



## Problem-solving and creative thinking skills with the PBL model: The concept of the human circulatory system

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### ABSTRACT

Science learning in elementary schools using the PBL learning model can grow students' higher-order thinking skills, such as problem-solving and creative thinking skills. The purpose of correlational research was to analyze the relationship between problem-solving and creative thinking skills of elementary school students through the implementation of PBL. The predictor variables and criteria in the research were in the form of problem-solving and creative thinking skills, respectively. The population of this study was the fifth-grade elementary school students, totaling 120 students. This study's sample was 33 students. The data retrieval used problem-solving and creative thinking skills tests on the concept of the human circulatory system. The data analysis was performed by linear regression. The results showed a correlation between creative thinking and problem-solving skills in learning with PBL. There is a strong relationship between problem-solving and creative thinking skills through PBL. The predictor variable contributed 37.8% to the criterion variable. This study recommends that it is essential to familiarize PBL in elementary schools learning to improve students' higher-order thinking skills.

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## INTRODUCTION

Problem-solving is one of the crucial skills in today's era. Problem-solving is a way of learning to develop effectively (Mintrop & Zumpe, 2019). Critical thinking skills and problem-solving are two essential criteria for students. It can be found in several cases in developed countries, such as Australia's psychology graduates (Haw, 2011). In Singapore, students develop problem-solving skills in learning mathematics integrated into technology (Jinfa Cai, 2003). Problem-solving skills are introduced to students since they are in grade 1 in Japan (Mogari & Lupahla, 2013). In addition, the education curriculum in Turkey is developed to train students' problem-solving skills (Öztürk et al., 2020).

Problem-solving skills are generally defined as a person's ability to engage in cognitive processes to understand and solve problems in everyday life (Shute et al., 2016; Çiftci & Bildiren, 2020). According to the Organization for Economic Cooperation and Development (OECD), problem-solving skills also include the motivation to engage with situations so that one develops potential as a constructive and reflective citizen. A recent OECD report showed that students in the US were ranked 15th out of 44 participating countries in the Program for International Student Assessment (PISA). (OECD, 2014).

A recent survey of business leaders conducted by the Association of American Colleges and Universities showed that as many as 24% of employed American college graduates could analyze and solve complex problems in the workplace (Hart Research Associates, 2015). Therefore, problem-solving skills are fundamental as navigation in learning at school, career, and in life in the real world (Serdyukov, 2017). Researchers have studied problem-solving for decades. It is seen as one of the most critical cognitive skills in any profession and everyday life (Roesler, 2016; Klegeris et al., 2019). A person is not born with problem-solving skills. On the other hand, these skills can be developed when they have the opportunity to solve problems (Jinghong Cai & Gut, 2020).

Currently, many studies have been conducted; among others, computers and video games are used effectively to develop problem-solving skills and improve children's memory (Granic et al., 2014). In addition, problem-solving skills are essential attributes in clinical psychology to reduce patients' fear, anxiety, and depression (Akechi et al., 2014). Problem-solving skills are also used to overcome student addiction to the internet (Ekinci, 2014). Problem-solving in mathematics is also helpful in (Kohen et al., 2019; Öztürk et al., 2020), science (Akben, 2020), entrepreneurs, and engineering scholars (Dickson, 2006), and sports (Senduran & Amman, 2015).

Problem-solving skills are cognitive-behavioral processes to identify, change, and find and apply alternative approaches to achieve goals. Therefore, problem-solving skills are closely related to creativity (Kim et al., 2019). The problem-solving process often includes gathering data and information needed to solve a problem, planning, implementing, and evaluating actions, using social networks, and exchanging knowledge and information with others through communication. Therefore, several studies have included analytic thinking, flexible thinking, and openness to new relationships as factors comprising problem-solving competence (Buchwald et al., 2015). In addition to the cognitive and problem-solving aspects, it also involves an emotional aspect. Positive emotions, such as joy or hope, can expand and build an individual's mind and become more open to new challenges and a creator. Cognitive and emotional aspects interact dynamically so that they can facilitate or hinder the problem-solving process. Some literature says that problem-solving skills are cognitive, emotional, and needed to identify problems and find solutions. A problem is a challenge, and a person is usually confident in dealing with it (Lee & Lee, 2020). Therefore, scientists feel called to solve complex and unstructured problems to serve the needs of society (Molnár & Csapó, 2018).

