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Publication Trend on the Plomp Development Model in Mathematics Education

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Abstract: The purpose of this bibliometric research is to identify journal publications on the Plomp development model during the period 2015-2023. The research data was collected and analyzed through four stages: (1) searching for journals using the Publish or Perish software; (2) filtering the journals through Microsoft Excel; (3) examining and completing journal attributes; and (4) conducting bibliometric analysis using VOSviewer and Microsoft Excel software. The results of this bibliometric research show the development of publications related to the Plomp development model in mathematics learning, along with an analysis based on author collaboration. The research findings reveal the selection of journal publications that meet the criteria related to the Plomp development model and mathematics learning. This creates significant opportunities for researchers to further investigate the Plomp development model in mathematics learning.

Keywords: Bibliometrics, plomp, and mathematics learning

1. Introduction

Mathematics education is considered a significant and complex field (Ghafoor & Rabaia, 2021). To enhance the quality of this education, the Plomp development model has been utilized as a framework for innovation and improvement in teaching and learning. Developed by Jan Plomp, this model offers a systematic approach that assists curriculum developers, teachers, and education practitioners in designing and implementing effective mathematics instruction through steps such as needs analysis, planning, material development, implementation, and evaluation (Mckenney et al., 2002). In the era of rapid technological and educational advancements, understanding the publication trend related to the Plomp development model in mathematics education becomes crucial. By monitoring this trend, we can gauge the application and progress of this model in various educational settings. According to Julius et al. (2021), publication analysis enables us to identify the extent of attention given to this model in academic literature and mathematical education practices. Additionally, Sporns (2014) suggests that tracking this trend also provides insights into new variations or approaches developed based on the Plomp development model in mathematics education. This research on the publication trend aims to identify recent developments, challenges, and opportunities in implementing this model in mathematics education, while providing guidance to practitioners, teachers, curriculum developers, and researchers to maximize the use of the Plomp Development Model. Through a profound understanding of the development of this publication, it is expected that we can obtain descriptive data and findings related to various issues associated with the Plomp development model in mathematics learning.

1.1 Study Problem

This study utilizes journal articles from the Publish or Perish database from 2015 to 2023. The aim of this research is to examine the publication trend regarding the utilization of the Plomp development model in mathematics education. Based on the aforementioned statement, it raises several interesting questions, such as identifying the journal publications on a specific issue with in a given time frame, in this case, the issue being the Plomp development model in mathematics education.

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1.2 Bibliometric

Bibliometrics is a field that employs mathematical methods and techniques to analyze, measure, and evaluate scholarly publications (Osareh, 1996). Initially associated with Library Science in the 1980s, bibliometrics has expanded its applications and studies to various fields over time (Sezgin et al., 2022). According to Ashiq et al. (2022), bibliometrics is a mathematical method used to identify academic publications related to citations and scientific aspects, particularly in the context of libraries or other fields. Meanwhile, Bogdan et al. (2023) explain that bibliometrics is a descriptive method used to analyze writing patterns, such as the gender of authors, types of work, collaboration levels, institutional productivity, and article subjects. Haryani & Sudin (2020) provide another approach to bibliometrics, describing it as a field of study that reveals the excellence and significance of an academic discipline from educational or non-educational institutions through using theories such as writing analysis, citation analysis, web-based bibliometrics, co-authorship, literature age, and other factors. Overall, bibliometrics is the science that studies writing and utilizes mathematical analysis. Bibliometric analysis is used to evaluate researchers' or authors' productivity based on the number of works they produce within a specific period, both collaboratively and individually (Uriarte et al., 2019). Therefore, bibliometrics can be employed as a tool to assess researchers' performance and determine their level of productivity.

1.3 Plomp Development Model

The Plomp development model is an approach used in the development and improvement of education (Yuwandra & Arnawa, 2020). According to Easterday et al. (2018), the Plomp Development Model was designed by Jan Plomp and outlines a series of interconnected stages in educational innovation. Furthermore, the Plomp Development Model assists curriculum developers, teachers, and educational practitioners in designing and implementing effective learning experiences (Nurhasnah et al., 2020). The model consists of various stages, which include preliminary investigation, design, implementation/construction, testing, evaluation and revision, and implementation (Akker et al., 1999). This approach involves interconnected stages. In the initial investigation stage, an analysis is conducted to understand the needs, context, and challenges of learning through in-depth research. The aim is to comprehend the problems to be addressed and the objectives to be achieved. Subsequently, in the design stage, developers design solutions based on the findings of the initial investigation. Clear learning objectives are established, appropriate teaching methods and strategies are selected, and instructional materials are systematically designed. The realization/construction stage involves the actual implementation of the designed solutions, employing the planned teaching approach and appropriate teaching methods and strategies. The testing stage gathers data on the effectiveness of the innovation in achieving learning objectives through observation, assessment of learning outcomes, and evaluation instruments. The evaluation and revision stage involves the assessment of the success of the innovation, identification of strengths and weaknesses, and necessary improvements. Finally, in the implementation stage, the revised innovation is widely applied within the learning context, ensuring that the implemented changes align with the learning objectives and provide the desired benefits. Thus, the Plomp Development Model offers a comprehensive and systematic approach to enhancing the quality of education.

