Systematic Literature Review: Mathematical Creative Thinking Ability in View of *Self-Confidence* in PBL Models Assisted by LKS Open Ended Question

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Abstract

PISA (Program for International Student Assessment) research from 2018 revealed that Indonesian students' capacities for creative thought were comparatively poor, ranking just 74th out of 79 nations with averaging a score of 379. This shows that the Indonesia's application of education is not optimal. Students need high creativity in the thinking process. This study's goal is to describe the to think creatively mathematically in terms of *self-confidence* in the PBL model assisted by LKS open ended questions. The capacity to think in terms of creatively and mathematically of trust in the PBL model with the use of LKS open-ended questions was studied using the systematic literature review (SLR) technique for studies published in 2016–2023. There are 23 national and international articles publications were found in the Google Scholar database. The outcomes demonstrated that the PBL model assisted by LKS open ended questions have a significant relationship positive effect on increasing students' mathematical creative thinking abilities in terms of self-confidence.

Keywords: *Ability to think creatively, Self-confidence, PBL, LKS Open Ended*

1. Introduction

Mathematics is a universal science that has a major role in developments in the fields of science, technology, and information (Istiqomah & Prihatnani, 2019; Muhtadi, Rochmad, & Isnarto, 2021; Sutarsa & Puspitasari 2021). Basic mathematics from various scientific disciplines because math must be a part of science. (Luritawaty, 2019; Lesi & Nuraeni, 2021). Therefore, mathematics lessons are given at every educational level in Indonesia beginning with elementary school to tertiary institutions with the aim of cultivating and developing job skills as well as the capacity to think clearly, analytically, methodically, critically, and creatively with students (Firdausi, et al., 2018; Nursyeli & Puspitasari, 2021).

One of the mathematical competencies that is expected to be developed in schools is student competence in terms of the ability to think creatively mathematically (Wulandari, Suwarto, & Novaliyosi, 2021). The process of developing ideas through creative thinking stresses the qualities of fluency, adaptability, novelty, and detail (Isaksen and Treffinger, in Fitriarosah, 2016). Creative thinking is one of the abilities that must be fostered through instruction in educational institutions, one of which is mastering mathematics. Mathematical creativity is the capacity to generate and discover novel ideas that are distinctive, unique, exceptional, and have definite and exact outcomes (Andiyana, et al., 2018; Rizti & Prihatnani, 2021). According to Torrance (1981), there are four creative aptitudes that can produce creative mindsets. Fluency, flexibility, originality, and elaboration are among these ability.

Apart from the the capacity for creative and mathematical thought as a cognitive aspect, there are also other important things that must be considered in learning activities (Aggraeni & Sundayana, 2021). This is the affective aspect. Affective aspects that must be considered for example self-confidence. According to Dewi & Minarti (2018), self-confidence means a sentiment of confidence in one's capacity for success certain achievements. Trisnawati, et al., (2018) stated that self-confidence consists of four indicators, namely a) Belief in one's own abilities; b) Be autonomous in decision-making; c) a healthy sense of self; d) Dare to voice opinions during discussions; e) Dare to face challenges.

Yates (in Hendriana, dkk., 2017) stresses that trust in oneself is crucial for students to succeed in learning mathematics. Based on the outcomes of Suhardita's research (2010), students will gain self-confidence from life experiences and relate to the ability to do things well. Thus with self-confidence students be capable to actualize the potential that exists in them. Self-confidence is also closely related to the ability to think creatively mathematically (Özreçberoğlu & Çağanağa, 2018; Maskur, et al., 2020). A creative person is a confident person (Herawati, et al., 2019).

One learning model that can be used as an alternative so that students' creative thinking abilities and students' self-confidence can be trained is problem-based learning. According to Riyanto (2010) suggests that, "Problem-Based Learning is a learning model designed to develop students' ability to solve problems.". Problem-Based Learning requires students to be able to solve problems given in their own way. In other words, students are required to think creatively and are required to increase their self-confidence in order to solve the problem.

According to Duch (Riyanto, 2010) stated "Problem-Based Learning is a learning model that faces the challenge of 'learning to learn'. Active members of the group work together to find solutions to problems. This problem serves as a reference for students to formulate, analyze, and apply it. To support Problem-Based Learning, we need a media that can help guide students in the learning process. One of the media that can be used in the implementation of problem-based models is LKS.

