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ELICITING ACTIVITIES MODEL ON STUDENTS' MATHEMATICAL LITERACY ABILITY

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Abstract

The low level of mathematical literacy in Indonesia is caused by the selection of an inappropriate learning model. The purpose of this study is to review various references related to the eliciting activities model and mathematical literacy. The type of research method used is Systematic Literature Review (SLR). Data collection used library research. A literature study was obtained by searching the sites scopus.com, scimagojr.com, and Google Scholar and grouping the data using publish or perish. The data were selected based on the strong link between mathematical literacy and the eliciting activities model and were taken from articles with the Scopus index. There are 10 articles that fit the criteria. The article was reviewed and analyzed with supporting references. The results of this study are known that improving students' mathematical literacy skills depends on the learning model provided and how educators can choose an appropriate learning model and apply the learning model properly. The eliciting activities model can also improve mathematical literacy by modifying learning models with various approaches. In addition, teachers also need to pay attention to each step in the eliciting activities model so that learning objectives can be achieved.

Keywords: Mathematical literacy ability; eliciting activities model; system literature review

Abstrak

Rendahnya literasi matematika di Indonesia diakibatkan pemilihan model pembelajaran yang kurang tepat. Tujuan penelitian ini adalah mengulas berbagai referensi terkait model eliciting activities dan literasi matematika. Jenis metode penelitian yang digunakan yaitu Systematic Literature Review (SLR). Pengumpulan data menggunakan studi pustaka.. Studi pustaka diperoleh dengan melakukan search proccess situs scopus.com, scimagojr.com dan google scholar dan pengelompokkan data tersebut menggunakan publish or perish. Data dipilih berdasarkan keterkaitan kuat antara literasi matematika dan model eliciting activities dari artikel dengan indeks scopus. Terdapat 10 artikel yang sesuai denga kriteria. Artikel tersebut diulas dan dianalis dengan diperkuat referensi pendukung. Hasil penelitian ini diketahui bahwa peningkatan kemampuan literasi matematika siswa bergantung dengan model pembelajaran yang diberikan dan bagaimana pendidik dapat memilih model pembelajaran yang sesuai dan menerapkan model pembelajaran tersebut dengan baik. Model eliciting activities juga dapat meningkatkan literasi matematika dengan memodifikasi model pembelajaran dengan berbagai pendekatan. Selain itu juga guru perlu memperhatikan setiap langkah pada model eliciting activities agar tujuan pembelajaran dapat tercapai.

***Kata kunci**: Kemampuan Literasi Matematika; Eliciting Activities Model*

INTRODUCTION

Literacy is a person's ability to process and understand information while doing the reading and writing process. While literacy in mathematics includes mathematical reasoning and the ability to use mathematical concepts, procedures, facts, and

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mathematical functions to describe, explain and predict phenomena (OECD, 2013). More simply mathematical literacy according to Ojose (Ojose, 2011) states that mathematical literacy is knowledge of knowing and applying basic mathematics every day. Understanding mathematical literacy is not just a mathematical operation based on the school curriculum but the use of mathematical knowledge and understanding in real life. So knowledge and understanding of mathematical concepts are very important, but even more important is the ability to activate mathematical literacy to solve problems encountered in everyday life. With mastery of mathematical literacy, each individual will be able to reflect mathematical logic to play a role in his life, community, and society. Mathematical literacy enables individuals to make decisions based on a constructive mathematical mindset

According to PISA in the Organization for Economic Co-operation and Development (OECD, 2019), mathematical literacy refers to students' activities in formulating, using, and interpreting in various contexts to solve various problems. Mena (Mena, 2016) says that a person's ability to understand and identify mathematics in contextual problems. By applying mathematical concepts, facts, and reasoning students can get mathematical conclusions to solve a mathematical problem. Interpreting in mathematical literacy focuses on interpreting itino the real context of everyday life by reflecting on mathematical solutions.

Kaye Stacey (2015) defines literacy in the context of mathematics as having the power to use mathematical thinking in solving everyday problems to be better prepared to face the challenges of life. The intended mathematical thinking includes problem solving thinking, logical reasoning, communicating, and explaining. This mindset is developed based on concepts, procedures, and mathematical facts that are relevant to the problems at hand. Werner Blum, Peter L. Galbraith,and Hans-Wolfgang Henn (2007) also added the word effectively in terms of mathematical literacy. Mathematical literacy is defined as the ability to use mathematical knowledge and understanding effectively in dealing with the challenges of everyday life. Someone who is literate in mathematics is not enough to only be able to use his knowledge and understanding but also must be able to use it effectively.