1.4 Mathematics Learning

Mathematics learning is a process in which students acquire knowledge, skills, and understanding of mathematical concepts and principles (Maarif, 2016). According to Kotzer & Elran (2012), mathematics learning is based on several interconnected theoretical concepts, such as the constructivist approach, which emphasizes that learners construct their understanding of mathematics through active interaction with the learning environment, involving exploration, reflection, and discussion. Moreover, learning models such as cooperative learning, problem-based learning, and project-based learning offer structures for organizing mathematics learning and promoting interactions among learners ((Dogara et al., 2020). Meanwhile, mathematical representations using symbols, diagrams, visuals, and language convey mathematical concepts, helping learners understand and communicate mathematical ideas more effectively (Rohid et al., 2019). In mathematics learning, the use of technology such as software, applications, and digital tools helps visualize abstract mathematical concepts and encourages interactive exploration and problem-solving (Shin et al., 2017). Furthermore, according to Herawaty et al. (2019), presenting mathematics in real-life contexts and connecting it to everyday life enhances the relevance and understanding of mathematical concepts for learners. Problem-solving is an essential aspect of mathematics learning, as it helps learners develop problem-solving strategies, critical thinking, and creative thinking in the context of mathematics (Walters et al., 2018). Based on these discussions, this theoretical study provides an essential foundation for effective approaches, strategies, and interactions in mathematics learning

1.5 Study Methodology

This research applies bibliometric analysis to describe the publication outcomes in journals related to development models. The aim of this bibliometric analysis is to obtain descriptive data and findings regarding various issues related to the publication of development models. By using this analysis, it is expected to provide a comprehensive and accurate

overview of publication trends and author collaborations in the relevant subject field. Although this study is based on quantitative methods in data collection and analysis, there are some aspects that cannot be fully addressed through these methods.

1.6 Research Methodology

In conducting bibliometric analysis, several steps need to be taken. First, a data search process is carried out, which includes journals related to the context of the Plomp development model in mathematics learning. During the data search, the Publish or Perish software is used, along with Google Scholar, ERIC, and Research Gate publications to obtain citation information and generate relevant statistics. After that, bibliographic filtering and verification of bibliographic attributes are performed to ensure data accuracy and suitability. Next, bibliometric analysis is conducted using Microsoft Excel software and specific websites such as VOSviewer to assist in visualizing the analysis results. Through these steps, bibliometric analysis can be conducted more effectively and yield valuable information regarding relevant scientific publications.

The data search for bibliographic information is limited to four aspects: (1) scientific works selected are limited to journal types; (2) in the Publish or Perish application, the search input for the title is "Mathematics"; (3) in the keywords search column, the input keyword is "Plomp"; and (4) the journals selected are those published between 2015 to 2023. The search in the Publish or Perish application was conducted on Saturday, July 13, 2023. The following presents the process of data search in the Publish or Perish application.

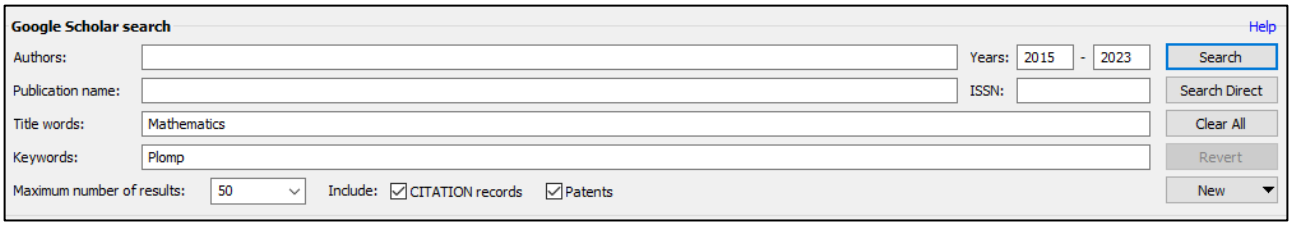

Fig. 1. Initial Data Search in the Publish or Perish Application

In the initial search results from the Publish or Perish application, a total of 50 journals were obtained, published by authors from both national and international sources. Subsequently, the data underwent filtering. The criteria applied for filtering were as follows: (1) covering the context of the Plomp development model, (2) published in reputable and clear data providers, and (3) types other than journals. This filtration process was carried out using Microsoft Excel software, a spreadsheet application capable of projecting, analyzing, and presenting data in table format (Sadikin et al., 2022). Within Microsoft Excel, the data resulted in 34 journals after elimination. For a more detailed overview of the journals before and after the elimination process, refer to the following table.

Table 1. The Results of Data Filtering Before and After Elimination

Year of Publication	Results	Eliminated	Total
2015	1	0	1
2016	1	1	0
2017	3	2	1
2018	11	7	4
2019	6	2	4
2020	8	1	7
2021	10	1	9
2022	6	2	4
2023	4	0	4
Total	**50**	**16**	**34**

Table 2 is the table of selected articles after the filtering process along with their respective objectives. After filtering the data by excluding non-journal entries, the next step is to conduct metadata examination. This examination encompasses various attributes such as author names, article titles, journal keywords, abstracts, publication year, volume, issue number, page numbers, journal citation count, article links, and journal publishers. Once the examination is completed, it is followed by bibliometric analysis. In this study, bibliometric analysis consists of two main aspects: publication trends or developments in journals related to the "Plomp development model," and analysis of author collaboration. To visualize the results of bibliometric analysis, the VOSviewer application (Nandiyanto & Husaeni, 2022) is used.

