Pertanika Proceedings 1 (2): 39 - 43 (2025)

PERTANIKA JOURNALS

PERTANIKA PROCEEDINGS

Journal homepage: http://www.pertanika.upm.edu.my/

A Bibliometric Study on Mathematical Modelling in Elementary Schools in the Scopus Database Between 1990–2024

Hardian Mei Fajri[1]*, Arita Marini[2] and Suyono[3]

[1]Doctoral Student of Basic Education, Faculty of Education, Universitas Negeri Jakarta, 13220, Jakarta, Indonesia
[2]Department of Basic Education, Faculty of Education, Universitas Negeri Jakarta, 13220, Jakarta, Indonesia
[3]Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta, 13220, Jakarta, Indonesia

ABSTRACT

Mathematical modeling is an approach to bridging real-world problems into mathematics in an effort to improve students' mathematical literacy. The purpose of this study is to conduct a bibliometric analysis of published articles related to Mathematical Modelling in Elementary School. This study used the Scopus database scanned with the keywords "Mathematical Modelling" and "Elementary School" with a time span of 1990–2024, obtaining as many as 78 articles. The data collected was then analyzed using R-software and VOSviewer applications. This study found that the development trend of Mathematical Modeling research in Elementary Schools significantly increased after 2015–2023 with a percentage of 67.95%. Authors from Germany and Denmark dominate the top researchers with the most influence. Furthermore, in recent years, the dominant topics in Mathematical Modeling research studies in elementary schools include Mathematical Modeling Cycle, Development, Mathematical Modeling Competency, Mathematical Concept, Mathematical Knowledge, Modeling Process, Mathematical Modeling Task, Empirical Study, and Creative Thinking. It is hoped that future research will focus on the literature on mathematical modeling at the high school and college levels.

Keywords: A bibliometric study, elementary schools, mathematical modelling

ARTICLE INFO

Article history:
Received: 12 December 2024
Published: 28 March 2025

DOI: https://doi.org/10.47836/pp.1.2.007

E-mail addresses:
hardianmf@gmail.com (Hardian Mei Fajri)
aritamarini@unj.ac.id (Arita Marini)
suyono@unj.ac.id (Suyono)
* Corresponding author

INTRODUCTION

Mathematical modeling is a promising research study and learning approach that can be implemented at every level of education. Although modeling has been taught informally for centuries, mathematical modeling has only recently emerged formally in education (Spooner,

2024). The study of teaching and learning mathematical modeling has grown to the extent that it has become a research field within the mathematics education community (Blomhø, 2019). Mathematical modeling is important in mathematics education worldwide and has been integrated into curricula and academic standards (Alwast & Vorholter, 2022). In addition, mathematical modeling has an impact on student learning outcomes, especially on mathematical literacy skills. Mathematical competence in the KOM-Project (mathematical modeling) shapes the PISA mathematics framework (Berget, 2023).

Bibliometric analysis contains many features to map information, such as network structure, keywords, publications, references, journals, and authors in the research field (Aria & Cuccurullo, 2022). Several previous studies have used bibliometric analysis of various research areas such as management (Lin et al., 2024), education and sustainable development (Prieto-Jiménez et al., 2021), use of technology in higher education (Díaz-García et al., 2022), social sciences (Mervar & Jokić, 2022), STEAM (Jantakun et al., 2024), and mathematics education (Cevikbas et al., 2022). The research question is: What are the popular research topic trends in the Mathematical Modelling in Elementary School literature in the Scopus database from 1990–2024?

METHOD

The method used in this research is bibliometric analysis (Figure 1), which uses the R-software and VOSviewer application tools. The researcher then conducted the document screening and eligibility step, determining and applying inclusion or exclusion criteria based on the title, topic, abstract and document content.

