023). With technology advancing at an unprecedented pace and the job market continually shifting its demands, it has become increasingly clear that equipping computer science students with skills to thrive in this ever-changing

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environment is paramount. Moreover, instilling a passion for learning and fostering the ability to adapt to new challenges are skills that will not only serve students during their academic journey but throughout their entire careers (Markova et al., 2019). To address these evolving needs, integrating self-directed learning techniques into computer science courses has emerged as a promising pedagogical approach.

The field of computer science education in higher institutions is constantly evolving to meet the changing demands of technology and the job market (Noone & Mooney, 2018). To address this, integrating self-directed learning approaches has emerged as a valuable strategy to empower students and enhance their readiness for the dynamic field of computer science (Onah, Pang & Sinclair, 2020).

Traditional computer science education often relies on teacher-led instruction, which may not fully engage students or adequately prepare them for the rapidly evolving industry (Oda, Noborimoto, & Horita., 2021). In contrast, self-directed learning places emphasis on student autonomy, motivation, and active participation in their education, allowing them to take control of their learning process (Bergamin et al., 2019). This approach can enhance student motivation, critical thinking skills, and adaptability to new technologies and concepts, vital attributes in computer science.

Research in various educational contexts has demonstrated the benefits of self-directed learning. It has been associated with improved student achievement, increased self-directed learning readiness, and more positive attitudes towards learning (Cigdem & Öztürk, 2016; Oda et al., 2021; Kayacan & Ektem, 2019). In the specific context of computer science education, self-directed learning offers several advantages (De Beer, 2016). It allows students to explore their interests, set personal learning goals, and select resources and strategies that align with their individual needs. This approach can lead to a deeper understanding of complex computer science concepts and the development of effective problem-solving skills (Bosch, 2017). Moreover, self-directed learning cultivates lifelong learning habits, which are crucial in a constantly evolving field.

Self-directed learning (SDL) is an educational approach that places the responsibility for learning on the student, allowing them to take control of their learning journey (Ona et al., 2020). This approach has gained prominence in computer science education due to its potential to foster independent and lifelong learning skills, which are crucial in a rapidly evolving field like computer science. This chapter embarks on a comprehensive exploration of the teaching and learning of computer science in higher education, with a keen focus on the invaluable perspective of self-directed learning. Self-directed learning is a multifaceted approach that emphasises students' active participation in their own learning process, allowing them to take ownership of their education (Oosthuizen, 2016; Ntombana, Gwala & Sibanda, 2023). As we delve into this perspective, we will uncover the multifarious benefits of self-directed learning, its challenges, and the considerations required for its successful implementation.

Implementing self-directed learning in computer science curricula comes with its own set of challenges. Assessment difficulties, scaffolding, accommodating diverse learning styles, and the ongoing professional development of academics are some of the obstacles that need to be addressed (Santhanam, Sasidharan & Webster, 2008; Thomson & Tippins, 2013; Markova et al., 2019; Threekunprapam & Yasri, 2020; Estisari, Wengrum & Nurhantanto, 2023). Despite these challenges, the potential benefits of self-directed learning in computer science education make it worthwhile. The key aim of this chapter is to provide a comprehensive view of self-directed learning in the teaching and learning of computer science in higher education. It reviews existing research on self-directed learning in computer science education, explores the potential synergies between self-directed learning principles and core computer science concepts, and discusses the challenges and considerations of implementing self-directed learning in computer science curricula.