The results of the PISA survey, in 2012 were ranked 64 out of 65 countries, in 2015 they were ranked 63 out of 69 countries and in 2018 they were ranked 74 out of 79 countries. Based on the three most recent surveys conducted, Indonesia is still ranked in the bottom 10. This shows that students' mathematical literacy in Indonesia is relatively low compared to other countries. In the research of Tabun et al (Tabun et al., 2020) in PISA Indonesian students occupy mathematical literacy at levels 1 and 2 of 6 levels, which shows students are only able to solve routine problems. When the questions given are related to everyday life or non-routine students will find it difficult to determine the formula they use to solve the problem.

Previous research also shows that the mathematical literacy skills of Indonesian students from various levels of education are still at a low level (Astuti et al., 2019; Julie et al., 2017; Kurniawati & Mahmudi, 2019; Rohman et al., 2019; Setiani et al. al., 2018; Wijayanti et al., 2018). Mathematical literacy ability is also influenced by

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several factors such as self-efficacy (Cheema, 2018), multiple intelligences (Mujib et al., 2020), learning (Atsnan et al., 2018; Paloloang et al., 2020; Wahyuni et al., 2017). The low mathematical literacy is because the learning media and learning models used have not been able to improve students' mathematical problem solving skills (Purnama & Suparman, 2020). Not all learning models can be applied in the classroom. Teachers need to choose the right learning model according to learning objectives and student characteristics (Rohana, 2020).

An approach that can stimulate students to model problems in the form of mathematical models is the Model-Eliciting Activities (MEA) (Yildirim et al., 2010; Yu & Chang, 2007). Some of the principles that use the MEA model, among others; are principles of meaningful learning, principles of construct models, self-evaluation, model documentation, simple prototypes, and generalizations (Dede et al., 2017; Lubis et al., 2017). The MEA learning model is based on students' real-life problems, works in small groups, and presents a mathematical model as a solution, the model is made by students, then its accuracy is measured in its presentation activities. The application of MEA in learning mathematics in the classroom has a good impact on improving student learning outcomes, especially creative thinking skills and self-confidence for high school students (Pane et al., 2017).

The MEA model is also able to train and help students to understand and solve problems, so the application of the MEA learning model is considered to be able to improve students' mathematical problem-solving abilities (Hamilton et al., 2008). Research on MEA and its relationship to problem-solving skills shows that students' mathematical problem-solving abilities using MEA in learning are better than using the Problem Based Learning (PBL) model (Risma, 2016). In addition, the application of the MEA approach has a positive effect on students' mathematical problem-solving abilities and there is a significant increase in problem-solving skills and mathematical dispositions in the repeated application of MEA (Baker & Galanti, 2017).

Based on the problems above, this study will present a study of the analysis of students' mathematical literacy skills and learning models of eliciting activities. The results of the study can be used as a guide for teachers or other researchers to determine the effect of eliciting activities model learning on mathematical literacy skills. As well as improving students' mathematical literacy skills by using eliciting activities learning models.

RESEACH METHOD

The type of research method used is Systematic Literature Review (SLR). Systematic Literature Review is a term used to refer to a particular research methodology or research and development carried out to collect and evaluate research related to the focus of a particular topic (Lusiana & Suryani, 2014). The purpose of the SLR is for various purposes, including identifying, reviewing, evaluating, and interpreting all available research with topic areas of interest to phenomena, with specific and relevant research questions (Hjelte et al., 2020; Yang et al., 2020). Researchers identify, review, evaluate and interpret research that has been done by other researchers. This research reviews various articles in reputable

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international journals, international journals, and national journals. The steps used were as follows: we (1) identified the topics and searched for relevant studies;(2) screened documents to identify essential studies; (3) examined eligibility studies; and (4) included the documents of the analyzing (Suherman & Vidákovich, 2022)

Researchers use library research, namely data collection techniques using references as research support, by completing or searching for the required data from various literature. The literature in this study was obtained by conducting a search process on the scopus.com and scimagojr.com sites to search for articles in reputable international journals, and on the Google, Scholar site to search for articles in international journals and national journals by analyzing and summarizing the articles. already selected. In addition, the researchers grouped the data using publish or perish. The results of the research are then used as a discussion in this article.

Articles that have been obtained are grouped by publisher. From the articles that have been obtained, then look for relationships between articles using viosviewer. After that, we looked at the lines showing the strong relationship between the eliciting activities model and mathematical literacy and selected 10 articles from reputable international proceedings.