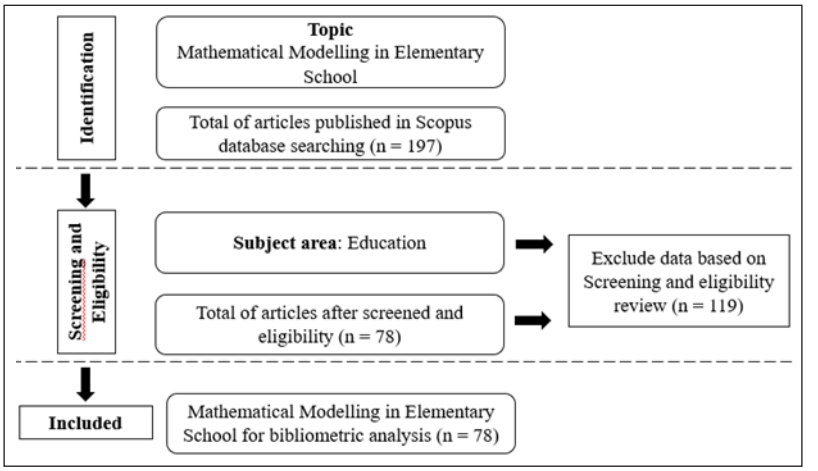

Figure 1. Flowchart of PRISMA procedure in filtering articles for bibliometric analysis

RESULTS AND DISCUSSION

Figure 2 shows the results of the co-occurrence analysis from VOSviewer. The most popular keywords in this research topic are Mathematical Modelling, Elementary School, Student, Problem, and teacher.

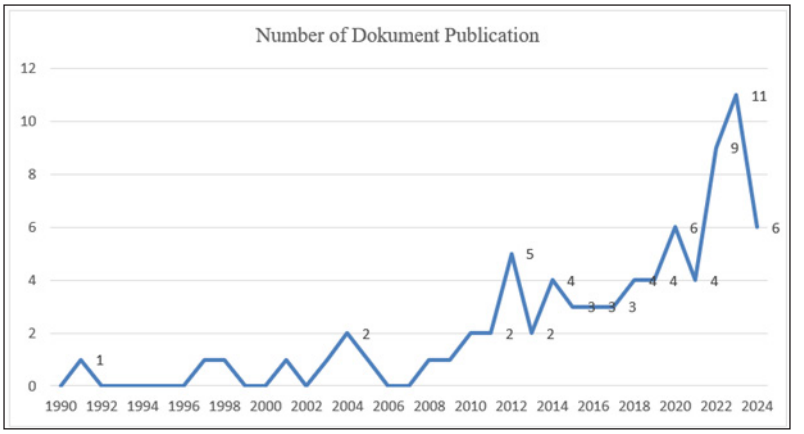

Figure 2. Co-occurrence of keywords on mathematical modeling research in elementary school between 1990 and 2024

The relationship between keywords is based on the circle's size and the path line's thickness, which means that the keywords have a strong relationship and often appear together with other keywords. The current trend of Mathematical Modelling research topics in elementary schools has become very diverse. These research topics mostly focus on developing and designing research methods for developing Mathematical Modelling Tasks. Then, the current research topic trend focuses on supporting learning activities such as improving Mathematical Modelling Competency, Mathematical Concept, Mathematical Knowledge, Modelling Process, and Creative Thinking.

Several studies have been conducted on the research topic of Mathematical Modelling in Elementary Schools, including combining Mathematical Modelling as a learning environment with the use of Virtual Manipulatives to help first-grade elementary school students overcome the difficulties detected in their learning related to basic arithmetic operations (Silva et al., 2021), modeling tasks on basic arithmetic operations assisted by artificial intelligence tools (Spreitzer et al., 2024), creating a mathematical modeling lesson based on Ethnomathematics in improving creative thinking of elementary school students (Supriadi et al., 2023), designing mathematical modeling tasks that provide experience in a financial context (Tural-Sonmez & Erbas, 2023), providing mathematical modeling problems to train grade 6 students in building conceptual models and understanding fractions (Shahbari & Peled, 2015).

CONCLUSION

The results of this study have implications for future researchers, teachers, and education policymakers. Based on research questions, namely on research topic trends in the form of popular keywords in mathematical modeling research, are useful for other researchers in identifying research topics that they can do in the future.

ACKNOWLEDGEMENT

The author would like to thank all parties who have helped and supported this research. The author would also like to thank the lecturers who have helped, educated, and provided guidance during the research. The author would also like to thank all parties who have helped in this research, both directly and indirectly. I hope this research can be useful for readers

REFERENCES

Aria, M., & Cuccurullo, C. (2022). *Science Mapping Analysis with bibliometrix R-package: An Example.* Bibliometrix.

