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Enhancing Children's Science Literacy Through the Use of Problem Based Learning Model

Lina Eka Retnaningsih [1, a*], Adisti Yuliastrin [2], Dwi Lyna Sari[3], Ferri Yonantha[1]
[1] STAIN Sultan Abdurrahman Kepri, Indonesia
[2] Universitas Terbuka, Indonesia
[3] Universitas Bengkulu, Indonesia
[a*] lina@stainkepri.ac.id

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ABSTRACT
This study is prompted by the low PISA scores in reading, math and science literacy. Science literacy is crucial to develop early when children are still in the foundation phase. The current Merdeka curriculum supports the development of science literacy. KB Tunas Harapan 1 Tunggunjagir rarely develops children's science literacy so that the phenomenon of low children's scientific literacy is found. The purpose of this study was to describe the process and results of applying the problem-based learning model to enhance children's science literacy skills at KB Tunas Harapan. This study is a classroom action research referring to the Kemmis and Mc Taggart model which consists of the stages of planning, action, observation and reflection. This research was conducted in 2 cycles where each cycle consisted of 6 meetings. The data were analyzed qualitatively and quantitatively. The results showed an increase in children's science literacy skills through the implementation of the problem-based learning model can be evidenced in the average pre-intervention score of 17.38 then increased in cycle I to 33.63 And in cycle 2 the average increase into 46.03 from the maximum score of 56.

INTRODUCTION

The Merdeka Curriculum is a happening discussion in the world of Indonesian education. Early childhood education is one of the levels of education that participates in using the independent curriculum in its learning reference.(Retnaningsih & Khairiyah, 2022)

Learning outcomes consisting of elements of Religious Values and Ethics, Identity, Literacy and Science, Technology, Engineering, Arts and Mathematics. Science has become indispensable in learning activities in every early childhood school unit. This also goes hand in hand with the rapid development of STEAM which is increasingly widespread, and has been widely applied to early childhood learning. In STEAM, the element that cannot be separated is Science. Science development in early childhood is certainly different from adults in general. The studies and materials developed, the way of development must of course pay attention to the characteristics of early childhood.

Science is inseparable in children's lives. Through the science process, children discover, observe, and learn from science objects encountered in the surrounding environment. Science literacy becomes very important and potential to start developing and nurturing in early childhood. (Handayani & Srinahyanti, 2018)

The development of scientific literacy needs to be introduced early because it is important to train children's scientific development and behavior (Sativa & Eliza, 2023). Science literacy is a discussion that is closely related to early childhood science

skills. It needs to be developed in children early on in the foundation period. Its activities will invite them to be able to build and develop science concepts as well as science skills that exist in children. (Anggreni et al., 2022)

Literacy is a government priority program where literacy is not limited to discussing the ability to write and read, but can be expanded understanding that can improve critical thinking skills, problem solving in a different context, effective communication, potential development, and active in society. (Rusdawati & Eliza, 2022)

In addition, science literacy is the ability of children to be able to explain, evaluate, make discoveries and interpret them so that they can be applied in real daily life. It is related to questions or money problems related to science (OECD, 2017). Understanding of scientific concepts and facts is the ultimate goal of science literacy. This literacy also allows children to not only be able to read, write, and talk about how science concepts but also have the ability to analyze, interpret, and make decisions in solving science problems. (Chen, 2019)

The application of science literacy in early childhood will make children able to be flexible and adaptive, able to interact socially, be productive, take independent fan initiatives and be able to think scientifically (Zahro et al., 2019). Conceptually, science literacy is part of the application of science content, so that to measure children's abilities in the field of science can be seen from the application of children's science literacy. (Widayati et al., 2020)

In 2018 the results of PISA Indonesia showed that Indonesia had decreased in rank to 72 out of 78 countries. These results include reading literacy 371, math literacy 379, followed by science literacy at 396 (Amini & Sinaga, 2021). These results show the low literacy in Indonesia, one of which is Science Literacy. The development of science literacy can be done since children are still in the foundation phase at the early childhood education level.

In KB Tunas Harapan, it can be seen that children's science literacy is still low, teachers rarely develop science literacy by using varied learning models, varied learning methods, and varied learning media that can support the development of early childhood science literacy. The selection of the right learning model is certainly a major factor in the success of learning or developing every ability and aspect of development in children. So far, it is still rare for science literacy to be developed in early childhood learning. One of the learning models that can develop children's science literacy skills is the problem-based learning (PBL) model.

