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SYSTEMATIC LITERATURE REVIEW: PROBLEM BASED LEARNING MODEL FOR MATHEMATICAL CONCEPT COMPREHENSION ABILITY

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ABSTRACT

This article aims to describe the media used in learning the *Problem Based Learning* (PBL) model for the ability to understand mathematical concepts and describe the material used in learning the PBL model for the ability to understand mathematical concepts. The *Systematic Literature Review* (SLR) method is the method used in this study. The research shows that the media used are Student Worksheets (LKPD), *Kahoot*, *Google Classroom*, GeoGebra, concrete objects, bottles, teaching aids, learning videos and materials used, namely algebra, functions, straight line equations, function derivatives, build flat side spaces, quadrilaterals and triangles, fractions, lines and angles, sets, vectors, discharges, numerical concepts, function inverses, Two-Variable Linear Equation System (SPLDV), Cartesian coordinates, trigonometry, presentation of data to the PBL model for the ability to understand mathematical concepts. A total of 20 articles discussing the development and use of teaching materials or media using the PBL model for mathematical concept comprehension skills and as many as 22 articles discussing material with PBL models for students' mathematical concept comprehension skills from Sinta and *Google Scholar*.

Artikel ini bertujuan untuk mendeskripsikan media yang digunakan dalam pembelajaran model Problem Based Learning (PBL) untuk kemampuan memahami konsep matematika dan mendeskripsikan materi yang digunakan dalam pembelajaran model PBL untuk kemampuan memahami konsep matematika. Metode Systematic Literature Review (SLR) adalah metode yang digunakan dalam penelitian ini. Penelitian menunjukkan bahwa media yang digunakan adalah Lembar Kerja Siswa (LKPD), Kahoot, Google Classroom, GeoGebra, benda botol beton, alat peraga, video pembelajaran dan bahan yang digunakan adalah aljabar, fungsi, persamaan garis lurus, turunan fungsi, bentuk geometris sisi datar, segiempat dan segitiga, pecahan, garis dan sudut, himpunan, vektor, debit, konsep numerik, fungsi terbalik, Sistem Persamaan Linear Dua Variabel (SPLDV), Koordinat Cartesian, trigonometri, penyajian data model PBL untuk kemampuan memahami konsep matematika. Sebanyak 20 artikel membahas pengembangan dan penggunaan bahan ajar atau media menggunakan model PBL untuk kemampuan pemahaman konsep matematika dan sebanyak 22 artikel

membahas materi dengan model PBL untuk kemampuan pemahaman konsep matematika siswa dari Sinta dan Google Scholar.

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1. INTRODUCTION

Education is very important for all human beings without exception, because it can improve the quality of human beings themselves. In addition, education has become one of the rights and obligations that must be fulfilled and therefore must be pursued. According to Kelana, J. B., & Wardani (2021) Learning is an interactive activity between teachers and students in which students experience direct understanding, respond, and achieve learning goals. Mathematics is one of the basic sciences and is a scientific thinking tool that students really need. Learning mathematics is a sufficient requirement to take education to the next level. Mathematics learning teaches students to reason critically, creatively, and actively. According to Djuanda et al., (2019) In mathematics learning, students can cultivate critical, logical, creative, effective and systematic thinking, thereby developing personality and thinking skills.

Understanding mathematical concepts is very important in the mathematics learning process because understanding concepts is the basis for solving mathematical problems and everyday problems. This is in line with Giawa et al., (2022) that mastery of problem solving requires conceptual knowledge to be applied to the technique of finding solutions. According to Hendriana, H., Rohaeti, E. E., & Sumarmo (2021) There are indicators of understanding mathematical concepts, namely a) repeating the concepts that have been learned; b) classify objects based on whether they meet the requirements that shape the concept; c) discover the properties of the operation or concept; d) apply the concept logically e) provide examples and counter examples of the concepts studied; f) display concepts in various forms of mathematical representation, such as tables, graphs, diagrams, sketches, mathematical models, or other means; g) relate various concepts both in mathematics and outside mathematics; h) create the necessary and/or sufficient requirements for a concept.

Students' ability to understand mathematical concepts has an effect on their learning outcomes. However, the reality is that students' ability to understand concepts is still relatively low. According to research conducted by Buyung et al. (2022) that the results of the preliminary research show that the students of SDN 14 Semperiuk A still have low learning outcomes. One of the influencing factors is the subject of mathematics, where students face difficulties in addition, division, multiplication, and subtraction when used in given problems. Students do not understand mathematical concepts well, which has a significant impact on the operation of addition and subtraction. Other factors that affect low learning outcomes are students' lack of interest in mathematics subjects, lack of student concentration in explaining the material, students consider mathematics subjects

difficult, lack of understanding of mathematical concepts and students' indiscipline.