Worksheets (Student Worksheets) that are suitable for use in the problem-based model are worksheets that support the stages (syntax) of the problem-based model itself, namely worksheets that require students to explore and generate possibilities for solving a problem. Takashi as cited by Qulub et al. (2015: 2), open ended questions are questions that have many solutions or settlement strategies. Giving open questions to students can require students to think about more than one alternative answer which is expected to develop students' mathematical thinking abilities and increase students' self-confidence.

Based on this background, the purpose of this study is to describe the capabilities for creative mathematical thinking in terms of self-confidence in the PBL model assisted by LKS open ended questions which are comprehensive (1) to describe the purpose and research methodology employed; (2) to describe the media and learning model that were chosen ; (3) to describe of 2016-2023 research trends connected to the PBL model assisted by LKS open ended question on the ability to think creatively mathematically in terms of self-confidence.

2. Method

SLR, or *systematic literature review*, was employed in this study. Research is a procedure with the purpose of identifying, assessing, and fending against certain already existing research. In this study, the researchers conducted a systematic review and identified several articles that were well structured and adhered to a consistent format (Triandini et al., 2019), among other things as listed below. First, *Research Question* (RQ). RQ was created based on requirements that were in line with the selected topic. RQ in this study includes (RQ1) What is the purpose and type of research methods used in this article regarding the analysis of mathematical creative thinking skills in terms of self-confidence in PBL models assisted by open ended question LKS in 2016-2023?; What models and learning media are used in articles regarding mathematical creative thinking ability in terms of self-confidence in PBL model assisted by LKS open ended question in 2016-2023?; (RQ3) What research trends regarding the ability to think creatively mathematically in terms of self-confidence in the PBL model assisted by LKS open ended question .

Second *search procedure*. The goal of this search procedure is to gather relevant data to answer the research question. The search is carried out using the Google Scholar database using key words creative thinking ability, Self-Confidence, PBL, and LKS Open Ended . Third, standards for inclusion and exclusion. Criteria that are inclusive and exclusive are used to determine if the data that has been obtained may be used in SLR research or not. The inclusion and exclusion criteria can be seen in the table.

Table 2. 1 Inclusion and Exclusion Criteria

Inclusion	Exclusion
Relevant National or International articles the ability to think creatively mathematically in terms of *self-confidence* in the PBL model assisted by LKS open ended question	Irrelevant National or International articles the ability to think creatively mathematically in terms of *self-confidence* in the PBL model assisted by LKS open ended questions
Article that is appropriate for the title and research topic, whether national or international.	National or international articles that don't match the title and research topic.
Articles published between 2016 and 2023.	Articles that was published before the year 2016.
Language that is spoken, either Indonesian or English..	Languages other than Indonesian or English that are used.

Fourth, *Quality Assessment* (QA). The data that has been obtained is evaluated based on the assessment criteria. QA in this study focuses on (QA1) Is this article published between 2016 and 2023?; (QA2) Does the data in the article state on the purpose of the study or the type of study that was used?; (QA3) Does the article write down the learning model and media used? From the above three questions, either a yes or no answer will be given.. Fifth, *data collection* Data that is used in this study as a starting point for analysis is data that was gathered by observation, interviews, or other means that satisfied the study's specific needs. Then, data analysis. The data that has been obtained and collected will be analyzed referring to the Research Question (RQ). Lastly, deviation from protocol.

3. Results and Discussion

There are 23 articles retrieved that are relevant to the keywords that have been determined. Then, the researcher review relevant articles related to the analysis of mathematical creative thinking skills in terms of *self-confidence* in the PBL model assisted by LKS open ended question.

Table 3. 1 Research Results of Mathematical Creative Thinking Ability Reviewed From Self-Confidence in the PBL Model Assisted by LKS Open Ended Question.

