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Systematic Literature Review : Increasing Mathematical problem-solving Ability Through the 7E Cycle Learning Model

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Model *Learning Cycle 7E* has been proven effective in improving students' understanding of concepts. However, research regarding the role of models *in Learning Cycle 7E* In developing students' problem-solving abilities, still needs to be done in more depth. This research aims to develop a more comprehensive framework regarding how to model *Learning Cycle 7E* can be used to facilitate the development of students' problem-solving abilities. In this research, a review of research articles on problem-solving abilities in mathematics with models was carried out *in Learning Cycle 7E*. This research will identify the characteristics of effective learning in developing students' problem-solving abilities using the 7E model. Through analysis of 10 articles published from 2019 to 2024, which we found in the Crossref and Google Scholar databases using the Publish or Perish application. By using keywords or a combination of keywords.

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Kata Kunci
mathematical problem-solving abilities, *Learning Cycle 7E*, and mathematics

Pendahuluan

Education is a long-term process that cannot be separated from human life. Through education, humans can develop various abilities. With this ability, humans can have understanding as a provision for living life in the future. In education, mathematics is one of the subjects that we always encounter, even in everyday life, and mathematics arises from human thinking which is related to ideas, processes, and intuition (Lesi & Husen, 2017).

Mathematics, one of the subjects taught in schools, contributes to realizing national education goals and building an Indonesian nation that is productive, creative, innovative and broadminded. Students need mathematics to meet real-world needs and solve problems. This shows that problem-solving ability is an important ability in learning mathematics. However, several studies reveal that students perform less well in solving mathematical problems. The 2022 PISA (Program for International Students Assessment) results in the mathematics ability category show that Indonesia is ranked 69th out of 79 participating countries with an average score of 366. Besides that, the average score in the international arena is 500 (Hewi & Shaleh, 2020). Therefore, solutions to improve this low problem-solving ability are very necessary.

The National Council of Teachers of Mathematics (NCTM) states that problem-solving is an ability that students must have in learning mathematics. The abilities that students need to have through learning mathematics, as determined by the National Council of Teachers of Mathematics (NCTM), are (1) problem-solving, (2) Reasoning and proof, (3) Communication, (4) Connection, and (5)) Representation. These skills are included in higher-level mathematical thinking, which must be developed during the mathematics learning process.

One way to improve students' problem-solving abilities and learning independence is to apply a learning approach that better supports students' active involvement in understanding the material. An effective approach that is believed to be able to improve students' problem-solving abilities and learning independence is the constructivism paradigm learning model.

Learning cycle 7E is a learning model specifically designed to stimulate students to observe phenomena that occur in the world, find problems, solve problems, and look for various other problems that occur in other places (Maryani, 2018). "*The Learning Cycle* is a series of activity stages that are organized so that students can master the competencies that must be achieved by playing an active role" (Maulana et al., 2018). "The characteristic of the learning cycle is that each student individually studies the material that has been prepared by

the educator. Then, the individual learning results are brought to the group to be discussed together regarding the overall answer" (Khashan, 2016).

Based on the description above, this research focuses on reviewing literature regarding improving students' problem-solving abilities through the Learning Cycle 7E learning model, to identify the effectiveness of this model in supporting active learning and improving students' mathematical abilities.

Metode

The method used in this research is *a Systematic Literature Review*. The SLR method is a literature review technique that involves the interpretation, assessment, and identification of findings from previous research related to a research topic aimed at answering predetermined research questions. (Kitchenham & Charters, 2007). This research aims to identify, study, and draw conclusions from literature that is relevant to students' problem-solving abilities through the cycle 7e learning model. Journal identification and evaluation are carried out carefully and in a structured manner, following the steps determined by Triandini, E., Jayanatha, S., Indrawan, A., Putra, G. W., & Iswara, B. (2019) to ensure accurate and reliable results.
Triandini et al. (2019) have provided complete guidance on the steps in writing an SLR journal, covering:

Research Questions

The initial stage of this research is formulating research questions. In this research, two specific questions will be identified. RQ aims to make it easier to search for topics and examine literature in depth so that it is oriented toward the research objective (Kurniawan and Agoestanto, 2023).