Currently, students are expected to learn collaboratively, but most students state that not all collaborative learning can solve problems. Some also assume that they prefer to learn independently. The collaboration aims to develop knowledge, train thinking skills, find joint solutions, increase motivation and build communication between colleagues (Rosen et al., 2020). In addition, improving cognitive processes can be done with attention, memory, reasoning, and thinking (Bruijnicks et al., 2020). Problem-solving skills have become a focus for addressing the challenges of education and learners in the 21st century (Stoeffler et al., 2020). In addition, creative thinking skills are also currently needed in addition to problem-solving (Hidayat et al., 2018).

Creative thinking skills are thought processes that produce new and broad ideas in various

ways. Guilford (1950) revealed that the creative thinking process involves fluency, flexibility, originality, and elaboration. These skills are strongly influenced by student efficacy. A study shows a significant relationship between creativity and self-efficacy (Du et al., 2020). Self-efficacy is defined as a belief in showing new actions taken to solve particular problems to achieve goals (Jaiswal & Dhar, 2016). Problem-solving skills are essential abilities possessed by students because they can motivate them to create and research their theories, check their friends' theories, delete them if they are inconsistent, and try other theories (Hämäläinen et al., 2017). The conclusion that can be drawn is that problem-solving skills are an action to solve problems or processes that utilize the mathematics and science mastered to solve problems. It can also be defined as a method for finding solutions through problem-solving steps (Zhang et al., 2019).

The alpha generation is elementary school students prepared to face the challenges of the industrial revolution 4.0 by having problem-solving and creative thinking skills (Nagy & Kölcsey, 2017). Problem-solving and creative thinking skills are mandatory so that students can compete globally in this revolution (Ceylan, 2020). The results of research in the field revealed that the creative thinking skills of elementary school students in the Aru Islands Regency, Indonesia were very disappointing in the moderate category (Leasa et al., 2021). Other findings also indicate that students' creative thinking skills in the original and elaboration categories are still low in high school students in Malang City, Indonesia (Batlolona et al., 2019). Several research reports show that most students' problem-solving skills are not satisfactory (Abdollahi et al., 2016; Argaw et al., 2017). Lack of creative thinking and problem-solving skills can be solved by training students to improve creative thinking and problem-solving skills (Khalid et al., 2020). In addition, there are many studies on improving students' creative thinking skills and problem-solving that have been carried out by sharing various models and innovative learning models (Yu et al., 2015).

Various research reports are still focused on the study of PBL on the variables of problem-solving skills and creative thinking separately. The implementation of PBL in the learning of problem-solving skills has been reported (Aslan, 2021). Several research studies focused on the influence of PBL on creative thinking skills were also reported by several researchers (Chan, 2013; Dawilai et al., 2021). Research on PBL studies on problem-solving and creative thinking skills in science is fascinating because it is contextual and helps students relate learning to real-life practice. Research examining the two leading variables in contemporary learning with PBL is limited. However, PBL can be implemented in various disciplines (McCrum, 2017). One of them is by using the concept of the circulatory system, so it is not merely rote. Such learning is more applicable, helping students to have experience solving problems and building more creative thinking, especially for elementary school students (Leggett, 2017).

PBL was first adopted in medical teaching at McMaster University, Canada (Servant-Miklos, 2019). PBL can promote critical thinking and problem-solving in authentic learning to lead to positive learning outcomes. Many research results said that PBL directs students to think constructively, independently, collaboratively, and contextually (Yew & Goh, 2016). Based on the existing problems, the purpose of this study was to analyze the relationship between problem-solving skills and creative thinking of elementary school students through the application of the PBL learning model.

## **METHODS**

### **Research Design**

This correlational research was conducted to analyze the problem-solving skills of elementary students' creative thinking through applying the PBL learning model. Problem-solving skills as predictor variables, and creative thinking skills as criterion variables.

### **Population and Samples**

The study was conducted in Ambon City in September-November 2020. This study involved 105 fifth-grade elementary school students as a population. The characteristics of the population taken are schools that carried out learning with the PBL model through *visiting teachers* in student study groups during learning in the Covid-19 Pandemic by following health protocols. The sample of this study amounted to 33 students, which were taken randomly.

## **Instrument**

The research instrument is problem-solving and creative thinking skills tests in the form of an essay. The subject matter of the test refers only to the concept of the human circulatory system. The problem-solving test instrument consisted of formulating problems, formulating hypotheses, collecting data, and conducting inferences/problems consists of 10 questions referring to Sanjaya (2006), which consists of 4 indicators, namely: formulating problems, formulating hypotheses, collecting data, and drawing conclusions. In addition, the creative thinking skills test instrument consists of 8 questions referring to Torrance (2006): fluent thinking, flexible thinking, original thinking, and elaborative thinking. Before being used, this question had been validated by experts in biology learning from the State University of Malang. This test instrument has also met the instrument eligibility criteria from validity and trust level (reliability).