Table 2. Collected Article Results

No	Study	Study Results
1	Wijaya et al. (2021)	The process of developing realistic mathematics teaching materials using the Plomp development model and the development of realistic mathematics teaching materials on the topic of systems of linear equations with three variables using the Plomp development model resulted in the creation of high-quality teaching materials (lesson plans, student worksheets, and teaching aids) that met the criteria of good instructional materials.
2	Aminah & Wahyuni (2018)	The validation of the PCK instrument design has successfully demonstrated content validity and construct validity, confirming the validity and practicality of the developed PCK instrument.
3	Subhi et al. (2020)	The implementation of distance learning design is of great importance and encompasses various aspects, such as the roles of lecturers, presenters, and students, the utilization of supporting applications like Zoom, YouTube, and OBS Studio, and the design of interactions that connect the roles of lecturers with these supporting applications. Integrating the functionalities of Zoom and YouTube has the potential to enhance the effectiveness and efficiency of distance learning.
4	Alim et al. (2021)	The mathematics textbook based on Realistic Mathematics Education (RME) for teaching LCM and GCD in this study is deemed suitable as it meets the criteria of up-to-date knowledge and the main principles of the RME approach. Additionally, the textbook is practical, aligning with the initial hypothesis. Moreover, it has been demonstrated that this textbook can enhance students' learning motivation by 6.45% and has a significant influence on students' motivation to learn.
5	Setyaningsih et al. (2019)	This research developed a realistic and child-friendly mathematics learning model for junior high school using the Plomp syntax, resulting in good practicality in mathematics teaching management by teachers, active student participation in learning activities, and overall positive student response.
6	Buchori & Setyawati, (2015)	The character education learning model is constructed through a five-stage process, and the effectiveness of the learning process is evaluated by observing the improvement of students' character values and their academic achievement.
7	Ilmi et al. (2021)	The Android-based e-module has been validated, deemed practical, and shown to be effective. The validity of the e-module was determined through expert assessments. The practicality of the e-module was evaluated based on questionnaire responses from teachers and students. The effectiveness of the e-module was measured by assessing the percentage of student learning mastery, which surpassed 70% after utilizing the e-module.
8	Murtikusuma et al. (2019)	Blended Learning, supported by Google Classroom in this study, has been assessed as valid by validators, deemed practical through observations of teacher activities and feedback from practitioners, and proven effective through student test results and observations of student responses.
9	Yuwandra & Arnawa (2020)	The instructional materials based on Contextual Teaching and Learning (CTL) have been validated, demonstrated practicality, and shown effectiveness. Utilizing the CTL approach in learning can enhance student engagement and active participation in the learning process.
10	Firmansyah & Rais (2023)	The quality of the mathematics textbook based on numeracy literacy in 7th-grade junior high school for the odd semester is valid, practical, and effective.
11	Zulfah et al. (2019)	The questions have diverse answers and methods of answering, capable of measuring high-level thinking skills, and the content is aligned with the topic of numbers. The constructional diagrams used in the questions are clear, there are clear instructions for solving them, and the language adheres to the Standard Indonesian Spelling. These questions are suitable for 7th-grade junior high school students' knowledge level and do not involve expressions that may cause interpretation.
12	Yulkifli et al. (2022)	The Physics E-Module, which incorporates an integrated project-based learning model and utilizes the Ethno-STEM approach, is deemed valid, practical, and effective for 11th-grade high school students' smartphones.
13	Arsoetar & Sugiman (2019)	The RME-based Student Worksheets oriented towards mathematical reasoning has fulfilled the aspects of validity, practicality, and effectiveness.
14	Fauziah & Pawestri (2022)	In the validity test conducted by the validator, the Misi Mahasiswa learning media was declared valid with a validity score of 3,50. The practicality test results through the subject response

