A SCOPING REVIEW ON MENTAL MODELS IN TEACHING BASIC PROGRAMMING WITH GENERATIVE AI

Amine Bitar

University of Balamand, LEBANON

Abstract

Since the mid-1980s, a growing body of literature has explored the role of mental models in software development and programming. These concepts are rooted in the field of cognitive science (Johnson-Laird, 1983). A crucial issue addressed in these studies is the role of mental models in learning programming, with Pirolli and Anderson's (1984) work marking a significant starting point. Numerous studies and experiments followed, but none explicitly translated the findings into a teaching method or technique.

With the proliferation of generative AI tools, there is a growing call to re-evaluate how programming is taught and how these tools affect students' computational thinking skills, programming self-efficacy, and motivation toward the material (Yilmaz & Karaoglan Yilmaz, 2023). In parallel, mental models are being reconsidered in the context of generative AI as the internal representations and frameworks that the AI system forms to comprehend and manipulate information.

These mental models are inspired by how human cognition operates, enabling AI to simulate creative thinking, problem-solving, and ideation. It is noteworthy that priority is given to the mental model adopted by the AI system, not the one formed by the human (Kelly et al., 2023).

On the other hand, some cognitive scientists consider generative AI an unreliable source of misinformation, bias, and false beliefs due to its manipulation of responses (Bos et al., 2019). Additionally, perceived AI accuracy can limit intellectual curiosity, creativity, and scientific inquiry (Abrams, 2024).

This paper is a scoping review attempting to answer the following questions:
- What is the exact place of mental models in generative AI?
- Are there authentic experiences in teaching basic programming through generative AI tools?
- What is the potential contribution of understanding mental models in generative AI in improving the teaching process of basic programming?