## **Procedure**

This research was conducted by following several procedures. After a survey of learning activities in elementary schools during the Covid-19 pandemic was carried out, it was decided that PBL learning was carried out asynchronously online combined with offline learning through teacher visits to study groups based on the schedule that had been prepared. It was followed by the practice of science learning on the concept of the human circulatory system using PBL every week as much as one meeting in a learning time duration of 3 x 35 minutes in each meeting for five meetings. They used PBL learning tools in the form of lesson plans (RPP) and student worksheets (LKPD) to follow the PBL flow. The learning is more focused on practicing problem-solving and creative thinking skills. The trick was to train students to solve the problem and think creatively related to the concept of the circulatory system. It could be seen in the design of the lesson plans and worksheets and their implementation in learning. The consistency of learning with PBL was ensured through observations of the implementation of learning with PBL carried out by teachers and students to ensure that all PBL syntax was carried out properly by the teacher. The PBL syntax includes orientation of student participants to problems, organizing students to learn, guiding individual/group investigations, developing and presenting work, and analyzing and evaluating problem-solving processes (Arends, 2015). After all learning activities were completed, the last step was to give a final test/posttest of problem-solving skills and creative thinking.

## **Data Analysis Techniques**

Student test results were corrected by referring to the rubric of problem-solving skills (Sanjaya, 2006) and creative thinking skills (Torrance, 2006) with a score range of 1-4. The test data were then tabulated and analyzed using linear regression with the assistance of the SPSS 16.00 program after all data met the criteria for normality and homogeneity. The normality and homogeneity values are 0.837 and 0.11, respectively.

## **RESULTS AND DISCUSSION**

Science learning for students on the concept of the human circulatory system using the PBL model was organized in 5 meetings. Learning was carried out with different subject matter at each meeting. The primary materials include circulatory organs (heart and blood vessels), the circulatory organs functions, the process of blood circulation, disorders of the circulatory organs, and how to maintain the health of the circulatory organs. In general, the learning syntax was the same, only the content of the subject matter was different. PBL's syntaxes began with initial activities, namely praying, attending, and delivering learning objectives. At first, students will focus on the material of the human circulatory organ (heart) and then orientation to the problem. The teacher asked several questions how are nutrients and oxygen distributed throughout the body? What happens if the body lacks nutrients and oxygen? Some students answered that nutrients and oxygen were circulated through the blood. If the body lacks nutrients and oxygen, it means that humans can die. Next, students observed pictures of the circulatory organ in the heart while the teacher explained to students the parts of the heart, the function of the heart, and the work of the heart in circulating blood throughout the body.

The second stage was to organize students to study. The teacher divided students into 2-3 study groups and then shared LKPD 1 (heart topic) to be studied in groups and became students' work instructions. Students read a discourse about the human heart and then formulated problems (questions) and hypotheses from the discourse.

Stage 3 was guiding individual investigations. In this activity, students did a human heart rate practicum. Each student sat in the group quietly. Then, they felt the veins on the left wrist with the right hand's index, middle, and ring fingers. Next, they pressed the three fingers until they felt the pulse. After that, they counted the pulse for one minute, then recorded the results in the table in the LKPD. In addition, students were also asked to run in place for 1 minute and 2 minutes, then wrote down their pulse and the conclusion of the activity. Furthermore, students also discussed several questions related to problem-solving skills and creative thinking, among others:

1. Based on the data in the observations table of the pulses, what can be concluded?
2. There are four steps that a person can take to find out the number of pulses per minute, explain those steps in your own words!
3. Based on the activity of checking the pulse and the data in Table 1, in your opinion, what factors can cause different pulse rates among people? Explain these 3-4 factors!
4. Dirty blood accommodated in the right atrium from all over the body needs to be cleaned again. Sequence 3-4 steps how the heart works to clean the dirty blood!
5. The human heart is only the size of a fist, but it works non-stop every day. Why do you think the heart can work to pump blood throughout the body?

All questions on the LKPD in each meeting were developed based on variable problem-solving and creative thinking skills indicators.