The use of technology for learning is becoming increasingly important in the increasingly advanced digital era. By using technology such as learning videos and math apps, students' mathematical concept skills can be improved in a more engaging and interactive way. The technology also allows students to learn independently and get feedback faster. According to Hasiru et al. (2021) learning media that can be used to help with mathematics learning are Google Classroom, learning videos, WhatsApp, and Zoom. Learning media such as *Google Classroom* and learning videos can meet the criteria of effective learning media, such as motivating students to learn, improving learning outcomes, and giving learners the ability to remember and apply what they learn.

According to Yuliandari & Anggraini (2021) One of the factors that affects students' ability to understand mathematics is the type and method of learning used in the classroom. Designing the right learning is another effort to help students understand the concepts of mathematics learning. In line with Syuhada et al. (2022) that the model *Problem Based Learning* (PBL) is one of the learning models that can help with mathematics learning because it allows students to be more involved in learning activities and become more active in the classroom, which has a positive impact on students' understanding of concepts.

According to Wanderer & Wardani (2021) that the learning model *Problem Based Learning* offer students real and relevant problems and deliver in the research process. If students are faced with situations in which ideas are applied, their learning will become more significant and broader. Students' confidence and independence can be improved with this learning model. In line with the research conducted by Zulfa & Warniasih (2019) that students in grade XI IPS 2 SMA Negeri 1 Gamping have the potential to improve their understanding of concepts about mathematics by applying a problem-based learning model *Problem Based Learning*. This is evidenced by the achievement of an average score of 86.83% (high criteria) on the math concept comprehension test, which was achieved by 29 out of 32 students (90.63%).

Based on the description above, this study aims to describe the application of *the Problem Based Learning* (PBL) model to the ability to understand concepts in mathematics lessons, namely: 1) Describe the media used in learning the PBL model for the ability to understand mathematical concepts; and 2) Describe the material used in learning the PBL model for the ability to understand mathematical concepts.

2. METHOD

Method *Systematic Literature Review* (SLR) is the method used in this study. According to Suciati & Palu (2022) The SLR research method is a systematic and objective research methodology used to collect, evaluate, and synthesize relevant evidence from various previously published literature sources. In line with Ramadhanti et al., (2022) SLR is a scientific approach used to conduct structured reviews related to relevant literature, and is carried out through pre-established protocols. According to Triandini et al., (2019) After selecting the source *literature* which corresponds to *Keyword* The required research, review and identification of selected journals in a structured manner are carried out in

accordance with the procedures set forth in the *systematic literature review* (SLR). This research uses three stages *systematic literature review* (SLR) according to Choifah et al., (2022) that is *Planning*, *conducting*and *Reporting*.

Planning

The first stage of the preparation *of the systematic literature review* protocol is planning. At this stage, the researcher determined the research topic, namely "Application of *Problem Based Learning* Model for Concept Understanding Ability in Mathematics Lessons". Furthermore, the article search criteria are determined based on *Scopus*, *Erics*, and *Google Scholar* sources from the period 2018 to 2024. The keywords used in this study include *Problem Based Learning* and the ability to understand concepts in mathematics learning.

Conducting

At the *Conducting* stage, it is the implementation of a *systematic literature review*. At this stage, the search for articles according to the criteria and suitability with keywords begins. At this stage, a total of 62 articles were obtained that met the criteria of keywords that act as the research population. After making a selection according to the inclusion and exclusion criteria of the existing population, 47 selected articles were selected. The inclusion criteria applied to this study are journals with clear SINTA and academic proceedings, journal publications in the last 5 years, types of experimental, qualitative, PTK, and development and education levels of elementary, junior high, and high school/vocational schools. While the exclusion criteria include irrelevant titles, no full text available, irrelevant abstracts, and unclear conclusions of research results. After the selection process is complete, the next stage is to synthesize data to analyze and evaluate the research results from various articles. The synthesis of data in this study will be presented in a narrative manner.

Reporting

The *reporting stage* is the last stage in the Systematic Literature Review (SLR) research. This stage includes writing the results of SLR analysis and evaluation from journals into the form of writing according to the predetermined format.