		sheets indicated that the Misi Mahasiswa learning media obtained a practicality score of 3,54, deemed valid, and did not require any improvements.
15	Ansari & Abdul (2017)	Teaching materials can be used in the learning process and can provide learning motivation to students.
16	Suryaningsih et al. (2023)	The geometry learning tool in the form of ethnomathematics-based worksheets on the ornament of Jami Sungai Jingah Mosque is valid and practical, based on the four stages of Plomp's development.
17	Ulfah et al. (2020)	The RME-based learning tools, in the form of Lesson Plans and Student Worksheets, are valid, practical, and effective in improving students' mathematical reasoning abilities.
18	Suastika (2021)	The open problem-solving mathematics learning model (PMT Model) has the ability to foster students' creativity and fulfills the criteria of being valid, practical, and effective. The PMT Model achieved a validity score of 3.21, indicating its validity within the acceptable range.
19	Sah et al. (2022)	The combination of the mathematical modeling approach and the PEBL model enhances and optimizes mathematical learning concepts in geometry, making it more effective.
20	Yerizon et al. (2018)	The designed worksheets received positive responses from students in terms of ease of use, attractiveness, ease of understanding, usefulness of the worksheets, and time efficiency.
21	Mursalin et al. (2018)	Algebra teaching materials that foster students' creative thinking abilities in higher education are worth using because they have been proven to be valid, practical, and effective.
22	Lestari et al. (2021)	The Lesson Plans and Student Worksheets based on the NHT model are valid and effective. This means that they have a positive impact on students' ability to solve mathematical problems.
23	Ardana et al. (2021)	The Mathematics Learning Model oriented towards the Tri Hita Karana Social-Cultural Theory is valid, practical, and effective in developing good character among students.
24	Suryani et al. (2020)	The practical module on triangle topics that utilizes GeoGebra is valid and practical.
25	Helsa et al. (2023)	The hybrid learning model based on TPACK influences computational thinking abilities in a valid, practical, and effective manner.
26	Gradini et al. (2022)	The Higher Order Thinking Skills (HOTS) test developed in this research is valid, reliable, practical, and effective in measuring students' higher-order thinking abilities in mathematics learning.
27	Yuniwati et al. (2021)	The attitude assessment instrument for discussions on the MOOC platform was developed using validity and reliability testing. Experts, lecturers, and students were involved in the testing process, resulting in a Cronbach's Alpha value of 0.849, indicating high reliability.
28	Harefa et al. (2023)	The animated video product as a mathematics learning media for the topic of transformations in 11th-grade high school, developed using the Plomp model, is valid, practical, and effective.
29	Priyatno et al. (2021)	Mathematics learning for junior high school students based on problem-based learning and assisted by GeoGebra has been practical.
30	Notika (2018)	The instrument designed for teaching using the Open-Ended approach successfully fulfills the criteria of validity, practicality, and effectiveness.
31	Wei et al. (2020)	The implementation of the flipped classroom approach results in a significant improvement in the mathematics learning performance of students at the middle level compared to students at high or low levels.
32	Nirfayanti et al. (2021)	The instrument that has been developed fulfills the criteria of validity, practicality, and effectiveness, making it suitable as a learning content for Mathematics Education lecturers in higher education.
33	Zainil et al. (2020)	The blended learning lesson plan incorporating the Elchotectim model for elementary school teacher education students in mathematics learning has been confirmed as valid.
34	Rusdi et al. (2020)	The outcomes of creating a mathematics learning model that integrates the Realistic Mathematics Approach and literacy can be observed in the form of a model syntax developed based on three principles of the Realistic Mathematics Approach.

2 Study Results

2.5 Publication Development

The results of the analysis of publication development related to the Plomp development model in Mathematics Education from 2015 to 2023, obtained after the filtration process, indicate inconsistent fluctuations. The highest number of publications was recorded in 2021, with a total of 9 journals, contributing to approximately 26.47% of the total 100%. On the other hand, the lowest number of publications occurred in 2016, with no contribution to publications, representing 0% of the overall total. The table below presents the percentage of the overall trend of these journal publications.

Table 3. The Percentage of Publication Development

Year of Publication	Total	Percentage
2015	1	2,94%
2016	0	0,00%
2017	1	2,94%
2018	4	11,76%
2019	4	11,76%
2020	7	20,59%
2021	9	26,47%
2022	4	11,76%
2023	4	11,76%
Total	**34**	**100%**

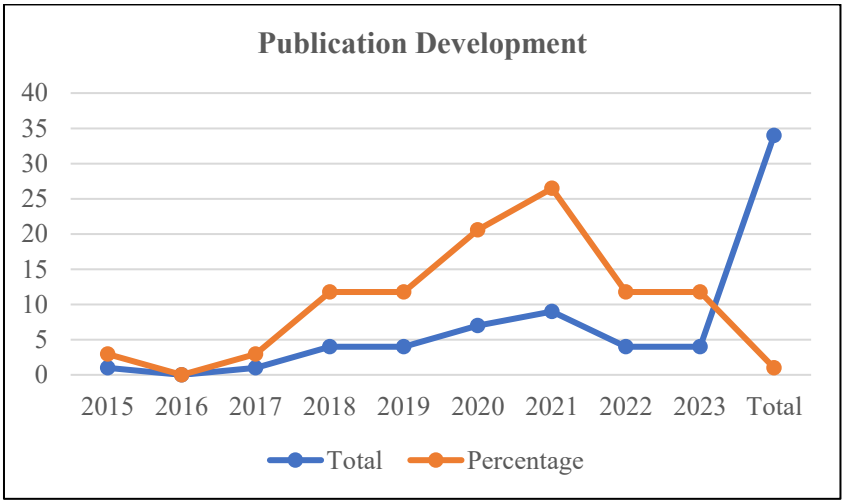

Fig.2. Journal Publication Development Graph

From the table and graph above, it can be observed that the total number of publications from 2015 to 2023 is 34 journals. On average, this translates to approximately 3-4 publications produced each year. The highest number of publications occurred in 2023 with a total of 9 journals, accounting for 26.47% of the total.

2.6 Analysis Based on Author Collaboration

In the gathered data, there are a total of approximately 93 authors. Among them, 23 authors exhibit the strongest associations. The author collaborations are visualized using the VOSviewer application, resulting in five different colors representing distinct groups: (1) red color for Group A consisting of 5 authors, (2) blue color for Group B consisting of 4 authors, (3) purple color for Group C consisting of 4 authors, (4) yellow color for Group D consisting of 3 authors, and (5) green color for Group E consisting of 6 authors. Each author is connected to one another, with the author "fauzan,a" having the highest number of connections. Please refer to the image below for a clearer visualization.

