Jurnal Pendidikan Matematika Vol: 1, No 2, 2024, Page: 1-13

Systematic Literature Review: Implementation of a Problem-Based Learning Model with Ethnomathematics Nuances in Improving Students' Mathematical Problem Solving Ability

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DOI:
https://doi.org/10.47134/ppm.v1i2.218
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Received: 25-12-2023
Accepted: 11-01-2024
Published: 25-02-2024

Abstract: The industrial revolution in the 21st century brought changes to the education system, especially in terms of learning media, where the media used must implement the results of innovation. For example, ethnomathematics is used to increase students' competence in finding solutions to mathematical problems. The aim of carrying out this research is to analyze the extent of students' abilities in solving mathematical problems after receiving based learning *Problem Based Learning* with ethnomathematics methods. Meanwhile, the research implementation method implements SLR (*Systematic Literature Review*) by reviewing several articles that have similar topics in the form of developing student competence in solving mathematical problems based on ethnomathematics in the Problem Based Learning learning model and published between 2019 and 2023. The number of national and international articles used as literature studies was 13 articles. This article was obtained by researchers from the Google Scholar publish or perish database. Based on the analysis carried out, the results showed that the effectiveness of the ethnomathematics-based Problem Based Learning learning model was found in optimizing student competence in terms of solving mathematical problems.

Keywords: Ethnomathematics, Mathematical Problem Solving Ability, Problem Based Learning

Introduction

The 21st century is an era of globalization where in all areas of life, technological developments and knowledge are growing very rapidly. The field of education is one of them, so the 21st century requires human resources who have extraordinary abilities. Therefore, innovation is needed to improve the ability of graduates with 21st century skills in the learning system (Zubaidah, 2018). Based on the explanation of Saryanto et al., (2022), several types of competencies that individuals must have in the 21st century are explained in the 21st Century Partnership Learning Framework, which include context-sensitive learning skills, having literacy related to communication and information media, having public speaking skills, innovative, creative, collaborative, trustworthy, has the ability to think critically, and is able to solve problems that occur. The definition of problem solving from G. Polya's perspective, namely efforts made to find solutions to problems that occur so that previously set goals can be achieved (Anam & Zahroh, 2022).

Another definition of problem solving based on "Regulation of the Minister of National Education No. 22 of 2006" namely a series of actions carried out by educational institutions for students to achieve the goals of mathematics learning (Utami & Wutsqa, 2017). Thus, it can be said that mathematical problem solving is a very important aspect to understand and develop in order to determine student success in achieving learning goals (Jiang, 2021; Nicolas, 2018; Takahashi, 2021; Walkington, 2019). Problem solving abilities as part of higher level thinking abilities are very important abilities for students to master in learning mathematics (Ulandari et al., 2019).

According to NCTM (2000), ability Problem solving is one of the goals of mathematics learning and is an important part of mathematics itself, so it must be included in mathematics learning (Nuriyati & Supriadi, 2022). Efforts that can be made to optimize student competence in solving mathematical problems include practicing problem solving in between learning activities. Based on the information reported (Kemendikbud, 2019) the number of students in Indonesia who had mathematical abilities in 2018 from the PISA test results was 71%. This percentage value has decreased compared to the previous year. The causal factor is students' low literacy regarding procedures for solving mathematical problems.

Each student in Indonesia has a different level of KPMM (Mathematical Problem Solving Ability). However, the majority indicated that in Indonesia students' KPMM is still relatively low. This is proven by research results Meilani & Maspupah, (2019) found that Madrasah Ibtidaiyah Bongas I class VI students were less skilled at solving mathematical problems because the literacy level regarding the solution procedures was not well understood, so the level of students' mathematical abilities was in the low category. Then, from the research results of Sriwahyuni & Maryati, (2022) they also found that the mathematical literacy level of Pakenjeng High School students was in the low

category. The causal factor is that the majority of Pakenjeng High School students have a low level of literacy in problem solving procedures and what is more, students do not understand the context of the questions well. Likewise, from the results of research by Nugraha & Zanthy, (2019) at SMA Sumur Bandung which found that the KPMM level of class X students was in the low category. This is due to the lack of students' skills in solving mathematical problems and when solving these problems students experience difficulties (Al-Mutawah, 2019; Daher, 2020; Kohen, 2022; Lubienski, 2021; Maker, 2020; Purwaningsih, 2020; Suarsana, 2019; Zhang, 2020).

Efforts that can be made by educators, both lecturers and teachers, to increase students' KPMM are choosing media, methods and learning models that are adapted to students' environmental conditions.For example, by applying the ethnomathematics learning model as has been studied byJaswandi & Mustamiin, (2018) whose research subjects were grade 5 students of SDN 2 Batu Jangkih who found that the students' KPMM scores were higher compared to conventional learning models.Likewise with research results Kartono & Sarah, (2022) found that students' KPMM scores had increased after receiving ethnomathematics-based learning using e-modules for students at SMA Negeri 9 Semarang class X. So the ethnomathematics learning model was effective in optimizing students' KPMM scores.