Source	Author, Year	Journal/Proceedings	Research result
Google Scholar	(Dalilan & Sofyan, 2022)	*Plusminus: Journal of Mathematics Education*	*Self-confidence* students influence students' mathematical creative thinking abilities.
Google Scholar	(Trisnawati et al., 2018)	*JPMI (Journal of Innovative Mathematics Learning)*	*Self confidence* has an effect on increasing students' mathematical creative thinking.
Google Scholar	(Eviliasani et al., 2018)	*JPMI (Journal of Innovative Mathematics Learning)*	Confidence affects students' mathematical creative thinking abilities.
Google Scholar	(Safitri et al., 2021)	*MATH LOCUS:Journal of Research and Innovation in*	Students with very high levels of self-assurance will demonstrate exceptionally innovative levels of thinking on measures of fluency,

		Mathematics Education	flexibility, and novelty, while students with good on fluency and flexibility indications, *self-confidence* will have a very high degree of creative thinking capacity.
Google Scholar	(Selfani et al., 2022)	*Research in the Mathematical and Natural Sciences*	The application of the Problem Based Learning model in learning has a significant influence on students' creative thinking abilities in the material of cubes and blocks.
Google Scholar	(Septian & Rizkiandi, 2017)	*Prism Journal*	When using the Problem Based Learning style of instruction, students learn more effectively and efficiently than when using more traditional methods of instruction.
Google Scholar	(Yulia, 2016)	*Pasundan Journal of Mathematics Education Journal of Mathematics Education*	1) Improving the creative thinking skills of students who get problem-based learning is better than students who get learning 2) There is a relationship between students' creative thinking abilities and students' self-confidence.
Google Scholar	(Handayani & Koeswanti, 2021)	*Basicedu Journal*	The capacity for creative thinking with students in a problem-based learning model can increased by lowest score of 2,65%, a maximum of 19,90%, and an averageincrease of 11,28%.
Google Scholar	(Ardeniyansah & Rosnawati, 2018)	*Journal of Physics*	The PBL model is an alternative teaching method that can

			improve students' ability for creative thinking. .
Google Scholar	(Rukhmana, 2022)	*EduResearch*	There is an influence on the ability to think creatively in learning mathematics that uses the PBL learning model and those that do not use the PBL learning model.
Google Scholar	(Telaumbanua, 2022)	*Educativo: Journal of Education*	Students' ability to think creatively mathematically by using a problem-based learning model is in a fairly creative qualification.
Google Scholar	(Aminy et al., 2021)	*Malikussaleh Mathematics Education Journal*	Improving creative mathematical thinking skills when using the Problem Based Learning learning model, students do better than when using a scientific approach
Google Scholar	(Nurlaeli, 2022)	*Journal of Tambusai Education*	The problem based learning (PBL) model has positive effects on students' creative thinking abilities
Google Scholar	(Masfufah et al., 2018)	*JPMI (Journal of Innovative Mathematics Learning)*	There is a significant connection between *self-confidence* and creativity, the higher the *self-confidence*, the higher the students' mathematical creative thinking ability..
Google Scholar	(Herawati et al., 2019)	*Journal of Authentic Research on Mathematics Education (JARME)*	All indicators on *self-confidence* are related to students' mathematical creative thinking abilities.

Google Scholar	(Pramudya, 2021)	Doctoral dissertation, Sriwijaya University	There is a relationship between the ability to think creatively and students' *self-confidence*.
Google Scholar	(Mimbarwati et al., 2023)	*Journal on Education*	Students' *self-confidence* and students' ability to think creatively in mathematics have a positive relationship and influence each other balanced improvement
Google Scholar	(Faishol et al., 2016)	*PRISMA, Proceedings of the National Mathematics Seminar*	The improvement of students' mathematical creative thinking abilities that were given PBL learning with open-ended questions was better than the class that was given conventional learning.
Google Scholar	(Nurbaiti & Marbun, 2019)	*Journal of Education And Development*	The resulting open-ended based LKS is effective, because it is seen that during learning with LKS it improves students' creative thinking.
Google Scholar	(Mahendrawan et al., 2022)	*Scholar's Journal: Journal of Mathematics Education*	When compared to the conventional approach, the use of LKS Problem Based Learning (PBL) is more effective in terms of mathematical creative thinking abilities.
Google Scholar	(Novyani et al., 2021)	*JOURNAL OF SYLOGISM: A Study of Mathematics and Its Learning*	Mathematical worksheets based on open-ended problems on the SPLDV material developed meet the criteria of validity, practicality and effectiveness.