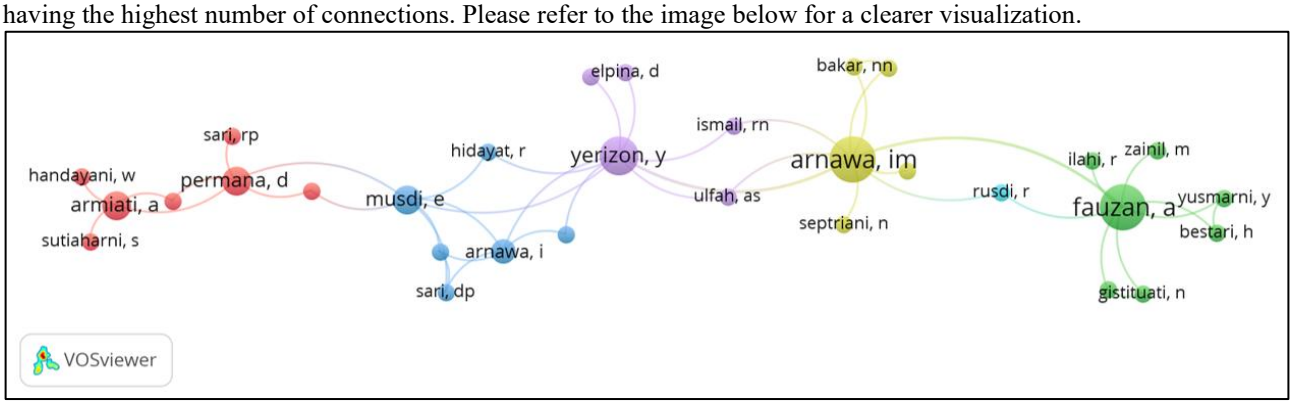

Fig. 3. Visualization of National and International Collaborative Network among Authors

Based on the above image, it is observed that "yerizon,y" in purple color and Group C has 8 connections. "fauzan,a" in green color and Group E has 7 connections. "arnawa,im" in yellow color and Group D has 7 connections. "musdi,e" in blue color and Group B has 5 connections. Furthermore, "permana,d" in red color and Group A has 4 connections.

3 Discussion

3.5 Publication Trends

Previously, the initial search yielded a total of 50 journals. The limitation in data search was found in the search using the title "Plomp" and the keywords "Mathematics," which likely included other journals that did not meet the desired search criteria but were included in the data. After further analysis, it was discovered that only 34 journals truly met the criteria and specifically addressed the Plomp development model in mathematics learning. However, there were still many journals that discussed "Plomp" either in the field of education or other fields. These were still included as they fulfilled the three criteria: (1) journals searched through the Publish or Perish application; (2) journals filtered through Microsoft Excel, eliminating non-journal formats; (3) reassessment of journal attribute completeness; and (4) bibliometric analysis conducted using VOSviewer and Microsoft Excel applications. Therefore, publications related to Plomp development in education and mathematics learning present significant opportunities for researchers to further explore and publish their findings.

3.6 Analysis Based on Author Collaboration

The collaboration among authors depicted in the VOSviewer application results in 5 clusters. The cluster with the highest collaboration is achieved by Cluster C, represented by the color purple, comprising a total of 8 authors' connections. Among all the clusters, the highest number of collaboration links is attained by "yerizon,y" from the purple cluster. From the analysis of author collaborations, it is evident that the distribution of authors is divided into separate smaller groups that do not interconnect with each other. This is likely due to the fact that the research fields of these authors are not related to one another.

4 Conclusion

The bibliometric analysis in this study covered two themes: publication trends or development of the Plomp development model and mathematics learning, as well as analysis based on author collaboration. Data retrieval was conducted using the Publish or Perish application, with searches in the title column for "Mathematics" and in the keyword column for "Plomp," which had limited relevance to the keywords in the journal data results. This resulted in general keywords that were less related to the field of education. The publication trend showed an increase from 2017 to 2021, with the highest number of publications in 2020 and the lowest in 2016. Regarding author collaboration, the analysis yielded limited results, with 50 authors forming 5 groups that were not interconnected. This indicates a lack of significant collaboration among the authors.

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Conflict of Interest

The authors declare no conflicts of interest.

References

Akker, J. van den, Branch, R. M., Gustafson, K., Nieveen, N., & Plomp, T. (1999). Design Approaches and Tools in Education and Training. In *Kluwer Academic Publisher*. https://doi.org/10.1007/s00477-014-0937-9

Alim, J. A., Hermita, N., Alim, M. L., Wijaya, T. T., & Pereira, J. (2021). Developing a Math Textbook using realistic Mathematics Education Approach to increase elementary students' learning motivation. *Jurnal Prima Edukasia*, *9*(2), 193–201. https://doi.org/10.21831/jpe.v9i2.39393

Aminah, N., & Wahyuni, I. (2018). Design of capability measurement instruments pedagogic content knowledge (PCK) for prospective mathematics teachers. *Journal of Physics: Conference Series*, *1013*(1). https://doi.org/10.1088/1742-6596/1013/1/012112

Ansari, A., & Abdul, R. (2017). Development of Teaching Material Using an Android. *Global Journal of Engineering Education*, *19*(1), 72–76. https://ssrn.com/abstract=2924342