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Table 1. Research Questions

ID	Pertanyaan Penelitiana
RQ1	What is the relationship between learning models *Learning Cycle 7E* and increasing students' mathematical problem-solving abilities??
RQ2	Why learning model *Learning Cycle 7E* effective in improving students' mathematical problem-solving abilities?
RQ3	What are the indicators in the learning model *Learning Cycle 7E* that support improving students' mathematical problem-solving abilities?
RQ4	What are the research trends in the 2019-2024 period regarding learning models *Learning Cycle 7E* on students' mathematical problem-solving abilities?

Search Process

The search process was carried out to answer research questions by utilizing references relevant to the research topic. The steps taken are to access the Crossref and Google Scholar databases using the Publish or Perish application to obtain literature related to the topic being studied. The next step is to enter the keywords used in the search, namely: *Learning Cycle 7E*, problem-solving Ability, and Mathematics. The articles searched and collected were articles published between 2019 and 2024.

Inclusion Criteria

This process relates to the steps of identifying and selecting data that is relevant and worthy of inclusion in a research *Systematic Literature Review* (SLR). In selecting data, there are two categories of criteria used, namely inclusion criteria and exclusion criteria. These two criteria are explained in detail in Table 1 to guide the data selection process more systematically and accurately.

Table 2. Inclusion criteria

Kriteria	Tipe
The literature used is national or international journals that discuss the 7E Learning Cycle model and students' mathematical problem-solving abilities	Inclusion
Literature published in the 2019-2024 period	Inclusion
Literature uses Indonesian or English	Inclusion
Literature indexed by Crossref or Google Scholar.	Inclusion

Quality Assesment

This stage is related to the process of evaluating data from SLR research results by asking questions to assess the level of quality. Questions related to quality assessment include:
QA 1. "Does the journal explain the 7E Learning Cycle model and students' Mathematical problem-solving Ability?"
QA 2. "Is the journal published in the 2019-2024 period?"
QA 3. "Does the literature use Indonesian or English?"
QA 4. "Is the literature indexed by Crossef or Google Scholar?"

Data Collection

The type of data source applied in this research is a secondary data source obtained through the literature study method to search for previous research that is relevant to this research topic.

Data Analysis

This stage is related to the analysis of previously collected data. The results of this analysis will demonstrate and answer the Research Questions that were set in the first step.

Results and Discussion

Search Process Results and Inclusion Criteria

After conducting a search using the Publish or Perish application with the keywords "problem-solving abilities, Learning Cycle 7E, and mathematics," 100 journals and articles were obtained. Next, researchers carried out filtering based on publication year, namely 2019-2024 and ensured that articles met the inclusion and exclusion criteria. From the results of this filtering, 10 national and international journals and articles were indexed by Crossref and Google Scholar. Data from the 10 articles are presented in Table 3.

Table 3. Selected Literature

No	Jornal, Country of Publishing	Author's, Year	Method
1	Asian Journal of Education and Social Studies, India	Hairini et al, 2024	Quantitative
2	International Journal Of Humanities Education And Social Sciences (IJHESS)	Yustikarinda et al, 2024	Quantitative
3	Pasundan Journal of Research in Mathematics Learning and Education, Indonesia	Octaviana & Rahman, 2021	Qualitative
4	Juring (Journal for Research in Mathematics Learning), Indonesia	Rukmana et al, 2021	Quantitative
5	Journal of Mathematics Education	Anshori et al, 2020	Mixed Method
6	Juring (Journal for Research in Mathematics Learning), Indonesia	Nufus et al, 2019	Quantitative
7	Journal of Social Sciences and Education (JISIP), Indonesia	Ewisahrani & Nursa'ban, 2021	Quantitative

8	Scholar's Journal: Journal of Mathematics, Indonesia	Utami et al, 2022	Quantitative
9	INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN MULTIDISCIPLINARY EDUCATION, Amerika Serikat	Saputri & Umamah, 2023	Quantitative
10	AXIOMA Journal of the Mathematics Education Study Program, Islamic University of Jember, Indonesia	Maulani, 2021	Mixed Method

Quality Assesment

In the next stage, researchers carried out a quality assessment of 10 pieces of literature that met the inclusion criteria. The assessment categories used have been formulated in point 2.4. The results of the literature quality assessment are presented in Table 4.