The PBL model is a learning model with an active learning approach in solving problems that exist in everyday life in classroom learning. The main thing that characterizes this learning model is that learning activities are child-centered and the teacher acts as a facilitator and guide (Tarhan & Acar-Sesen, 2013). PBL aims to improve children's ability to think critically, analytically, logically and systematically to find solutions to problems through scientific activities (Wulandari & Suparno, 2020). Therefore, it is important to conduct this research to investigate if Problem Based Learning (PBL) learning model can improve early childhood science literacy.

METHOD

Using an Action Research type, this research was conducted in 2 cycles. The design model used was the Kemmis & Taggart model which consisted of four stages:

planning, action, observation, and reflection. The success criteria for the actions taken in this study were 71%, following the Mills standard. (Retnaningsih, et.al, 2023)

This research was conducted at KB Tunas Harapan. The subjects of this study were 24 playgroup children. The data were collected through observation, interview, and documentation. Then, they were analyzed quantitatively and qualitatively. The quantitative data analysis with descriptive statistics is used to compare the scores obtained during pre-intervention, cycle I and cycle II. Meanwhile, the qualitative data analysis was carried out by analyzing data from the results of field notes and interviews during the study with the steps: data reduction, data display, and data verification.

Before explaining the increase in children's literacy scores at KB Tunas Harapan, researchers firstly showed the instrument overview to observe children's science literacy skills. The valid and reliable Children's Literacy skill instrument overview was utilized to measure children's science literacy skills. The instrument overview can be seen from the table below: (Anggreni et al., 2022)

Table 1. The Instrument Overview of Children's Science Literacy Skills

Variable	Dimension	Indicator	Item
Children's Science Literacy Skills	Ability to use science knowledge	Explaining the process of natural phenomena	1,2
		Showing Information about science	3,4
		Explaining the new knowledge gained	5,6
	Ability to use science concepts (test observable events of the universe)	Experimenting the interaction of two objects	7,8
		Experimenting a simple natural event process	9,10
	Interest in Science	Exploring the natural environment	11,12
		Telling about science	13,14

Problem Based Learning Model has a syntax. The syntax in the problem-based learning model is described in the table below: (Arends, 2013)

Table 2. Steps of Problem Based Learning Model

No	Step	Activity
1	Provide problem-related orientation to the children	The teacher provides problems that must be solved by children and motivate children to be involved in solving problems posed by the teacher.
2	Prepare children for learning	The teacher assists children in organizing learning tasks linked to previously discovered problems.
3	Guide independent and group investigation	The teacher motivates the children to gather real information and encourage children to conduct experiments and find solutions to problems.
4	Develop and present the works	The teacher assists children in planning and preparing their work and presenting their work to others.
5	Analyze and evaluate the problem-solving process.	The teacher assists the children to evaluate the activity and the problem-solving process so that further learning can be improved.

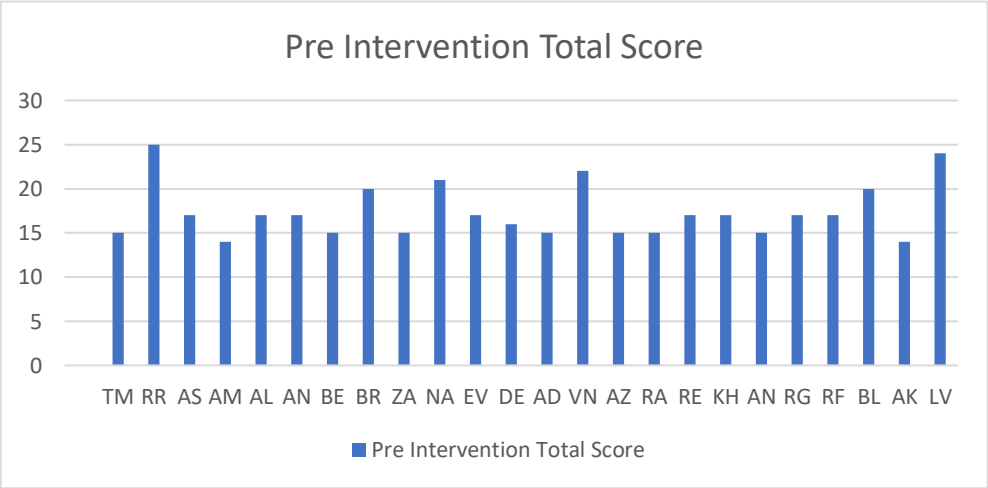
RESULT AND DISCUSSION

The implementation of PBL applied by teachers in learning activities has brought changes to the atmosphere of play activities more fun. The use of the model also provides an increase in children's science literacy. The increase in early childhood literacy scores is measured by the instrument grids used to observe children's science literacy skills.