The increasingly rapid digital development in the 21st century makes it easier for information to enter Indonesia from outside, giving rise to various problems and the erosion of local culture.In facing future threats, education plays an important role. Therefore, mathematics learning must have innovation, one of which is ethnomathematics or culturally based contextual learning.Apart from being a means of introducing local culture, good use of ethnomathematics as an approach and learning also encourages the development of students' KPMM. According to the problem description previously explained, the implementation of this research has several objectives, namely to describe the implementation of ethnomathematics in detail (1) to find out how the results of ethnomathematics studies with problem-based learning nuances are seen from students' mathematical problem solving abilities, as revealed based on research published in 5 years final; (2) to describe the chosen learning media; (3) to describe the research trends of related student KPMM research Problem Based Learning based on ethnomathematics in 2019-2023.

Methodology

The aim of carrying out this research was to interpret, evaluate, study, analyze and identify the results of previous research, so the researcher chose the SLR (Systematic Literature Review) method. The research stages in this research include the identification

stage to a structured review of previous articles, as the stages involved include (Triandini et al., 2019):

1. RQ (Research Question)

   The preparation of the RQ is based on the needs of researchers in this topic, where the RQ in this research includes:

   RQ1 :"What are the results of research on problem based learning with ethnomathematics nuances on students' mathematical problem solving abilities from research published in the last 5 years?"

   RQ2 :"What are the learning media chosen in the article regarding ethnomathematics learning on students' mathematical problem solving abilities in the last 5 years?"

   RQ3 :"What is the trend in ethnomathematics nuanced PBL research on students' mathematical problem solving abilities in the last 5 years?"

2. Search Process

   The activities involved in the search process stage are searching for data related to the research question by utilizing the Google Scholar publish or perish database. The keywords used in search engines are: *Problem Based Learning,* mathematical problem solving abilities, and ethnomathematics.

3. Inclusion and Exclusion Criteria

   Inclusion and exclusion criteria are used to determine whether or not the data obtained in SLR research is appropriate. Inclusion and exclusion criteria can be seen in table 1 below.

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
National or international articles that are appropriate to ethnomathematics to improve KPMM	International and national articles that do not implement ethnomathematics methods in developing KPMM
International or national articles that are in line with the topic or research title	National or international articles that do not match the title and research topic
Articles published in 2019-2023	Articles published before 2019
The language used is Indonesian or English	The language used is other than Indonesian or English

4. QA (Quality Assessment)

   The next stage is analyzing the data that has been collected based on Quality Assessment, namely:

QA1 :"Was the article published in 2018-2023?"

QA2 :"Does the article state the research objectives or type of research or research design used?"

QA3 :"Does the article state the learning media used?"

The answer to each QA is yes or no.

5. Data Collection

   In this research, the data collected for review is primary data, namely data collected through interviews, observations, surveys, or according to needs. The data that has been collected is then analyzed to answer the RQ.

6. Data Analysis

   Data analysis is based on research questions.

7. Deviation from Protocol

   Throughout the research, the researcher made slight changes related to keywords by refining word similarities.

Result and Discussion

RQ1. "What are the results of research on problem based learning with ethnomathematics nuances on students' mathematical problem solving abilities from research published in the last 5 years?"

Number of articles published in the last five years related to modelsProblem Based Learningethnomathematics-based to improve students' KPMM totaling 13 articles, as a summary of these articles is represented in Table 3.

Table 3. Research Results related to the Implementation of the Problem Based Learning Model with Ethnomathematical Nuances in Increasing Students' KPMM

Writer	Journal/Proceedings Publication Category	Research result
(Andriyanti & Prihastari, 2023)	Scientific Journal of Basic Education, National S5	The application of the PBL model with ethnomathematics nuances increases the average KPMM score of students.
(Aulia et al., 2019)	Journal of Mathematics and Natural Sciences Education, National S3	The results of the average KPMM score with contextual learning with ethnomathematics nuances are better.
(Hayu et al., 2023)	Scholar's Journal: Journal of Mathematics Education, National S4	The learning model implemented in the form of PBL with ethnomathematics methods to increase junior high school students' literacy regarding the