Alwast, A., & Vorhölter, K. (2022). Measuring pre-service teachers' noticing competencies within a mathematical modeling context – An analysis of an instrument. *Educational Studies in Mathematics*, *109*(2), 263–285. https://doi.org/10.1007/s10649-021-10102-8

Berget, I. K. L. (2023). Mathematical modelling in the discourses of the KOM and PISA frameworks and teacher interviews. *Research in Mathematics Education*, *26*(3), 425–442. https://doi.org/10.1080/14794802.2023.2165536

Blomhøj, M. (2019). Towards integration of modelling in secondary mathematics teaching. In G. A. Stillman & J. P. Brown (Eds.) *Lines of Inquiry in Mathematical Modelling Research in Education* (pp. 37–52). Springer. https://doi.org/10.1007/978-3-030-14931-4_3

Cevikbas, M., Kaiser, G., & Schukajlow, S. (2022). A systematic literature review of the current discussion on mathematical modelling competencies : State-of-the-art developments in conceptualizing, measuring, and fostering. *Educational Studies in Mathematics, 109*(2), 205-236. https://doi.org/10.1007/s10649-021-10104-6

Cevikbas, M., Kaiser, G., & Schukajlow, S. (2022). A systematic literature review of the current discussion on mathematical modelling competencies : State-of-the-art developments in conceptualizing, measuring, and fostering. *Educational Studies in Mathematics, 109*(2), 205-236. https://doi.org/10.1007/s10649-021-10104-6

Díaz-García, V., Montero-Navarro, A., Rodríguez-Sánchez, J. L., & Gallego-Losada, R. (2022). Digitalization and digital transformation in higher education: A bibliometric analysis. *Frontiers in Psychology*, *13*, Article 1081595. https://doi.org/10.3389/fpsyg.2022.1081595

Jantakun, K., Jantakun, T., Trisupakitti, S., & Limpinan, P. (2024). STEAM education with gamification: A bibliometric analysis. *Higher Education Studies*, *14*(3), Article 90. https://doi.org/10.5539/hes.v14n3p90

Lin, X., Ribeiro-Navarrete, S., Chen, X., & Xu, B. (2024). Advances in The innovation of management: A bibliometric review. *Review of Managerial Science*, *18*(6), 1557–1595. https://doi.org/10.1007/s11846-023-00667-4

Mervar, A., & Jokić, M. (2022). Core-Periphery nexus in the EU social sciences: Bibliometric perspective. *Scientometrics*, *127*(10), 5793–5817. https://doi.org/10.1007/s11192-022-04493-5

Prieto-Jiménez, E., López-Catalán, L., López-Catalán, B., & Domínguez-Fernández, G. (2021). Sustainable development goals and education: A Bibliometric mapping analysis. *Sustainability*, *13*(4), Article 2126. https://doi.org/10.3390/su13042126

Shahbari, J. A., & Peled, I. (2017). Modelling in Primary School: Constructing conceptual models and making sense of fractions. *International Journal of Science and Mathematics Education*, *15*(2), 371–391. https://doi.org/10.1007/s10763-015-9702-x

Silva, R., Costa, C., & Martins, F. (2021). Using mathematical modelling and virtual manipulatives to teach elementary mathematics. In A. Reis, J. Barroso, J. B. Lopes, T. Mikropoulos & C. W. Fan (Eds.) *Technology and Innovation in Learning, Teaching and Education* (pp. 75–89). Springer International Publishing. https://doi.org/10.1007/978-3-030-73988-1_6

Spooner, K. (2024). What does mathematical modelling have to offer mathematics education? Insights from students' perspectives on mathematical modelling. *International Journal of Mathematical Education in Science and Technology*, *55*(3), 615–627. https://doi.org/10.1080/0020739X.2021.2009052

Spreitzer, C., Straser, O., Zehetmeier, S., & Maaß, K. (2024). Mathematical Modelling abilities of artificial intelligence tools: The case of ChatGPT. *Education Sciences*, *14*(7), Article 698. https://doi.org/10.3390/educsci14070698

Supriadi, S., Alfarisa, F., Hanif, M., & Belinda, B. (2023). Elementary school students: Analysis of questionnaire in creative thinking and mathematical modelling in ethnomathematics learning. *AIP Conference Proceedings*, *2621*(1), Article 020008. https://doi.org/10.1063/5.0142463

Tural-Sonmez, M., & Erbas, A. K. (2023). Seventh-Grade Students' Understanding of Risk and Reward Arising from Mathematical Modelling Activities. *International Journal of Mathematical Education in Science and Technology,* 1–29. https://doi.org/10.1080/0020739X.2023.2258881