Table 4. Result and Quality Assesment

No	Author's, Year	Title	QA1	QA2	QA3	QA4	Result
1	Hairini et al, 2024	The Effect Of Implementing Learning Models Cycle 7e On Mathematical Problems-Solving Ability	Y	Y	Y	Y	Accepted
2	Yustikarinda et al, 2024	Mathematical Dispositionand The Impact Of Learning Cycle 7E On Problem-Solving Skills In Mathematics	Y	Y	Y	Y	Accepted
3	Octaviana & Rahman, 2021	Literature Study About Mathematical Problem-solving Ability Through the 7E Learning Cycle Model at School Secondary	Y	Y	Y	Y	Accepted
4	Rukmana et al, 2021	Solution to problem Student Mathematics in Learning Cycle 7E Viewed from Self-Efficacy	Y	Y	Y	Y	Accepted
5	Anshori et al, 2020	The Effect of Learning Cycle 7E Accompanied by Mind Mapping on Problem-solving Ability Mathematics Viewed From the Adversity Quotient	Y	Y	Y	Y	Accepted
6	Nufus et al, 2019	Effect of Implementing the 7E Learning Cycle Model On problem-solving Ability Mathematics Reviewed Based on Student Learning Independence at SMPN 31 Pekanbaru	Y	Y	Y	Y	Accepted

7	Ewisahrani & Nursa'ban, 2021	Problem-solving Skills And Self Confidence in the 7E Learning Circle Model with an Open-Ended Approach	Y	Y	Y	Y	Accepted
8	Utami et al, 2022	Mathematical problem-solving Ability and Self-Regulated Learning with Models Learning Cycle 7E learning	Y	Y	Y	Y	Accepted
9	Saputri & Umamah, 2023	The Effect Of The Learning Cycle 7E Model With Prezi Media On problem-solving Skills And History Learning Outcomes	Y	Y	Y	Y	Accepted
10	Maulani, 2021	Learning Cycle 7E to Improve Ability Solution to problem Mathematics and Analysis Self Regulated Learning Reviewed Based on Aq	Y	Y	Y	Y	Accepted

Research Questions

(RQ1) What is the relationship between the Learning Cycle 7E learning model and increasing students' mathematical problem-solving abilities?

The application of the Learning Cycle 7E learning model significantly increases students' mathematical problem-solving abilities. This model is designed to encourage students in active thinking processes, build their knowledge, and develop better analytical skills.

Based on Table 5, research related to "Cycle 7E Learning Model on mathematical problem-solving abilities in the 2019-2024 period" shows an increase in students' problem-solving abilities after receiving learning with the model *Learning Cycle 7E* (Hairini et al, 2024), (Yustikarinda et al, 2024), (Rukmana et al, 2021), (Anshori et al, 2020), (Ewisahrani & Nursa'Ban, 2021), (Utami et al, 2022), (Saputri & Umamah, 2023), and (Maulani, 2021). This statement is in line with the results of research (Octaviana & Rahman, 2021) and (Nufus et al, 2019) which found that there was a significant increase in students' problem-solving abilities influenced by the 7E Learning Cycle Model.

Conventional learning models are less effective in improving students' mathematical problem-solving abilities because this method tends to lack active interaction and independent participation from students. Conventional learning focuses more on passive delivery of material so that students are less involved in critical thinking processes and in-depth exploration of the concepts being studied. In contrast, the 7E Learning Cycle model is considered to better support the development of problem-solving abilities by encouraging active involvement, reflection, and collaboration in learning (Octaviana & Rahman, 2021), (Rukmana et al, 2021) and (Utami et al, 2022).

(RQ2) Why is the Learning Cycle 7E learning model effective in improving students' mathematical problem-solving abilities?

Learning model *Learning Cycle 7E* is effective because it is based on a constructivist approach that emphasizes active and independent learning. With seven systematic stages, namely Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend, this model helps students understand problems in depth, build new knowledge based on previous concepts, and be actively involved through exploration and reflection. Each stage is designed to improve students' critical thinking, creativity, and systematic abilities. The research results show that

Learning Cycle 7E significantly improve students' problem-solving abilities compared to conventional learning, especially because this approach encourages active involvement and application of knowledge to real situations.