The fourth stage was presenting the work. Students were asked to prepare their work in the LKPD or on manila cardboard. Students also wrote solutions that were relevant to the problem formulation given previously. Students were also asked to write conclusions based on the results of group work and discussion. In the fifth stage, analyzing and evaluating the problem-solving process, students and teachers assessed group performance. In addition, the teacher also guided students to answer some reflection questions, including what have students learned? Are there any difficulties in learning the concept of circulatory organs? The learning ended with an oral evaluation, feedback on the learning process and results, and information delivery for activities at the next meeting. It was hoped that students' problem-solving and creative thinking skills could be developed during the learning process. The following shows some descriptions of the results of students' work on the posttest related to aspects of problem-solving skills.

**Table 1**  
The results of students answers for aspects of problem-solving skills

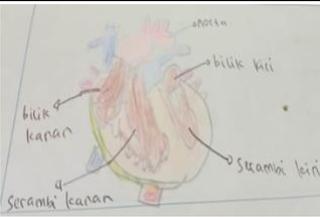
<b>Problem-solving Skills Indicator</b>	<b>Questions</b>	<b>Student Answers</b>	<b>Category</b>
Formulating problem	Make two problem formulations or questions based on the discourse of the human heart that is presented!	<ol style="list-style-type: none"> <li>1. Is there any effect of activity on a person's heart rate?</li> <li>2. Is there any effect when the heart beats fast?</li> </ol>	Very problem solver (4)
Formulating hypothesis	Make two hypotheses based on the questions developed from the discourse on the human heart!	<ol style="list-style-type: none"> <li>1. There is an effect of the activities carried out on a person's heart rate.</li> <li>2. Chest pain/chest feel like being crushed.</li> </ol>	Quite a problem solver (3)
Collecting data	Write down 4 data that you can collect about the heart from the discourse!	<ol style="list-style-type: none"> <li>1. The parts of the heart</li> <li>2. Definition of the heart</li> <li>3. How the heart works</li> </ol>	Less problem solver (2)
Making conclusions	Write a conclusion from the discourse of the human heart!	<ol style="list-style-type: none"> <li>1. Humans must be diligent in exercising so that the body is</li> </ol>	Significantly less problem solver (1)

Problem-solving Skills Indicator	Questions	Student Answers	Category
		healthy. 2. The heart beats about 60-100 times per minute	

Table 1. informs that the problem-solving indicators for students are considered very problem solvers because they provide problem formulations according to the topic of discourse, focus, and in the form of interrogative sentences, use precise language, and point to problem answers. In the indicator of formulating hypotheses, students only make one hypothesis that is right following the discourse. Namely, there is an effect of the activities carried out on a person's pulse. It is considered quite a problem solver. The formulation of the hypothesis answers following the formulation of the problem was supported by the data collected. It was formulated with a clear statement sentence. Students were asked to collect data related to the heart from the discourse. The data collected by students is precise but general and comes from discourse only (reliable sources). Therefore, it is considered less problem solver. In the indicator of making conclusions, students were asked to make conclusions from the heart discourse. However, these conclusions were irrelevant to the problem formulation, so they are considered fewer problem solvers. Therefore, the problem-solving indicator was developed from a discussion related to learning, namely about the heart. The same is true for other basic materials in the human circulatory system.

**Table 2**

Students answer results for aspects of creative thinking skills

Creative Thinking Skills Indicator	Questions	Students Answers	Category
Fluency	The human heart is the size of a fist and has four perfectly divided chambers, namely two atria and two chambers. Draw a human heart along with its parts!		4 (very creative)
Original	Hemophilia is a blood disorder in which the blood is difficult to clot. Design 3-4 ways that a person can do to avoid the risk of getting hemophilia.	<ol style="list-style-type: none"> <li>1. Avoid bleeding gums</li> <li>2. Avoid physical contact</li> <li>3. Avoid taking drugs without a doctor's prescription</li> </ol>	3 (quite creative)
Flexibility	Explain 3-4 reasons why human blood is red!	<ol style="list-style-type: none"> <li>1. Because it contains hemoglobin</li> <li>2. Hemoglobin is red</li> </ol>	2 (less creative)
Elaboration	Tell me about 3-4 steps of the small blood circulation process in humans!	<ol style="list-style-type: none"> <li>1. Right chamber</li> <li>2. Lungs</li> <li>3. Left atria</li> <li>4. Pulmonary arteries</li> </ol>	1 (not creative)