Google Scholar	(Ledy et al., 2023)	*Journal of Mathematics Learning Development*	Students' high levels of self-confidence also have an impact on their high levels of mathematical creativity.
Google Scholar	(Gunawan et al., 2022)	*International Journal of Instruction*	The development of creative thinking abilities is closely correlated with confidence.

(RQ1) What purpose and types of research methodology used in article's discussion mathematical creative thinking ability in terms of *self-confidence* in the 2016-2023 open ended question LKS-assisted PBL model?

In **Figure 3. 1** below, it shows that research found in 2016-2023 regarding the mathematical creative thinking ability in terms of *self-confidence* in the 2016-2023 open ended question LKS assisted PBL model, there are variations in research focus. There are 5 research focuses found from 23 articlesFocusing on self-confidence and creative capacity, as well as trying to understand how PBL affects creative capacity, led to a similar percentage of respondents, or about 39%. As a result, it can be inferred that research conducted between 2016 and 2023 on the subject of mathematic creativity abilities was focused on the relationship between self-confidence and creative thinking as well as the influence of PBL on creative thinking. There is a correlation between self-confidence and the capacity to engage in creative thinking.

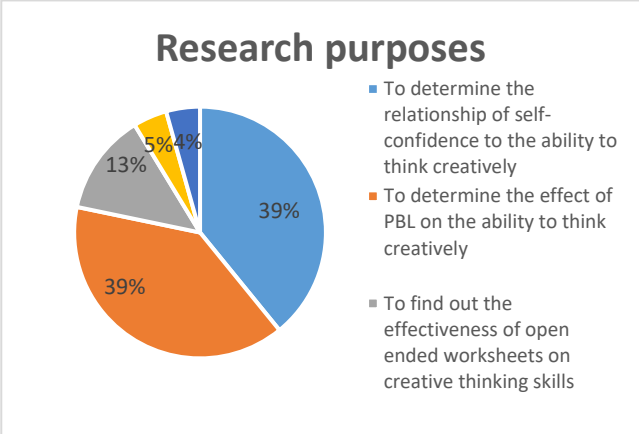

Figure 3. 1 Research Objectives

While Focusing research on the effectiveness of LKS open ended questions with regard to creative problem-solving capacity yields a 13% response rate. Dissimilarly, the emphasis on the analysis of creative math skills in PBL models with long open-ended questions can still be successful and has the opportunity to be extended, both of which are necessities for understanding the Society 5.0 age.

In **Figure 3. 2** below, it shows that 7 different forms of research are employed in 23 publications in the analysis of mathematical creative thinking skills in terms of *self-confidence* in the PBL model assisted by LKS open ended question texts published in 2016-2023. Qualitative a study with a 31% percentage, Give evidence that this type research is being used more and more in studies about analysis of mathematical creative thinking abilities in terms of *self-confidence* in PBL models assisted by LKS open ended questions.

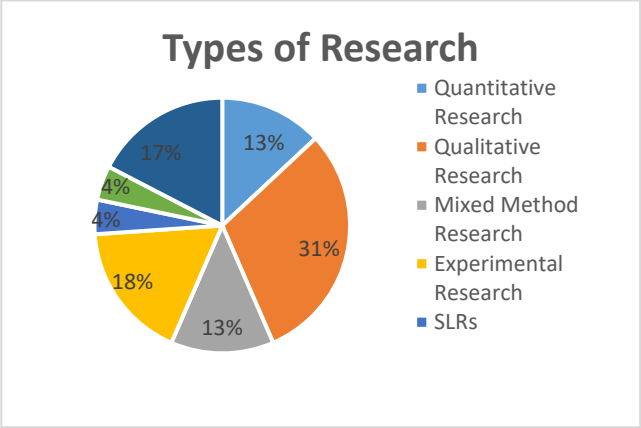

Figure 3. 2 Types of Research

(RQ2) What models and learning media used in an article mathematical creative thinking abilities in terms of *self-confidence* in the PBL Models assisted by LKS open ended question in 2016-2023?