Ardana, I. M., Ariawan, I. P. W., & Sugiharni, G. A. D. (2021). The expansion of sociocultural theory-oriented mathematical learning model. *Cypriot Journal of Educational Sciences*, *16*(6), 3016–3032.

https://doi.org/10.18844/cjes.v16i6.6493

Arsoetar, N., & Sugiman, S. (2019). Development of student worksheets based on Realistic Mathematics Education (RME) oriented to mathematical reasoning. *Journal of Physics: Conference Series*, *1397*(1). https://doi.org/10.1088/1742-6596/1397/1/012091

Ashiq, M., Ur Rehman, S., Muneeb, D., & Ahmad, S. (2022). Global research on library service quality: a bibliometric analysis and knowledge mapping. *Global Knowledge, Memory and Communication*, *71*(4–5), 253–273. https://doi.org/10.1108/GKMC-02-2021-0026

Bogdan, V., Popa, D. N., Beleneşi, M., Rus, L., & Scorțe, C. M. (2023). Gender Diversity and Business Performance Nexus: A Synoptic Panorama Based on Bibliometric Network Analysis. *Sustainability (Switzerland)*, *15*(3). https://doi.org/10.3390/su15031801

Buchori, A., & Setyawati, R. D. (2015). Development Learning Model of Character Education Through E-Comic In elementary School. *International Journal of Education and Research*, *3*(9), 369–386. www.ijern.com

Dogara, G., Saud, M. S. Bin, Kamin, Y. Bin, & Nordin, M. S. Bin. (2020). Project-based learning conceptual framework for integrating soft skills among students of technical colleges. *IEEE Access*, *8*, 83718–83727. https://doi.org/10.1109/ACCESS.2020.2992092

Easterday, M. W., Rees Lewis, D. G., & Gerber, E. M. (2018). The logic of design research. *Learning: Research and Practice*, *4*(2), 131–160. https://doi.org/10.1080/23735082.2017.1286367

Fauziah, N. F., & Pawestri, A. S. (2022). Development of Student's Mission Learning Media on The Addition and Subtraction of Integer. *Of Education and Learning*, *3*(1), 14–21. http://jelmar.wisnuwardhana.ac.id/index.php/jelmar/article/view/66%0Ahttp://jelmar.wisnuwardhana.ac.id/index.php/jelmar/article/download/66/41

Firmansyah, B., & Rais, M. R. (2023). Development of mathematical literacy-based teaching material on mathematics. *MaPan: Jurnal Matematika Dan Pembelajaran*, *11*(1), 21–37.

Ghafoor, N. F. A., & Rabaia, S. M. (2021). Stimulants of Cognitive Strategies: The Most Prominent Types & Importance of Using in the Teaching and Learning Process (A Survey Study of the Relevant Literature). *International Journal of Higher Education*, *11*(2), 30. https://doi.org/10.5430/ijhe.v11n2p30

Gradini, E., Khairunnisak, C., & Noviani, J. (2022). Development of Higher-Order Thinking Skill (Hots) Test on Mathematics in Secondary School. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(1), 319. https://doi.org/10.24127/ajpm.v11i1.4649

Harefa, A. O., Harefa, A. R., & Zebua, F. (2023). Development of Animated Videos as a Medium for Learning Mathematics Class XI at State High School 2 Gomo. *JETISH: Journal of Education Technology Information Social Sciences and Health*, *1*(2), 222–231. https://doi.org/10.57235/jetish.v1i2.137

Haryani, C. S., & Sudin, A. (2020). Analisis Bibliometrik Tren Publikasi dan Tingkat Kolaborasi pada Model Situation-Based Learning (2010-2019). *Jurnal Pena Ilmiah*, *3*(2), 131–140.

Helsa, Y., Turmudi, & Juandi, D. (2023). TPACK-based hybrid learning model design for computational thinking skills achievement in mathematics. *Journal on Mathematics Education*, *14*(2), 225–252. https://doi.org/10.22342/jme.v14i2.pp225-252

Herawaty, D., Widada, W., Nugroho, K. U. Z., & Anggoro, A. F. D. (2019). *The Improvement of the Understanding of Mathematical Concepts through the Implementation of Realistic Mathematics Learning and Ethnomathematics*. *295*(ICETeP 2018), 21–25. https://doi.org/10.2991/icetep-18.2019.6

Ilmi, R., Arnawa, I. M., Yerizon, & Bakar, N. N. (2021). Development of an Android-Based for Math E-Module by using Adobe Flash Professional CS6 for Grade X Students of Senior High School. *Journal of Physics: Conference Series*, *1742*(1). https://doi.org/10.1088/1742-6596/1742/1/012026

Julius, R., Halim, M. S. A., Hadi, N. A., Alias, A. N., Khalid, M. H. M., Mahfodz, Z., & Ramli, F. F. (2021). Bibliometric Analysis of Research in Mathematics Education using Scopus Database. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(12). https://doi.org/10.29333/EJMSTE/11329

Kotzer, S., & Elran, Y. (2012). Learning and teaching with Moodle-based E-learning environments, combining learning skills and content in the fields of Math and Science & Technology. *1st Moodle Research Conference*, 14–15. http://research.moodle.net/55/1/16%5Cn-%5CnKotzer%5CnLearning%5Cnand%5Cnteaching%5Cnwith%5CnMoodle-based%5CnE-learning.pdf%5Cnhttp://research.moodle.net/55/1/16 - Kotzer - Learning and teaching with Moodle-based E-learning.pdf

