A Systematic Review of Gemini and Mathematics Education

Ali Mazı
http://orcid.org/0000-0001-9188-8583
Ministry of National Education, Turkey

ABSTRACT

The integration of artificial intelligence into the field of mathematics education has the effect of increasing the interactivity and accessibility of the learning processes involved. This systematic review aims to make a contribution to the current discourse by providing a comprehensive view of Gemini in mathematics education. This study examined the use of Gemini in mathematics education, covering themes such as pedagogical approach and methodology. The articles were analysed following the PRISMA approach. In this context, a total of seven research articles published until December 2024 were analysed. The results of the study show that Gemini is most commonly used as a chatbot in mathematics education. It was concluded that the research mainly used experimental design and qualitative methodology.

INTRODUCTION

Mathematics education is a fundamental discipline that aims to cultivate individuals' analytical thinking, problem-solving, and logical reasoning abilities (Cotič et al., 2024) Mathematics is a field with a vast array of applications, spanning decision-making processes in daily life to scientific studies (Faruq, 2023; Rane, 2023). Therefore, effective planning and implementation of mathematics education is of paramount importance (Cevikbas, Koenig & Rothland, 2024; Mazı, 2024). The enhancement of students' mathematical thinking skills facilitates more effective problem-solving in both academic and daily contexts (Chen, 2024). In the mathematics lesson, the utilisation of technology to provide visual representations of theoretical concepts facilitates the learning process and enables students to gain a deeper understanding of mathematical principles (Cirneanu & Moldoveanu, 2024). It is becoming increasingly notable that artificial intelligence (AI) is at the vanguard of technological integration (Dockendorff & Zaccarelli, 2024) in mathematics education (Li, 2024; Sharma, 2024).

The AI is currently employed in educational settings as a cutting-edge technology that facilitates the creation of tailored learning pathways within the educational sphere (Alshahrani & Qureshi, 2024). It furnishes content and strategies that can be adapted in a dynamic manner according to the specific needs, learning speed and interests of the students (Chigbu, Umejesi & Makapela, 2024). A number of

DOI: 10.4018/407445

studies have highlighted the positive impact of AI applications in education on learning outcomes (Mazı, 2024; Wu & Yu, 2024), particularly in areas such as language learning (Karataş et al, 2024) and science (Almasri, 2024). Furthermore, educators can more efficiently oversee the assessment of achievements and provide feedback through the use of AI-powered tools, allowing for a greater allocation of time for direct instruction in the classroom (Onesi-Ozigagun et al., 2024). Mathematics education is regarded as one of the academic disciplines that can potentially benefit the most from the opportunities offered by AI (Wardat et al., 2024). The ability to visualize abstract concepts (Rane, 2023), present diverse problem-solving strategies to students (Opesemowo & Ndlovu, 2024), and conduct immediate error analyses are among the significant innovations that AI brings to mathematics education.

BACKGROUND

The field of mathematics is inherently associated with the process of problem-solving (Memiş, 2025). The utilisation of AI has emerged as a pivotal instrument in the cultivation of students' problem-solving competencies (Benvenuti et al., 2023). The utilisation of AI in educational processes has been demonstrated to facilitate an efficient learning environment by adapting to the individual learning speeds and styles of learners (Mazı & Yıldırım, 2025). The objective of this initiative is to enhance the relevance and appeal of mathematics for students who have developed an aversive attitude towards the subject or experience feelings of anxiety (Abd Algani, 2024). It is acknowledged that research on the effects and applications of AI in education is still in its infancy, and that a comprehensive discussion of its positive and negative aspects is necessary (Chen & Lin, 2024). Gemini, an AI-based platform utilised within the domain of mathematics education, represents a recent development in large language models (LLMs) by Google DeepMind AI. The entity known as Gemini was formerly referred to as BARD (Urman & Makhortykh, 2025). Recent studies have demonstrated that Gemini has been observed to successfully perform a variety of tasks, including the generation of text (Pande et al., 2024), the composition of code (Lohana et al., 2025), the translation of languages (Farghal & Haider, 2024), the provision of creative content (Amin, 2024), and the provision of detailed and informative responses to questions regarding large text and code datasets. The features of Gemini can be enumerated as follows (Amin, 2024; Rane, Choudhary & Rane, 2024; Sam Prince Franklin et al., 2025; Veerakannan, 2025). Multi-model processing: Gemini has the capacity to process a variety of data types, including text, images, audio, and video, in a simultaneous manner. This facilitates the provision of more comprehensive and informative answers to questions. Reasoning and problem solving: Gemini is capable of comprehending both elementary and intricate inquiries. The capacity to provide rational responses to these inquiries is a key capability. Furthermore, it is capable of identifying existing problems and providing solutions. Creative content generation: Gemini is capable of producing a variety of creative written works (Karaca, 2024), in addition to code and musical compositions. Information search and synthesis: Gemini is capable of searching for and retrieving desired information from the internet, and utilising this information to provide comprehensive and informative answers. In general, Gemini has been identified as the optimal choice for multimedia content. It is noteworthy that different iterations of Gemini have been developed across successive eras, namely Gemini 1.0, Gemini 1.0 Pro, Gemini 1.0 Ultra, Gemini 1.5 Pro, Gemini 1.5 Flash