Direction of Gamification in Science Education: Literature Review and Indexed Bibliography

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Abstract

Gamification in science education has gained significant attention as an innovative approach to enhance student engagement, motivation, and comprehension of complex scientific concepts. This study conducts a systematic literature review and bibliographic analysis to explore the research trends in gamification within science education from 2015 to 2024. The study addresses existing gaps in applying and evaluating gamification in science learning, particularly focusing on its role in enhancing student engagement, motivation, and comprehension of complex scientific concepts. Data was collected from the Scopus database using search terms like "gamification," "science," and "education," yielding a total of 865 relevant publications, including articles, conference papers, and book chapters, published in English. The analysis identifies key contributors in the field, including influential authors such as Papadakis, Kalogiannakis, and Zourmpakis, and highlights prominent journals like *Lecture Notes in Computer Science* and *Education Sciences.* Various bibliometric techniques, including citation analysis and keyword co-occurrence mapping, were applied to uncover trends and key themes in gamification research. Findings reveal a sharp increase in publications, especially from 2023 to 2024, reflecting a growing global interest in gamifying science education. The study identifies several recurring themes, such as the integration of digital technologies like virtual reality, the impact of gamification on student motivation, and its diverse applications in science, technology, engineering, and mathematics education. Despite its potential, the research also points to significant challenges, including limited empirical evaluations, insufficient pedagogical frameworks, and the need for broader accessibility. The study concludes that while gamification offers considerable promise in science education, further research is essential to address these gaps, refine implementation strategies, and measure its long-term effects on learning outcomes.