Lestari, A., Permana, D., Musdi, E., & Arnawa, I. M. (2021). The development of mathematics learning tools based on number heads together model to improve mathematical problem-solving skills of grade vii junior high school students. *Journal of Physics: Conference Series*, *1742*(1). https://doi.org/10.1088/1742-6596/1742/1/012027

Maarif, S. (2016). Improving junior high school students' mathematical analogical ability using discovery learning method. *International Journal of Research in Education and Science*, *2*(1), 114–124. https://doi.org/10.21890/ijres.56842

Mckenney, S., Nieveen, N., & Van Den Akker, J. (2002). Computer support for curriculum developers: CASCADE. *Educational Technology Research and Development*, *50*(4), 25–35. https://doi.org/10.1007/BF02504982

Mursalin, M., Nuraini, N. L. S., Purnomo, H., Damayanti, N. W., Kristanti, D., Rohim, A., Widyastuti, R., Wulandari, Y. O., Saleh, H., Mayangsari, S. N., Fonna, M., Rohantizani, R., Muhammad, I., Nufus, H., Sulastri, R., Amalia, R., Nuraina, N., & Muliana, M. (2018). The development of algebra teaching materials to foster students' creative thinking skills in higher education. *Journal of Physics: Conference Series*, *1088*. https://doi.org/10.1088/1742-6596/1088/1/012101

Murtikusuma, R. P., Hobri, Fatahillah, A., Hussen, S., Prasetyo, R. R., & Alfarisi, M. A. (2019). Development of blended learning based on Google Classroom with osing culture theme in mathematics learning. *Journal of Physics: Conference Series*, *1165*(1). https://doi.org/10.1088/1742-6596/1165/1/012017

Nandiyanto, A. B. D., & Husaeni, D. F. (2022). Bibliometric Analysis of Engineering Research Using Vosviewer Indexed By Google Scholar. *Journal of Engineering Science and Technology*, *17*(2), 883–894.

Nirfayanti, Nurwijaya, S., Djafar, S., Ramdani, R., Padang, N. S., & Ernawati. (2021). Development of Discrete Mathematics Learning Content Using Google Classroom in Mathematics Education Students. *Proceedings of the 1st International Conference on Mathematics and Mathematics Education (ICMMEd 2020)*, *550*(Icmmed 2020), 276–281. https://doi.org/10.2991/assehr.k.210508.075

Notika, M. H. (2018). *Development Mathematics Teaching-Instrument Learning Using Open-Ended Approach To Improve Mathematics Communication Ability And Independent Learning Student*. *285*(Icm2e), 183–185. https://doi.org/10.2991/icm2e-18.2018.42

Nurhasnah, N., Kasmita, W., Aswirna, P., & Abshary, F. I. (2020). Developing Physics E-Module Using "Construct 2" to Support Students' Independent Learning Skills. *Thabiea : Journal of Natural Science Teaching*, *3*(2), 79. https://doi.org/10.21043/thabiea.v3i2.8048

Osareh, F. (1996). Bibliometrics, citation analysis and co-citation analysis: A review of literature I. *Libri*, *46*(3), 149–158. https://doi.org/10.1515/libr.1996.46.3.149

Priyatno, N., Arnawa, I. M., & Bakar, N. N. (2021). The Development of Mathematics Learning Devices Based on Problem Based Learning and Geogebra-Assisted for Junior High School Students. *Journal of Physics: Conference Series*, *1742*(1). https://doi.org/10.1088/1742-6596/1742/1/012004

Rohid, N., Suryaman, S., & Rusmawati, R. D. (2019). Students' Mathematical Communication Skills (MCS) in Solving Mathematics Problems: A Case in Indonesian Context. *Anatolian Journal of Education*, *4*(2), 19–30. https://doi.org/10.29333/aje.2019.423a

Rusdi, Fauzan, A., Arnawa, I. M., & Lufri. (2020). Designing Mathematics Learning Models Based on Realistic Mathematics Education and Literacy. *Journal of Physics: Conference Series*, *1471*(1). https://doi.org/10.1088/1742-6596/1471/1/012055

Sadikin, A. N., Mustaffa, A. A., Hasbullah, H., Zakaria, Z. Y., Hamid, M. K. A., Man, S. H. C., Hassim, M. H., Aziz, M. A. A., & Khairiyah, M. Y. (2022). Qualitative Development of Students' Digital Skills by Integrating a Spreadsheet Software in First Year Introduction to Engineering and Seminar Course. *Article in International Journal of Emerging Technologies in Learning*, *16*(December 2021), 69–84. https://www.researchgate.net/publication/356843846

Sah, R. A. A., Effendi, M. M., Darmayanti, R., & In'am, A. (2022). Strengthening Student Concepts: Problem Ethnomatmatics Based Learning (PEBL) Singosari Kingdom Historical Site Viewed from Learning Styles in the Middle School Curriculum. *Indomath: Indonesia Mathematics Education*, *5*(2), 165–174. https://jurnal.ustjogja.ac.id/index.php/

Setyaningsih, N., Rejeki, S., & Ishartono, N. (2019). Developing Realistic and Child-friendly Learning Model for Teaching Mathematics. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *4*(2), 79–88. https://doi.org/10.23917/jramathedu.v4i2.8112