Each article will be reviewed starting from the title, author, research subject and research results. After obtaining the data, it is then analyzed with each article with reinforced references that support it and finally makes a conclusion.

RESULTS AND DISCUSSION

Based on the search results for articles in Publish or Perish that match the theme of mathematical literacy and MEA from 2015-2021.

Table 1. Article data

No	Publisher	Math Literacy
1	Taylor & Francis	23
2	Springer	14
3	IOP	31
4	ERIC	17
5	Elsevier	16
6	UNSRI	2
7	Emerald	1
8	IEEE Explore	-
	Total	104

Based on Table 1 the relationship between literacy mathematics articles can be described as Figure 1.

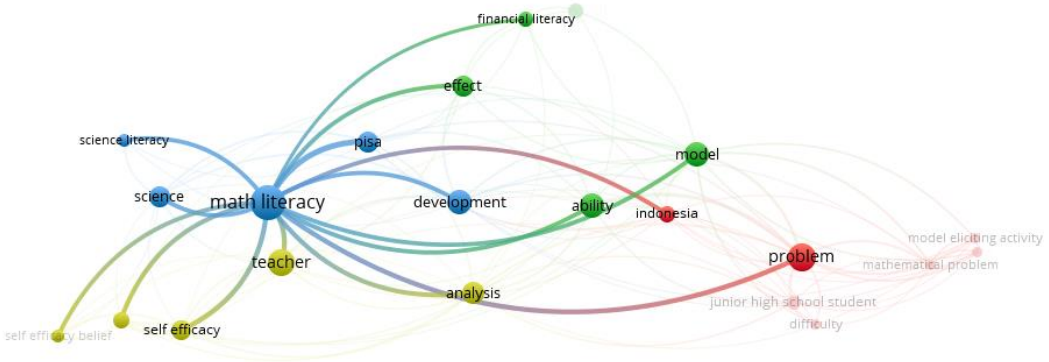

Figure 1. Relationship of each math literacy article

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The results of the research data are in the form of a literature review that analyzes and summarizes the learning model of eliciting activity on mathematical literacy skills.

The research Setiani et al., (2018) results with title analysis of mathematical literacy ability based on self-efficacy in model eliciting activities using metaphorical thinking approach shows that MEAs learning using Metaphorical Thinking approach accomplishes good criteria both quantitatively and qualitatively. Students with low self-efficacy can identify problems, but they are lack ability to arrange problem-solving strategy on mathematical literacy questions. Students with medium self-efficacy can identify information provided in issues, but they find difficulties to use math symbols in making a representation. Students with high self-efficacy are excellent to represent problems into mathematical models as well as figures by using appropriate symbols and tools, so they can arrange strategy easily to solve mathematical literacy questions. The subject of this research is VIII grade students of SMP Negeri 3 Semarang Indonesia.

From the research results Setiani et al., (2018) it is known that students with low self-efficacy can identify problems, but have difficulty using mathematical symbols in making representations so they are less able to develop problem solving strategies for mathematical literacy questions. This is due to a lack of reasoning in understanding the problem because mathematical literacy allows students to develop reasoning skills as they learn to verify solutions to problems (Niss & Jablonka, 2020). Thus, successful learning requires more than just understanding concepts and principles, learning mathematics is also closely related to literacy development. Other studies also reveal that there is a relationship between theory and practice (Moody et al., 2018; Wright, K. L., Franks, A. D., 2016) in the theory of teaching mathematical literacy there are several theories studied such as schema theory, reading motivation theory, transactional theory, and dual coding theory.

The research Wijayanti et al., (2018) results with title Analysis of mathematical literacy ability based on goal orientation in model eliciting activities learning with murder strategy showed that (1) MEAs Learning with MURDER strategy on students' mathematical literacy ability is qualified, (2) Students who have mastery goal characteristics are able to master the seven components of mathematical literacy process although there are still two components that the solution is less than the maximum. Students who have performance goal characteristics have not mastered the components of mathematical literacy process with the maximum, they are only able to master the ability of using mathematics tool and the other components of mathematical literacy process is quite good. The subject of this research is VIII grade students of SMP Negeri 3 Semarang Indonesia.