An overview of students' answers to the creative thinking skills variable is shown in Table 2 below. Students are instructed to draw a human heart with its parts (two atria and two ventricles). Students' answers were considered very creative because students can clearly and correctly describe all parts of the human heart consisting of the left atrium, right atrium, left ventricle, and right ventricle. In the original indicator, questions focused on hemophilia. Students were expected to design 3-4 ways to avoid the risk of developing hemophilia. There are two correct answers among the three student answers. There are two correct answers: avoiding bleeding gums and avoiding taking medicines

without a doctor's prescription. According to the answer, the students were considered quite creative. Students were asked to give 3-4 reasons why human blood is red in the flexibility indicator. The correct answer of the student was only 1, namely because it contains hemoglobin. The student was considered less creative. Students were asked to describe 3-4 steps of small blood circulation in humans in the elaboration indicator. The student's answer was considered incorrect but contained a few correct elements. The student answered by mentioning several organs and parts of the heart that play blood circulation. Therefore, students were categorized as not creative.

This study aimed to analyze the relationship between problem-solving and creative thinking skills. The results of ANOVA regarding the relationship between the two variables are as shown in Table 3. The analysis shows that the significance value is smaller than alpha 0.05, which means there is a relationship between problem-solving skills and creative thinking skills in learning the circulatory system with PBL.

**Table 3**

The ANOVA summary of the relationship between problem-solving and creative thinking skills with the PBL model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1321.782	1	1321.782	18.862	.000 <sup>a</sup>
	Residual	2172.400	31	70.077		
	Total	3494.182	32			

a. Predictors: (Constant), PM

b. Dependent Variable: KBK

Information regarding the contribution of problem-solving skills to creative thinking skills through PBL learning is shown in Table 4.

**Table 4**

The regression coefficient value between problem-solving and creative thinking skills with the PBL model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.615 <sup>a</sup>	.378	.358	8.37123

a. Predictors: (Constant), PM

The R-value on the correlation between problem-solving skills and creative thinking skills is 0.651, and the R<sup>2</sup> value is 0.378 or 37.8%. Thus, the aspect of problem-solving skills in learning with PBL contributes 37.8% to creative thinking skills. It means that other factors outside of problem-solving skills contributed as much as 62.2%. The regression equation analysis of the relationship between problem-solving skills and creative thinking skills in learning with PBL is shown in Table 5. Because the value of a = 46.505 and b = 0.445, the regression equation in the PBL learning model is  $Y = 46.505 + 0.445 X$ .

**Table 5**

The regression coefficient value between problem-solving skills and creative thinking with the PBL model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	46.505	5.481		8.484	.000
	PM	.445	.103	.615	4.343	.000

a. Dependent Variable: KBK

The research findings reveal a linear relationship between problem-solving and creative

thinking skills through learning with PBL. The relationship between the two variables is in the robust category ( $r$ -value = 0.65). It means that students' creative thinking skills can be predicted by problem-solving skills. In learning with PBL, students conducted investigations individually or in groups. Thus, it encouraged students to collect data or information in order to analyze problems with different styles. Data was collected by studying reading materials in LKPD, relevant books, discussions with friends or teachers. They even access information through online media, for example, by studying videos related to the subject matter. The teacher sent this video to students in the WA group and is also available on LKPD. This process helps students form their creative ideas. When students solve problems, they even think creatively to find various ways or solutions (Titus et al., 2018; Lim & Han, 2020).

The problem-solving process requires creative ideas. This process can occur spontaneously when a problem needs to be resolved. Usually, problem-solving is not done arbitrarily, but it really must be thought out carefully. Therefore, various creative ideas could be considered to decide which creative ideas were considered adequate to be a solution. More thorough problem identification is carried out to identify and explore a problem (Gallagher, 2015; Leasa et al., 2019). The solution produced by not understanding the problems may not solve the problem. However, it may have the potential to give birth to new problems. In this case, creative thinking is focused on identifying and exploring problems that need to be solved. It is like we find the correct file, so it helps in handling it.

Problem-solving is the essence of creativity, but not all conditions are suitable for it. Problem-solving that can produce creativity contains novelty and originality (Mainert et al., 2018). Therefore, problem-solving does not guarantee to produce something original or a novelty dimension. In order to produce something new, higher thinking skills are needed. Students who can encourage problem-solving skills through creative ideas, insights, processes, or products that are new and unique, and have differences from those that have existed, even including things that have never been seen or thought of, are predicted to have superior creative thinking skills.