(RQ3) What are the indicators in the Learning Cycle 7E learning model that support increasing students' mathematical problem-solving abilities?

Indicators in the model *Learning Cycle 7E* that support improving students' mathematical problem-solving abilities are:

1. Understand the Problem
   At the level *of Elicit* And *Engage*, students are directed to reveal their initial understanding of the problem at hand. Teachers relate learning material to real-life contexts to increase students' interest and curiosity. This process helps students better recognize problems and build a strong foundation for the next steps.
2. Develop a problem-solving plan
   Level *Explore* provides opportunities for students to carry out in-depth exploration of relevant concepts without direct intervention from the teacher. On stage *Explain*, students formulate solutions through group discussions and present their findings. These two stages allow students to design problem-solving plans with various strategies.
3. Implement the Resolution Plan
   Level *Elaborate* directs students to apply concepts and strategies that have been designed for real problems. This process trains students to apply their understanding in more complex practical situations.
4. Evaluate and Reflect on Results
   At the level *of evaluation*, students are invited to assess the effectiveness of the solutions they have used. This evaluation includes reflection on the completion steps and final results.
5. Strengthening Understanding Through Advanced Applications
   Level *Extend* provides space for students to expand their understanding by applying concepts to new problems. This process engages students in additional exploration to strengthen their knowledge and problem-solving skills.

(RQ4) What are the research trends in the 2019-2024 period regarding the Learning Cycle 7E learning model on students' mathematical problem-solving abilities?

Research related to the "7E Learning Cycle Learning Model on mathematical problem-solving abilities" obtained by researchers based on publication year covers the period 2019-2024. In 2021, there were the highest number of articles, namely 4 articles, and there were 2 articles published in 2024. Meanwhile, the lowest number of articles were found in 2019, 2020, 2022, and 2023, with only 1 article each. This data can be seen in Figure 1, which shows the classification of articles regarding the "7E Learning Cycle Learning Model on mathematical problem-solving abilities" based on the year of publication.

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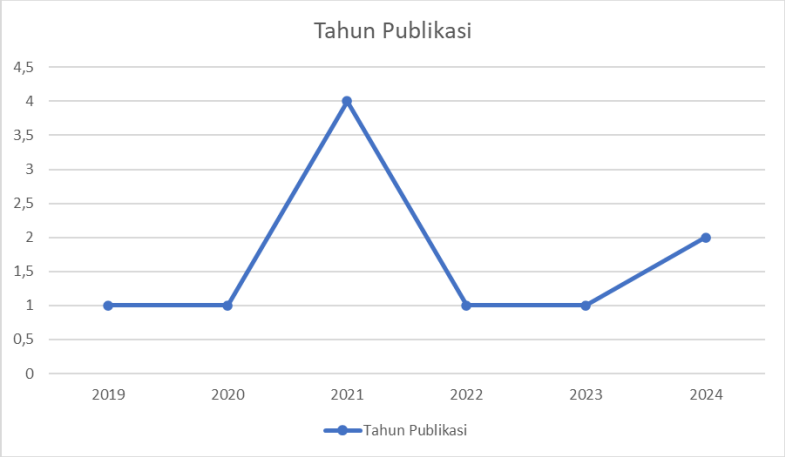
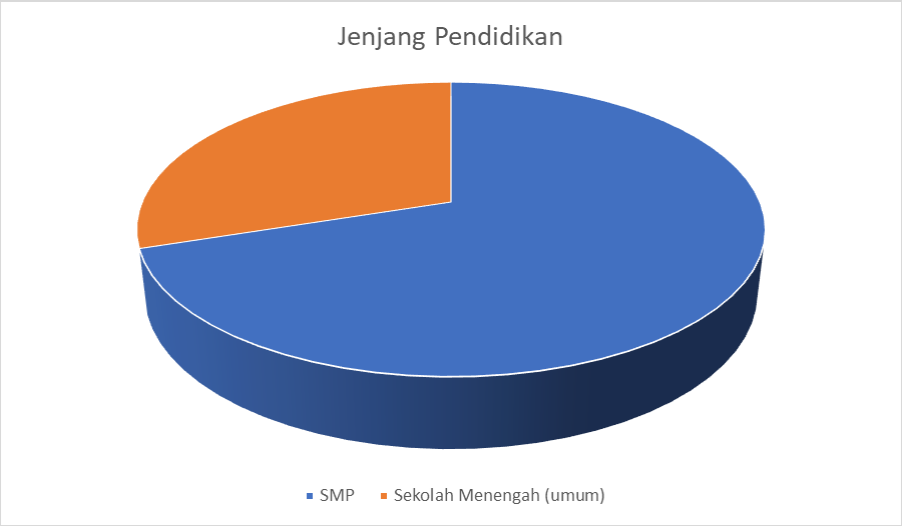
Figure 1. Classification based on year of publication