In this study, students with high abilities in learning MEAs with the MURDER strategy have seven components in the process of mathematical literacy. There are six principles in learning with the MEA approach, namely: 1) the principle of meaningfulness, 2) the principle of model construction, 3) the principle of self-evaluation, 4) the principle of model documentation, 5) the simple

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prototype principle, and 6) the principle of model generalization (Lesh & Doerr, 2003). These six principles are more owned by students with high abilities so that their mathematical literacy is better than students with medium and low abilities. Learning with the MEA approach requires students to work in groups (Guler et al., 2019). Working in groups allows students to discuss and communicate their ideas as well as listen to their peers. MEA is also an activity to build mathematical models. Building a mathematical model requires a strong concept in understanding the problem so that students can simplify their thinking.

The research Zaenuri et al., (2020) results with title Mathematical Literacy in Setting Model Eliciting Activities Nuanced Ethnomathematics Mathematical literacy skills of students who received MEAs learning with ethnomatematic nuances were completed individually and classically, this was indicated by the value of zcount = 1.78 and zcount ≥ z(0.5 − α) = 1.64 , where H0 is rejected. The average and proportion of mathematical literacy abilities of the experimental class students with an average of 78.38 is better than that of the control class of 71.38. Starting from the perspective of ethnomatematics, literacy is best understood as the integration of schools and cultural contexts through cultural dynamics. The subject of this research is Class VIII Junior High School in Central Malaka, Malaka Regency, NTT.

In this study Zaenuri et al., (2020), MEAs learning with ethno-mathematical power is better than discovery learning. This shows that success in learning mathematics in building students' knowledge with mathematical modeling is better than students making discoveries. Fitriah et al., (2012) also stated that to make students interested and like solving problems is through MEA learning.

The research Stohlmann (2017) results with tittle Mathematical Modeling with Middle School Students: The Robot Art Model-Eliciting Activity show mathematical understandings that a diverse class of urban middle school students demonstrated on a mathematical modeling activity focused on geometry and measurement. At times students had difficulties in communicating clearly but based on the structure of the activity students were able to self-assess the quality of their communication and work towards improvement. The groups in the class were able to develop methods for how to program a robot to recreate a picture, though improvements could be made to the design of the activity. Teachers can use MEAs and mathematical modeling as formative assessment to build on students' understandings and further develop ideas that the teacher has in mind to pursue. Such assessment provides a rich basis for identifying evolving mathematical understandings that can be further developed. The subject of this research is primary school 4th grade students.

In research Stohlmann (2017), teachers can use MEA and mathematical modeling as formative assessments to build student understanding and further develop ideas that teachers have in mind to pursue. Like assessment provides a rich basis for identifying developing mathematical understandings that can go much further developed. Student understanding can be built by giving problems to students. In some studies, MEAs can develop good teamwork and communication skills, proficiency in design, as well as the ability to overcome types of open

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problems (Akera, 2019; Baker & Galanti, 2017). In addition to open problems, the problems given relate to real life (Abassian et al., 2020). MEA is a problem, not an exercise, that makes it different from the many tasks students experience in the classroom daily (Abassian et al., 2020). A problem is a task that requires critical thinking because: (a) the solution strategy is not clear to the individual, (b) the solution and number of solutions are uncertain, and (c) it can be solved in more than one way. Practice is a task that is intended to increase students' facilities and speed with known procedures (Kilpatrick et al., 2002).

The research Kaygısız & Şenel, (2023) result wit title Investigating mathematical modeling competencies of primary school students: Reflections from a model eliciting activity show The students' warm-up activities, the context of the MEA, and their previous modeling experiences all contributed to the students' representation of different levels of modeling competency. Due to the frequent use of multiple-choice questions in their classrooms, students also had difficulty interpreting qualitative data and understanding the mathematical task they were given. The subject of this research is primary school 4th grade students.

In research Kaygısız & Şenel, (2023), at the beginning of student learning students were asked to contribute to modeling experiences from various levels of modeling competency. However, educators often provide multiple choice questions so that when children are given description questions, they have difficulty interpreting qualitative data and understanding the mathematical assignments given. Mathematical models are meant to represent situations or things mathematically. With modeling, students will be familiar with the steps of modeling, such as: simplifying the problem; building mathematical models; modifying and finding results by using the model, and interpreting the results. Previous research stated that the MEA approach can develop students' abilities and problem-solving skills (Budiman & Syayyidah, 2018; Clark et al., 2008; Dede et al., 2017; Lubis et al., 2017; Yu & Chang, 2007).