Writer	Journal/Proceedings Publication Category	Research result
		basic shapes of triangles and quadrilaterals obtained valid results.
(Hervanda et al., 2020)	THETA: Journal of Mathematics Education	The research results show that the average KPMM score of students meets the good criteria. Thus, mathematics questions in the context of PISA model ethnomathematics can be used to measure students' KPMM.
(Hidayati & Restapaty, 2019)	SENPIKA II: National Seminar on Mathematics Education, National Proceedings	In class VII SMP, the PBL model with ethnomathematics nuances of sasirangan cloth motifs helps solve story problems on square and rectangular materials. This reduces KPMM and love of local culture.
(Paramartha et al., 2020)	Journal for Lesson and Learning Studies, National S3	There was an increase in students' KPMM after implementing the LKS-based ethnomathematics learning model. Apart from that, the application of this learning method can increase student enthusiasm during the delivery of cultural material.
(Patmara et al., 2019)	Journal of Primary Education, National S3	Problem-based learning with ethnomathematics nuances increases students' KPMM.
(Purwanti et al., 2021)	Journal of Primary Education, National S3	The problem-based learning (PBL) model, which is based on ethnomathematics, has succeeded in increasing students' KPMM in learning mathematics, especially geometry material.
(Putri et al., 2021)	Juring (Journal for Research in Mathematics Learning), National S4	Valid and practical criteria have been met by mathematics learning tools that use the Problem Based Learning (PBL) model based on ethnomathematics. This device helps students solve mathematical problems in curved geometric

Writer	Journal/Proceedings Publication Category	Research result
		figures.
(Safitri et al., 2021)	Unnes Journal of Mathematics Education Research, National S4	PBL has Acehnese cultural nuances and descriptive feedback is effective for students' KPMM.
(Saputro et al., 2020)	Imaginary: Journal of Mathematics and Mathematics Education	The application of the ethnomathematics nuanced PBL model is more effective in increasing students' KPMM compared to traditional lecture-based learning.
(Sofiyani & Zaenuri, 2023)	Circle: Journal of Mathematics Education	The research results show that the PBL model with ethnomathematics nuances assisted by e-LKPD is effective in helping students solve problems. Apart from that, the application of the PBL model with ethnomathematics assisted by e-LKPD increases students' love for local culture.
(Yunitasari, R. & Zaenuri, 2020).	PRISMA, Proceedings of the National Seminar Mathematics	The application of ethnomathematics nuanced PBL is more effective in increasing students' KPMM and independence.

(RQ2) "What are the learning media chosen in the article regarding ethnomathematics learning on students' mathematical problem solving abilities in the last 5 years?"

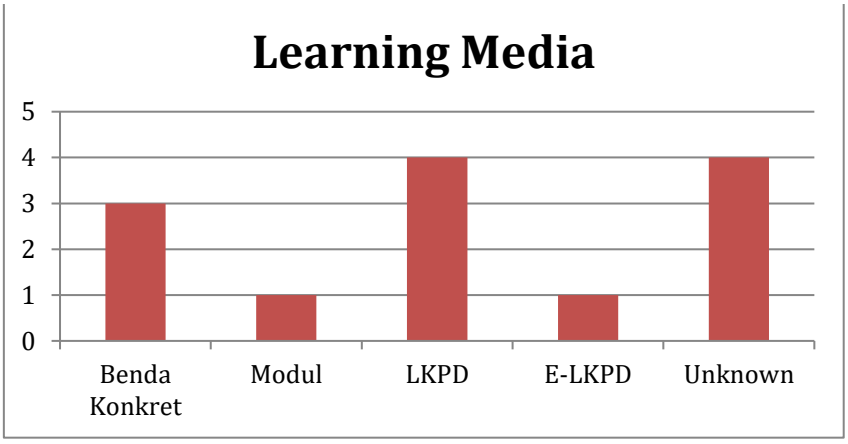

Figure 1. Learning Media

Figure 1 shows the learning media used in research regarding ethnomathematics nuanced Problem Based Learning for KPMM in 2019-2023. It can be seen that the learning media that is often chosen in research regarding ethnomathematics nuanced Problem Based Learning for KPMM is Student Worksheets (LKPD).

(RQ3) "What is the trend of ethnomathematics nuanced PBL research on students' mathematical problem solving abilities in the last 5 years?"