3. RESULTS AND DISCUSSION

Research Results and Discussion

The results of the study are based on the *Systematic Literature Review* (SLR) method from the results of the analysis of articles about *the Problem Based Learning* (PBL) model in mathematics learning seen from the ability to understand mathematical concepts achieved and the level/level of the research so that conclusions can be drawn to find out the *Problem Based Learning* model (PBL) for the ability to understand mathematical concepts when applied to the application of mathematics learning. From the results of the article analysis, 22 articles related to *the Problem Based Learning* (PBL) model or the ability to understand mathematical concepts were obtained.

Use of Media in *the Problem Based Learning Model* for Understanding Mathematical Concepts

The teaching and learning process is based on *Problem-Based Learning* (PBL) has existed since the time of John Dewey. Virginia and Wasitohadi (Attalina & Irfana 2020) say model *Problem-Based Learning* (PBL) is an innovative learning model. This model starts by giving students a problem or topic of a problem and gives them the opportunity to work together in a group to solve a problem. Therefore, it is hoped that *Problem-Based Learning* (PBL) can improve students' ability to understand material independently, improve their thinking skills, and provide freedom to students during the teaching and learning process so that they become more confident.

The results of the article analysis that have been carried out are 20 articles that discuss the development and use of teaching materials or media using *the Problem Based Learning* (PBL) model for students' ability to understand mathematical concepts. In more detail, the results of the analysis of 20 articles are described in Table 1.

Table 1. Analysis of Media Use Articles in the Problem *Based Learning* (PBL) Module for Understanding Mathematical Concepts

Year of Publication	Types of Teaching Materials and Media Developed
2017	Student Worksheets
2018	Student Worksheets
2019	Student Worksheets
2020	Student Worksheets
2021	Student Worksheets, *Kahoot*, *Googgle Classroom*
2022	Learner Worksheets, GeoGebra, Bottle Concrete Objects, Learning Videos
2023	Props
2024	Student Worksheets, Learning videos

Based on the results of the analysis of articles that discuss the use of teaching materials or media in the use of teaching materials or media using the *Problem-Based Learning* (PBL) for understanding mathematical concepts, there are several media used, namely Student Worksheets (LKPD), *Kahoot*, *Googgle Classroom*, GeoGebra, concrete objects such as bottles, teaching aids, learning videos (Isroila et al., 2018;Rubianti et al., 2019;.Fariana, 2017;Wahyuni et al., 2020; Asih et al., 2019; Amalia et al., 2021; Rahmananda et al., 2024; Harmaen et al., 2024; Mulyanti & Puspitasari, 2022; Ninef et al., 2023; Zulfikar et al., 2020; Afridiani et al., 2020; Sitorus & Sirait, 2022; Wahyuni & Sholichah, 2022; Khalid et al., 2022; Kurino et al., 2020; Harahap, 2021). As for one example of analysis *Reviews* which is carried out on the use of teaching materials or media in the use of teaching materials or media using the *Problem-Based Learning* (PBL) to improve the ability to understand mathematical concepts. According to Sitorus & Sirait (2022) With the application of the learning model *Problem Based Learning* (PBL) to improve the understanding of mathematical concepts at SMP Negeri 3 Medan stated that the ability to give examples increased from 84.77 to 89.06, the ability to give examples and not examples from 80.47 to 84.38, the ability to present concepts mathematically increased from 68.36

to 71.09, and the ability to apply concepts increased from 71.48 to 78.52. The material of the first cycle from 69.3 is not enough to 77.81 is enough.

Results of the analysis *Reviews* shows that the use of Geogebra learning media can help students develop the ability to understand mathematical concepts towards the use of teaching materials or media in the use of teaching materials or media using models *Problem-Based Learning* (PBL) to improve the ability to understand mathematical concepts. This is also in line with research conducted by Wahyuni & Rahmadhani (2020) who used "GeoGebra" media where the results of the math concept comprehension test of grade XI MAN 1 Takengon students showed that learning using the PBL model with the help of GeoGebra media was more effective than learning using the PBL model without the help of GeoGebra media. Another learning medium that also supports learning to improve the ability to understand mathematical concepts is the Student Worksheet (LKPD). Student Worksheets (LKPD) are teaching materials that can be used as learning guidelines that require students to actively participate in learning. According to Apriani et al. (2021) that the results of the small trial show that students have the ability to understand mathematical concepts with LKPD-based *Problem-Based Learning* (PBL).

Use of Materials in *the Problem Based Learning Model* for Understanding Mathematical Concepts

The results of the article analysis that have been carried out are 22 articles that discuss material with the *Problem-Based Learning* (PBL) model for students' ability to understand mathematical concepts. In more detail, the results of the analysis of 22 articles are described in Table 2.