Sezgin, A., Orbay, K., & Orbay, M. (2022). Educational Research Review From Diverse Perspectives: A Bibliometric Analysis of Web of Science (2011–2020). *SAGE Open*, *12*(4), 1–13. https://doi.org/10.1177/21582440221141628

Shin, M., Bryant, D. P., Bryant, B. R., McKenna, J. W., Hou, F., & Ok, M. W. (2017). Virtual Manipulatives: Tools for

Teaching Mathematics to Students With Learning Disabilities. *Intervention in School and Clinic*, *52*(3), 148–153. https://doi.org/10.1177/1053451216644830

Sporns, O. (2014). Contributions and challenges for network models in cognitive neuroscience. *Nature Neuroscience*, *17*(5), 652–660. https://doi.org/10.1038/nn.3690

Suastika, K. (2021). Mathematics Learning Model of Open Problem Solving to Develop Students' Creativity. *International Electronic Journal of Mathematics Education*, *12*(3), 569–577. https://doi.org/10.29333/iejme/633

Subhi, M. A., Nurjanah, N., Kosasih, U., & Rahman, S. A. (2020). Design of distance lectures in mathematics education with the utilization of the integration of Zoom and YouTube application. *Journal of Physics: Conference Series*, *1663*(1). https://doi.org/10.1088/1742-6596/1663/1/012058

Suryani, A. I., Anwar, Hajidin, & Rofiki, I. (2020). The practicality of mathematics learning module on triangles using GeoGebra. *Journal of Physics: Conference Series*, *1470*(1). https://doi.org/10.1088/1742-6596/1470/1/012079

Suryaningsih, Y., Fajriah, N., & Kamid, K. (2023). Geometry Exploration for the Development of Ethnomathematics Worksheet Based on the Ornament of Jingah River Jami Mosque. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *7*(2), 298. https://doi.org/10.31764/jtam.v7i2.12366

Ulfah, A. S., Yerizon, Y., & Arnawa, I. M. (2020). Preliminary Research of Mathematics Learning Device Development Based on Realistic Mathematics Education (RME). *Journal of Physics: Conference Series*, *1554*(1). https://doi.org/10.1088/1742-6596/1554/1/012027

Uriarte, M. de las M. C., Casado-Belmonte, M. del P., Marín-Carrillo, G. M., & Terán-Yépez, E. (2019). A bibliometric analysis of international competitiveness (1983-2017). *Sustainability (Switzerland)*, *11*(7). https://doi.org/10.3390/su11071877

Walters, L. M., Green, M. R., Goldsby, D., & Parker, D. (2018). Digital Storytelling as a Problem-Solving Strategy in Mathematics Teacher Education: How Making a Math-eo Engages and Excites 21st Century Students. *International Journal of Technology in Education and Science (IJTES)*, *2*(1), 1–16. www.ijtes.net

Wei, X., Cheng, I. L., Chen, N. S., Yang, X., Liu, Y., Dong, Y., Zhai, X., & Kinshuk. (2020). Effect of the Flipped Classroom on the Mathematics Performance of Middle School Students. *Educational Technology Research and Development*, *68*(3), 1461–1484. https://doi.org/10.1007/s11423-020-09752-x

Wijaya, R. P., Budiarto, M. T., & Wijayanti, P. (2021). Development of Realistic Mathematics Learning Tools to Improve Students' Mathematical Literacy Ability. *Mathematics Education Journal*, *5*(2), 124–131. https://doi.org/10.22219/mej.v5i2.16571

Yerizon, Y., Putra, A. A., & Subhan, M. (2018). Student Responses Toward Student Worksheets Based on Discovery Learning for Students with Intrapersonal and Interpersonal Intelligence. *IOP Conference Series: Materials Science and Engineering*, *335*(1). https://doi.org/10.1088/1757-899X/335/1/012113

Yulkifli, Y., Yohandri, Y., & Azis, H. (2022). Development of physics e-module based on integrated project-based learning model with Ethno-STEM approach on smartphones for senior high school students. *Momentum: Physics Education Journal*, *6*(1), 93–103. https://doi.org/10.21067/mpej.v6i1.6316

Yuniwati, I., Yustita, A. D., Hardiyanti, S. A., & Suardinata, I. W. (2021). Development of Attitude Assessment Instrument in Engineering Mathematics 1 Course to Assess Discussion on MOOC Platform. *Journal of Physics: Conference Series*, *1918*(4). https://doi.org/10.1088/1742-6596/1918/4/042079

Yuwandra, R., & Arnawa, I. M. (2020). Development of learning tools based on contextual teaching and learning in fifth grade of primary schools. *Journal of Physics: Conference Series*, *1554*(1). https://doi.org/10.1088/1742-6596/1554/1/012077

Zainil, M., Fauzan, A., & Lufri. (2020). *Developing A Lesson Plan of Elchotectim Model Based on Blended Learning for Teaching Mathematics at Primary Schools*. *504*(ICoIE), 111–116. https://doi.org/10.2991/assehr.k.201209.202

Zulfah, Astuti, Insani, S. U., Zulhendri, & Akbar, P. (2019). Development of Open-Ended Based Mathematics Problem to Measure High-Level Thinking Ability. *Journal of Physics: Conference Series*, *1315*(1). https://doi.org/10.1088/1742-6596/1315/1/012047