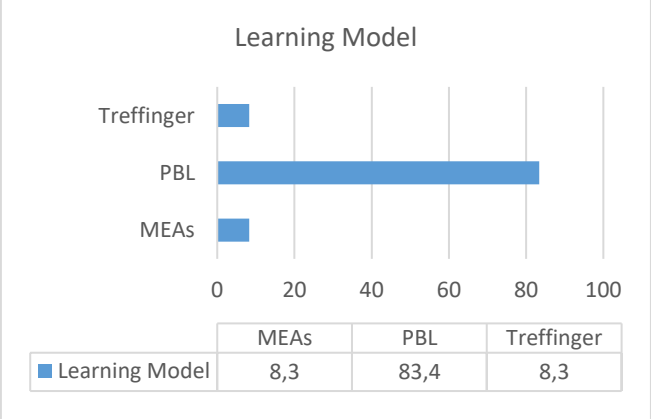

Figure 3. 3 Learning Model

In **Figure 3. 3**, the model of instruction that was used to analyze the creative ability of self-confident students using PBL models with open-ended questions for the years 2016 to 2023 is shown. The figure demonstrates that the PBL model frequently appears in published research in 2016-2023.

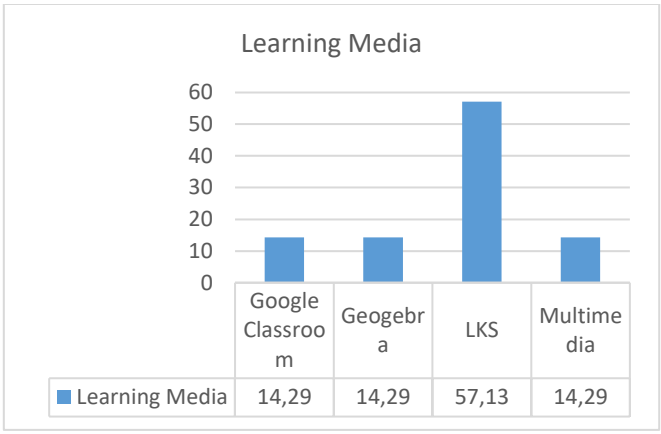

Figure 3. 4 Learning Media

Then, **Figure 3. 4** illustrates the media that were used in the study on the analysis of the creative potential of self-confidence in PBL models with open-ended questions for the years 2016 to 2023. The figure shows that the learning media for choosing worksheets are widely chosen in research.

(RQ3) What are the research trends abaout the ability to think creatively mathematically in terms of *self-confidence* in the PBL Models assisted by LKS open ended question?

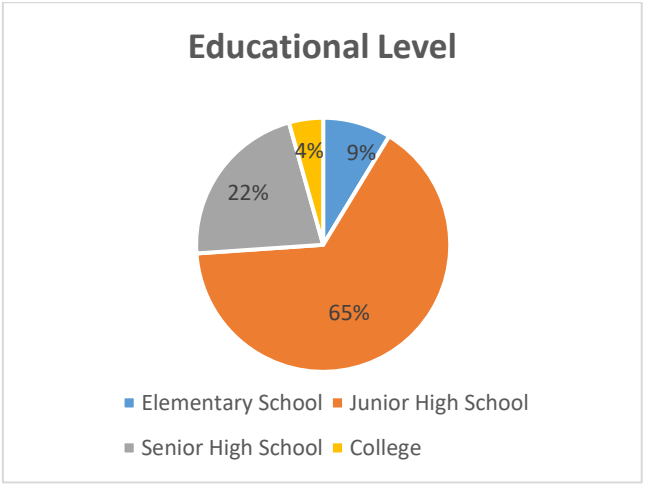

Figure 3. 5 Educational Level

Figure 3. 5 shows research at the tertiary level shows a percentage of College 4%, Senior High School 22%, Junior High School 65%, and Elementary School 9%. In conlusion that research on creative thinking skills in terms of *self-confidence* in the PBL model assisted by open ended questions tends to be conducted in junior high schools.

4. Conclusion

Based on the findings and analysis of the examination of 23 publications published between 2016 and 2023, in coclusion. First, was found to have a tendency to test the

relationship of *self-confidence* to the ability to think creatively and to determine the effect of PBL on the ability to think creatively. Second, was found to tend to use the PBL model and use LKS learning media. Third, research on creative thinking skills in terms of self-confidence in the PBL model assisted by LKS open ended questions is more often done at the junior high school level.

Furthermore, from the results get, seems like that the PBL model research assisted by the open ended question LKS in the method or model is still relevant for further research related to the effectiveness of mathematical creative thinking abilities.

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