Chapter 14

A Bibliometric Review of Pedagogical Innovations and Future Directions for Generative Artificial Intelligence in Computer Science Education

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ABSTRACT

This chapter provides a bibliometric review of research on Generative Artificial Intelligence (GAI) in Computer Science (CS) education over the past decade. A total of 582 documents been catalogued in Scopus for the period of 2014-2024 was used. The publications were analyzed using Biblioshiny for Bibliometrix and the results were used to identify gaps in the literature and guide future research directions on GAI's impact in education. The findings revealed the surge in publications and citations post 2020 can be attributed to large language models and AI coding assistants. Thematic and keyword analyses show that GAI has been applied primarily in programming education, intelligent tutoring, personalized learning, and assessment. These applications yield outcomes such as enhanced efficiency, student engagement, and scalability, yet also raise concerns about academic integrity, over-reliance, and algorithmic bias. GAI research is spearheaded by developed nations which poses fairness concerns, and simultaneously fosters advancement and moral quandaries in computer science pedagogy.

INTRODUCTION

The swift advancement of Generative Artificial Intelligence (GAI) has transformed global educational practices. Within this broader transformation, one of the most active areas of GAI is Computer Science (CS) education. GAI is a type of artificial intelligence that utilizes deep learning architectures, such as Transformers and Generative Adversarial Networks (GANs), to generate new and realistic outputs in text, images, code, and multimedia (Brown et al., 2020; Chen, Balan, & Brown, 2023). Current applications, such as ChatGPT, GitHub Copilot, and DALL·E, demonstrate how they may alter pedagogy, curriculum development, and the way students learn (Franklin, Denny, Gonzalez-Maldonado, & Tran, 2025).

Against this technological backdrop, recent scholarly investigations reveal that the educational incorporation of GAI is advancing across several pivotal dimensions. First, GAI is being used more and more to personalize lessons and create adaptive learning paths that give students feedback, practice opportunities, and real-time scaffolding that are tailored to their requirements (Roll & Wylie, 2016). Second, GAI makes exercises, tutorials, and assignments that automatically produce material. This makes things easier for teachers and allows students access to a greater range of learning materials (Siemens & Baker, 2012). Third, a lot of people need programming and debugging support. Students can use GitHub Copilot and other tools to write code, explain it, and rectify faults. Fourth, GAI is transforming how we evaluate papers, discover plagiarism, and give comments that can be used

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