Learning with PBL is driven by problems. This process becomes an excellent opportunity to develop students' problem-solving and creative thinking skills. The precursor to any creative activity is a willingness to be fully involved in the problem space. In PBL, students learn to be more motivated in solving problems. Learning experiences that are formed through PBL are sometimes completely unrelated to previous knowledge. It means that PBL is a rich space that can train students to solve problems with various patterns and encourage the formation of student experiences in solving problems more creatively (Gallagher, 2015; Puccio et al., 2020; Hsia et al., 2021). In other words, PBL helps students to solve unstructured problems in a holistic transformation, which opens the door to authentic problem-solving more creatively.

In PBL, students are given problem scenarios (Dawood et al., 2021). They formulate and analyze the problem by identifying the relevant facts from the scenario. The fact identification step is enough to help students represent the problem. In this phase, students also know which knowledge is still needed in identifying the problem. These elements can be considered learning issues that are studied or investigated more deeply during learning with better self-regulation for learning.

In learning the concept of the circulatory system, students were given information in the form of discourse. The discourse was available in the LKPD so that it could be read by students repeatedly. For example, in the concept of blood vessels, the teacher provided a discourse about blood vessels. This condition could strengthen their understanding of blood vessels' meaning, types, characteristics, and functions. From this information, students could review it with other sources of information available on the video link provided by the teacher (<https://www.youtube.com/watch?v=QutmgcIzIEE>) and combine it with other references that students can access. In PBL, they were required to solve problems, so creative thinking was needed to find unique ideas or concepts. This idea was the result of deep thought and reflection. It could be seen in the questions given to students.

For example, the question asked 3-4 reasons why the pulmonary arteries are rich in carbon dioxide (CO<sub>2</sub>). This question could be answered if students paid attention to some of the information in the discourse: pulmonary arteries carry blood to the lungs, while systemic arteries carry blood to the head, liver, and lower body. That means the blood in the pulmonary arteries is dirty blood (rich in CO<sub>2</sub>); because it has not been brought to the lungs, the pulmonary arteries will carry dirty blood to be

cleaned in the lungs. Dirty blood comes from all over the body that is accommodated in the arteries. Another reason is that the pulmonary artery blood was previously in the right ventricle, which is also rich in CO<sub>2</sub> (Whittemore & Cooley, 2009). A learning environment rich in problems needs to be provided by the teacher in various forms such as discourse, phenomena, or cases related to learning materials. Therefore, the implementation of learning with PBL also requires strong information literacy to find, evaluate, and use information effectively and argumentation skills to produce coherent arguments (Wartono et al., 2018; Foo et al., 2021).

A learning environment with PBL helps students who have previously experienced learning failures and require additional academic skills to experience authentic learning. It is not only centered on the information presented or conveyed by the teacher. Learning with the PBL model provides a learning challenge that greatly motivates students with these limitations to develop their academic potential. Female students who had a lower pre-test than male students in learning science experienced a significant increase in the post-test. These findings indicate that PBL is very effective in learning for all categories or characteristics of students with different academic abilities (Gallagher & Gallagher, 2013). Learning with PBL is also considered quite fun for students compared to other classes in science learning. Students practiced their collaborative learning and self-regulation skills to become independent learners. They not only learn to solve problems through PBL, but they can also control their learning, collaborative work, and solve unstructured problems in an authentic context. It may not be found outside the learning environment with PBL (Chang et al., 2020; Ghani et al., 2021).

## CONCLUSION

The conclusion drawn from this study shows a correlation between creative thinking and problem-solving skills in PBL learning. There is a strong relationship between problem-solving skills and creative thinking through PBL. The predictor variable contributed 37.8% to the criterion variable. For elementary school students, learning with PBL requires teacher assistance and guidance, especially in introducing problems by presenting discourses or phenomena relevant to the content of the material. From this discourse, the teacher can raise various questions relevant to the indicators of problem-solving skills, including formulating problems, formulating hypotheses, collecting data, and making conclusions. Meanwhile, with PBL, students are also triggered to build divergent thinking. Students' thinking is broad and rich with new ideas in finding solutions to the problems they are experiencing. Thus, this study recommends that it is important to familiarize PBL in elementary schools to sharpen students' problem-solving and creative thinking skills. This study has contributed to the literature by 1) this study used the PBL learning model, which is generally considered to be rather challenging to implement in science learning in elementary schools because of the assumption that elementary students have not been trained to solve problems. 2) This research used PBL to grow and familiarize elementary school students with high-level thinking, especially problem-solving and creative thinking skills. These two competencies are superior in learning in the 21st century.

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