Table 2. Article Analysis of the Use of Materials in the Problem *Based Learning* (PBL) Module for Understanding Mathematical Concepts

Year of Publication	Types of Materials Developed
2017	Function
2018	Algebra
2019	Straight Line Equations, Function Derivations, Data Presentation
2020	Build Flat Side Spaces, Quadrilaterals and Triangles, Fractions, Cartesian Coordinates
2021	Lines and Angles, Sets, Vectors
2022	Algebra, Debit, Two-Variable Linear Equation System (SPLDV), Cartesian Coordinates
2023	Numerical Concepts, Inverse Functions, Two-Variable Linear Equation System (SPLDV), Cartesian Coordinates
2024	Trigonometry, Data Presentation

Based on the results of the analysis of the article that discusses the material used in the model *Problem-Based Learning* (PBL) for the understanding of mathematical concepts, there are several materials used, namely functional materials, algebra, straight line equations, derivative functions, build flat side spaces, quadrilaterals and triangles,

fractions, lines and angles, sets, vectors, discharges, numerical concepts, function inverses, two-variable linear equation systems, Cartesian coordinates, trigonometry, data presentation (Tohang et al., 2023; Wahyuni et al., 2020; Asih et al., 2019; Amalia et al., 2021; Santosa et al., 2022; Santosa et al., 2022; Silalahi et al., 2023; Zulfa & Warniasih, 2019; Harmaen et al., 2024; Nurlita et al., 2019; Mulyanti & Puspitasari, 2022; Marliana et al., 2023; Ninef et al., 2023; Zulfikar et al., 2020; Afridiani et al., 2020; Sitorus & Sirait, 2022; Wahyuni & Sholichah, 2022; Nuraeni, 2018; Khalid et al., 2022; Kurniawan et al., 2023; Harahap, 2021). As for one example of analysis *Reviews* that is done on the material using the *Problem-Based Learning* (PBL) to improve the ability to understand mathematical concepts. According to Tresnawati et al., (2019) Students' understanding of the concept of statistics in the experimental class is influenced by the model *Problem Based Learning* (PBL). If applied to statistical materials, PBL can significantly improve students' understanding of concepts.

The results of the analysis show that the use of statistical materials can help students to improve their understanding of mathematical concepts using models *Problem Based Learning* (PBL). According to Fitrah (2017) Concept comprehension is the ability of students to master various subject topics. This means that not only are they able to remember some concepts, but they are also able to explain concepts in different ways and apply them to concepts that fit their own cognitive structure. One of the main goals in mathematical learning is the understanding of concepts. By understanding concepts, students can understand, interpret, translate, or express concepts in their own way (Yanala et al., 2021).

According to research Hariyadi & Fauzan Muttaqin (2020) that ethnomath-charged learning can help students understand the concept of geometry using *Problem Based Learning* (PBL). Ethnomathematics improves students' ability to interpret and analyze mathematical codes and increases curiosity and confidence, which makes learning more interesting and enjoyable. To prevent students from getting bored in the classroom, teachers, especially those working in elementary schools, can use a more creative learning model. Students will love learning math and learning about the culture around them. Other materials also support learning to improve the ability to understand mathematical concepts using *Problem Based Learning* (PBL). According to the results of the study Nalman et al., (2023) During learning in the Problem Based Learning model by emphasizing the ability to understand concepts and students' mathematical problem-solving skills in straight line equation material, there is a significant influence by using the learning model *Problem Based Learning* (PBL) to students' ability to understand concepts.

CONCLUSION

Based on the analysis using the *Systematic Literature Review* (SLR) method, it can be concluded that the research findings show that *the Problem based Learning* (PBL) model is the ability to understand students' mathematical concepts. The teaching materials or media used based on the findings of the researched articles are teaching materials or media that are specifically designed and arranged by paying attention to the needs of students at each level, especially as reinforcements in students' ability to understand mathematical concepts, such as being made more interesting and creative in the form of Student

Worksheets (LKPD), *Kahoot*, *Google Classroom*, GeoGebra, bottle concrete objects, props, learning videos. The media that is often used is the Student Worksheet (LKPD).

The material used in the Problem based Learning (PBL) model for students' ability to understand mathematical concepts also varies such as algebra, functions, straight line equations, function derivatives, build flat side spaces, quadrilaterals and triangles, fractions, lines and angles, sets, vectors, discharges, numerical concepts, function inverses, Two-Variable Linear Equation System (SPLDV), Cartesian coordinates, trigonometry, data presentation. The material that is often used is the coordinates of Cartesian.

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