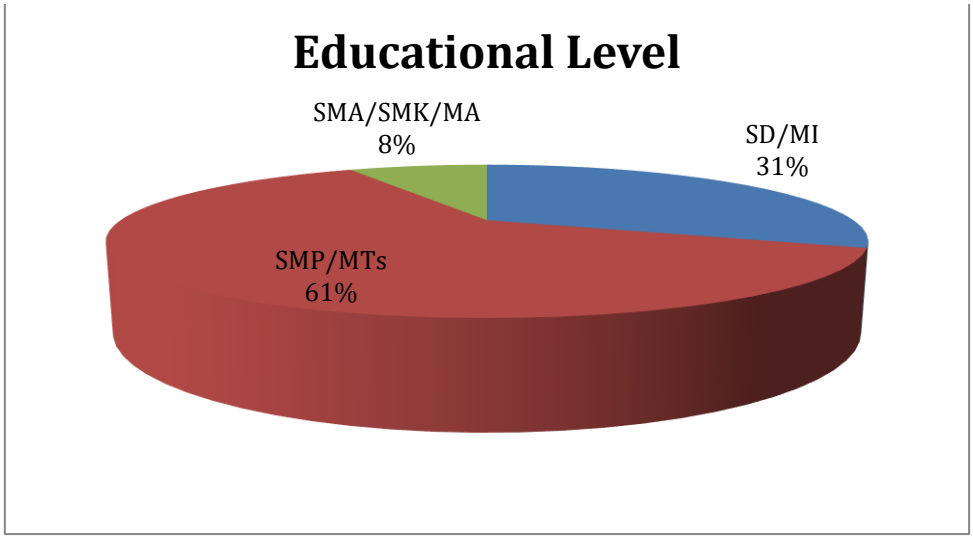

Figure 2. Educational level

Figure 2 shows that research regarding Problem Based Learning has an ethnomathematics nuance towards students' KPMM in the 2019-2023 publications. It can be seen that at the junior high school level the percentage shows 61%, which means that research on ethnomathematics nuanced Problem Based Learning towards KPMM is mostly carried out at the junior high school level.

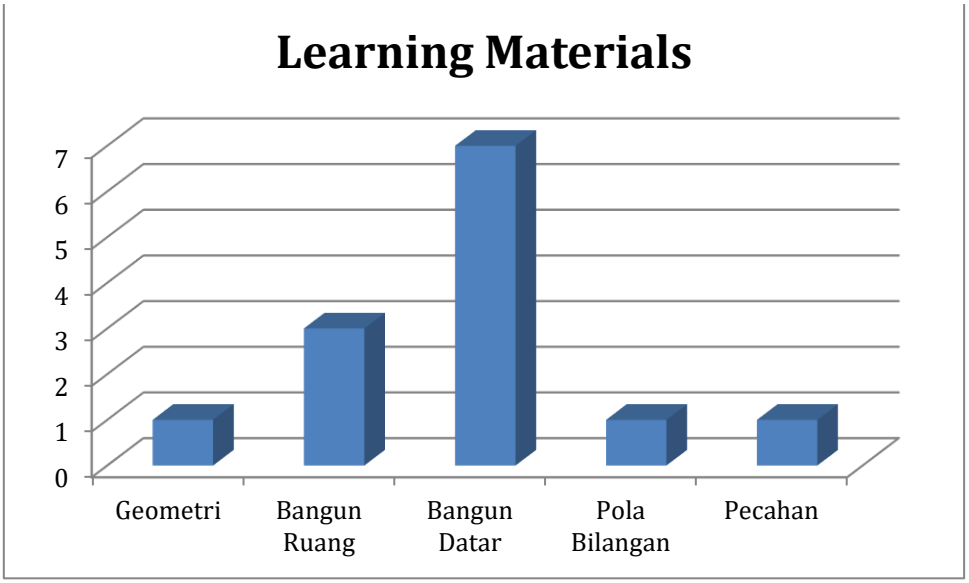

Figure 3. Mathematics Learning Materials

Figure 3 shows a graph of learning materials that implement the modelProblem Based Learningbased on ethnomathematics to increase students' KPMM. The graphic data is the result of previous research published from 2019 to 2023. According to the graphic above, the material that often implements the Problem Based Learning model is flat shapes.

Of the 13 articles that have been reviewed, the authors of these articles are Indonesian. The development of ethnomathematics research in Indonesia can be carried out through learning approaches or media. Ethnomathematics is related to learning media which can be in the form of ethnomathematics modules (Bahri et al., 2018), ethnomathematics worksheets containing story problems (Paramartha et al., 2020), and the use of ethnomathematics e-LKPD (Setiana et al., 2021). Furthermore, e-LKPD is an LKS/LKPD that was developed by following technological developments and canmade one of the optionsdistance learning media. Not only that, e-LKPD with an ethnomathematics nuance can also be used to develop students' KPMM and can be used as a bridge in embedding students with the surrounding culture.

Conclusion

There are 13 research articles that use the ethnomathematics nuanced PBL learning model as a treatment for students with the aim of increasing students' KPMM in the 2019-2023 period. Publications in the 2019-2023 period are dominated by the SMP/MTs level. First, the results of these studies generally prove that there is an influence of the Problem Based Learning model with ethnomathematics nuances on increasing students' KPMM when compared to other learning models. Second, ethnomathematics research on KPMM and KCBL published in 2019-2023 tends to use LKPD learning media. Third, more research focuses on problem-based learning models with ethno-mathematical nuances for KPMM published in 2019-2023, and more research chooses mathematical material about plane figures. And most of the research in that time period tends to increase. The results show that research on methods or models using ethnomathematics is still suitable for subsequent research on how effective student KPMM is.

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