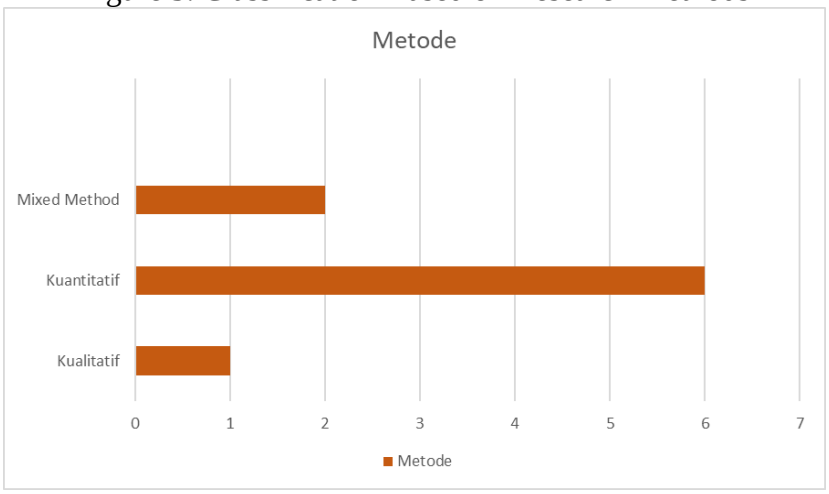
The 7E Learning Cycle model is applied at various levels of education in Indonesia to improve students' mathematical problem-solving abilities in mathematics learning. During the last 6 years, namely from 2019 to 2024, the application of the 7E Learning Cycle Model to students' mathematical problem-solving abilities was mostly carried out at the SMP/MTs level, with 7 articles obtained by researchers. Apart from that, 3 articles discuss the application of this model at the Middle School (General) level. This data can be seen in Figure 2, which shows the classification of articles regarding the "7E Learning Cycle Learning Model on mathematical problem-solving abilities" based on educational level.

Figure 2. Classification based on education level



If we look at the types or research methods used regarding the implementation of the 7E Learning Cycle Model at various levels of education in Indonesia in the 2019-2024 period, this research is dominated by a quantitative approach, with 7 articles. In addition, 2 articles were found that used the method *mixed method* and only 1 article used qualitative methods in that period. This data can be seen in Figure 3, which shows the classification of articles regarding the "7E Learning Cycle Learning Model on mathematical problem-solving abilities" based on the type or method used.

Figure 3. Classification Based on Research Methods



So it can be concluded that the research trend related to the "7E Learning Cycle Learning Model on mathematical problem-solving abilities" in the 2019-2024 period if viewed from the year of publication, is dominated by 2021 with 4 articles obtained. If seen from educational level, dominated by SMP/MTs with 7 articles obtained. Then, if we look at the type of research, it is dominated by quantitative research with 7 articles obtained.

Conclusion

Through analysis of several research articles from 2019 to 2024 learning models *Learning Cycle 7E* Effective in improving students' mathematical problem-solving abilities, this model is proven to encourage students to think actively, build knowledge, and develop better analytical skills.

The application of the Learning Cycle 7E learning model significantly increases students' mathematical problem-solving abilities. This model is effective because it is designed to encourage active engagement, build knowledge through exploration, and develop students' analytical skills. By following the stages of Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend, students can understand problems more deeply, plan solutions effectively, and evaluate results more critically.

Research trends during this period also show dominance in 2021 with the highest number of articles, while the educational level most frequently researched is SMP/MTs. In terms of research methods, the quantitative approach is the most widely used. This confirms that the model *Learning Cycle 7E* is a good approach in efforts to improve mathematical problem-solving abilities, especially at the secondary education level.

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