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# Problem-Based Learning in Mathematics Education: A Bibliometric Analysis on Research Trends, Contributions, and Thematic Analysis from the Dimensions AI Database

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## Abstract

Problem-based learning (PBL) has emerged as a prominent student-centred approach that fosters active learning, problem-solving, and higher-order thinking skills (HOTS) in mathematics education. This study aims to examine the trends of PBL research in mathematics education, its scholarly contributions, and its thematic developments within the last decade, 2016-2025. A total of 274 articles related to the research domain were obtained from the Dimensions AI Database using “problem-based learning” and “mathematics education” as the search keywords. The PRISMA Framework was employed to ensure transparency and the completeness of the selection process when reporting the bibliometric review. VOSviewer was used to analyse the publication trends, author contribution, co-occurrence of keywords, as well as thematic clustering. The findings indicate that the PBL research tends to increase steadily, which indicates an increasing of scholarly interest in PBL in mathematics education, especially starting from 2023. Indonesia was the leading contributor in both publication and citation impact in the field of PBL research. However, the findings indicate low global collaboration intensity comparatively, as reflected by limited total link strength. Thematic mapping identifies three interrelated clusters, including (i) the development of critical thinking and problem-solving skills, (ii) mathematical literacy, reasoning, and conceptual competence, and (iii) technological integration and innovative instructions. The study concluded that this research field is consistently increasing. However, it remains structurally fragmented, which requires stronger global collaboration, deeper theoretical integration, and greater emphasis on technology-enhanced pedagogical practices. As a contribution, this study provides a comprehensive overview of the intellectual framework and future directions of PBL research in mathematics education.

**Keywords:** *bibliometric analysis; mathematics education; problem-based learning; research trends; scholarly contribution, thematic analysis*

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