Blum, (2015) research says that the eliciting activity model enables students to use mathematics effectively in everyday life, associate mathematics with real life situations, produce different solutions to the problems they face, and think analytically. However, the eliciting activities model is not in accordance with the objectives achieved if the teacher cannot apply the model properly. Research in schools also shows that there are different approaches used by teachers in teaching mathematical literacy (Graven & Venkat, 2007). Umbara and Suryadi's research (Umbara & Suryadi, 2019) shows that there are 60% of teachers have less knowledge about mathematical literacy. So that the teacher's lack of understanding of mathematical literacy results in the teacher being less precise in choosing the approach to learning and resulting in the low literacy ability of students. In other studies, there is a Vygotskian approach whose activities are current and authentic (Mavugara-shava, 2005; Venkat et al., 2009) and these activities affect students' mathematical literacy connections. Here it can be understood that the right approach/model can affect mathematical literacy.

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Before the teacher applies the eliciting activity model, it is necessary to pay attention to the steps at each stage so that during implementation it can run optimally. The MEAs learning steps according to Jumadi (2017) are students are faced with real-life problems, then work in small groups, and find and present a mathematical model as a solution, then the model made by students will be measured for accuracy in presentation activities. In addition, the MEAs stages according to Chamberlin & Coxbill (2012) state that MEA is implemented in several steps, namely: 1) the teacher reads a problem sheet that develops the student context; 2) students are ready to ask questions based on the problem sheet; 3) the teacher reads the problem with the students and ensures that each group understands what is being asked; 4) students try to solve the problem; and 5) students prepare their mathematical models after discussing and reviewing solutions. The syntax of the MEA learning model is: 1) presenting material with a heuristic-based problem solving approach; 2) elaborate, into simpler sub-problems; 3) identify problems that have been cut into several parts, 4) arrange sub-problems so that connectivity occurs and aims to develop problem-solving skills in learning mathematics, and 5) choose the right solution to solve problems. So that the stages in the MEAs approach are possible to facilitate or create an active and student-centered learning process to improve students' mathematical literacy.

In Guler et al., (2019) research it was revealed that pre-service teachers used engineering skills in designing, modeling, and producing models. When participants' views on the use of technology before and after MEA conducted with 3D printers were examined, it was observed that MEA had a positive effect on prospective teacher interest and motivation related to technology. In MEA, the technological equipment used by students in the process of forming and modeling models has a significant effect.

A single modeling task that students perform has a limited effect on the development of modeling skills (Doerr et al., 2014). For this reason, there must be an enriched modeling process MEA. That's why design-oriented modeling and practice with digital tools and technology has become effective today (Blikstein et al., 2017). These tools include 3D printers. Researchers stated that engineering practicals including 3D printers enhance students' skills for using computers and information and communication technology, provides for the use of concrete materials in education, provides a meaningful understanding of the characteristics of the model related to the creation process concrete material, and provides opportunities to develop understanding and communication about blind individuals. At the same time, 3D printer technology allows students to using a 3D modeling program. According to Blikstein et al., (2017), 3D printer technology allows students to acquire procedural knowledge in the process of solving problems through modeling. In this study aims to undergraduate students use 3D printing technology effectively and demonstrate their engineering skills problem solving process through modeling in MEA.

Another study Anggralia (2019) showed that MEA had a positive effect on communication skills, reasoning abilities, connection skills, and mathematical dispositions. A study also

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states that if the MEA model is combined with 4C Skills it can increase creativity, communication skills, and collaboration skills, and can improve problem-solving abilities (Handajani et al., 2018). The ability to solve problems can also improve several abilities, including; visualization, association, reasoning, abstraction, analysis, synthesis, and generalization, which are higher-order thinking skills. So the effect of MEA on math skills indirectly implies that MEA can positively affect more complex abilities, namely problem-solving skills.

Based on the results of several articles it was found that improving students' mathematical literacy skills depended on the learning model provided and how educators could choose the appropriate learning model and apply the learning model properly. The model eliciting activities can also improve mathematical literacy by modifying learning models with various approaches. In addition, teachers also need to pay attention to each step in the eliciting activities model so that learning objectives can be achieved.

CONCLUSION AND SUGGESTION

Mathematical literacy ability is an ability that must be possessed by students. Based on several research results, improving students' mathematical literacy skills depends on the learning model provided and how educators can choose an appropriate learning model and apply this learning model properly. The eliciting activities model can also improve mathematical literacy by modifying learning models with various approaches. In addition, teachers also need to pay attention to each step in the eliciting activities model so that learning objectives can be achieved.

Suggestions for future research are to conduct further research related to the application of the eliciting activities model whether it can also improve other competencies besides mathematical literacy. For teachers in applying the eliciting activity model, in addition to modifying the learning model, learning media is also needed so that the learning process becomes more interesting and fun.

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