Modelling of Interactive Learning through Artificial Intelligence: A Theoretical Framework for Adaptive Educational Systems

Petya Byalmarkova
Department of Computer Systems and Technologies, Faculty of Mathematics and Informatics, St. Cyril and St. Methodius University of Veliko Tarnovo, Bulgaria

Abstract

This paper proposes a comprehensive theoretical framework for modelling interactive learning through Artificial Intelligence aimed at designing adaptive educational systems that respond dynamically to learner needs. The framework integrates machine learning algorithms, natural language processing, and cognitive modelling to create personalized learning pathways and foster active engagement. By leveraging real-time data from learner interactions, the system adapts instructional content, feedback, and assessment strategies to optimize learning outcomes. The proposed model emphasizes interactivity, adaptivity, and scalability, ensuring that educational environments can accommodate diverse learning styles and contexts. By framing interactive learning as a continuous feedback loop between the learner and the system, the study highlights the potential for AI-driven solutions to support individualized learning trajectories and foster deeper conceptual understanding.

Furthermore, the framework outlines key components, including learner profiling, adaptive content delivery, and intelligent feedback mechanisms, supported by ethical considerations for data privacy and fairness. This approach aims to bridge the gap between traditional pedagogy and AI-driven personalization, offering a roadmap for future research and implementation in intelligent tutoring systems and digital learning platforms.

The paper concludes by outlining key design principles, theoretical implications, and future research directions for advancing adaptive educational systems through AI.

Keywords

Adaptive Educational Systems, Artificial Intelligence, Intelligent Tutoring Systems, Interactive Learning, Personalized Learning.