Chapter 13
Tools and Resources for K–12 Computer Science Education

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ABSTRACT

K-12 computer science education utilizes a variety of tools and resources that make significant contributions. Tools such as unplugged computer science tools, block-based computer science tools, text-based computer science tools, physical computer science tools, robotic kits, artificial intelligence, etc. have an important place in K-12 computer science education. It is crucial to incorporate computer science instruction into the basic courses of K-12 students, as well as to incorporate these tools into the curriculum. Worldwide resources have a significant impact on the enrichment and dissemination of K-12 computer science education. The content and resources created by platforms like Computer Science Teachers Association (CSTA), International Society for Technology in Education (ISTE), National Centre for Computing Education (NCCE), etc. contribute significantly to K-12 computer science education. Websites such as K-12 Computer Science, CS for ALL, Teach Computing, Code.org, Scratch, etc. are also important platforms that have become learning communities in computer science education.

DOI: 10.4018/979-8-3693-4542-9.ch013

1. INTRODUCTION

Tools and resources make important contributions to the analysis, design, development, implementation and evaluation processes while designing computer science education. Within the scope of the chapter, tools and resources that can be utilized in K-12 computer science education will be evaluated. The chapter aims to focus on the tools and resources necessary to develop students' computational thinking skills in K-12 computer science education.

In K-12 computer science education, various resources and tools play an important role in introducing computer science concepts and computational thinking. Computational thinking encompasses a range of specific thinking skills for problem solving including abstraction, decomposition, pattern recognition, logic and algorithm design, evaluation (Grover & Pea, 2018). Unplugged computer science tools, block-based computer science tools, text-based computer science tools, physical computer science tools, robotics kits, artificial intelligence tools have an important place in K-12 computer science education. It's critical to integrate these tools into the curriculum and to incorporate computer science education entering the basic courses of primary and high school students (Ballard & Haroldson, 2021). Studies conducted in the field show how crucial it is to introduce students to computer science education at a young age, and there is a growing movement in K–12 education to start computer science education early(Chittora & Baynes, 2020). Furthermore, among the resources now used in K–12 computer science teaching include augmented reality, virtual reality, artificial intelligence, and data science. According to Ersözlü and Clark (2019), the educational technology tools now employed in computer science education are essential for helping students build computational thinking abilities and serve as a basis for more complex ideas. In addition to being essential elements of contemporary K–12 computer science education, augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) also provide immersive and dynamic learning environments. Another approach suggests that workshops focused on data science examples can help students understand algorithms and make inferences from data, and demonstrate practical applications of AI in education (Chittora & Baynes, 2020). By visualizing difficult concepts and offering hands-on experiences, augmented reality and virtual reality technologies have been demonstrated to increase student engagement and improve learning outcomes. Moreover, AI applications in K-12 computer science education offer personalized learning experiences and adaptive feedback mechanisms. Abdulrhman et al. (2023) emphasize that artificial intelligence (AI) systems are constantly evolving to operate efficiently and mimic human thought processes, highlighting the potential of AI to enhance educational practices.