In the results of this study, the scores of children at the time of pre-intervention, cycle I, and cycle 2 are shown. Afterwards the results explain about how children's science literacy skills has improved in each cycle.

Pre-Intervention

Pre-intervention is referred to as an initial assessment to find out how the initial condition of the science literacy skills of KB Tunas Harapan children. The pre-intervention of children's science literacy is as follows:

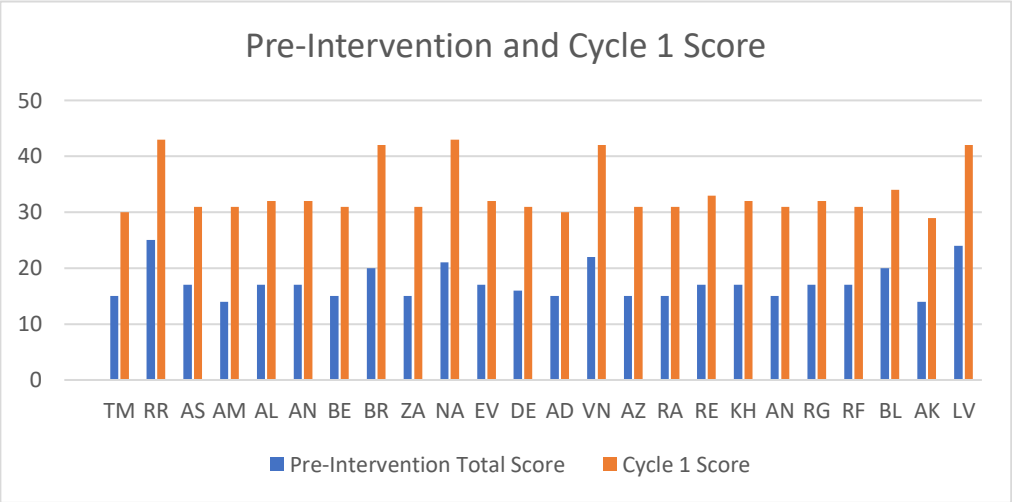


Picture 1. Pre-Intervention Score

From the graph above, it can be seen that the highest score of children's science literacy skills was obtained by RR with a total score of 25 from a maximum score of 56. While the lowest score was obtained by AM and AK with a score of 14 out of 56. Based on the pre-intervention results in the initial assessment, the researchers provided a program to improve children's science literacy skills by applying the Problem Based Learning model.

Cycle 1

Observations made in cycle 1 were carried out to determine the score of children's science literacy skills after being given the action of the Problem Based Learning model. The observation data of group children's science literacy skills in cycle 1 can be seen from the graph below.



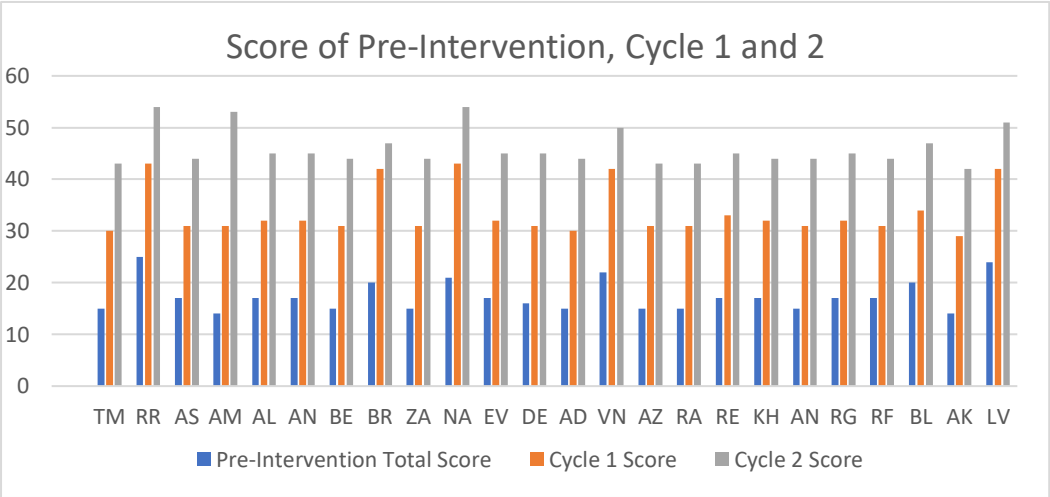
Picture 2. Pre-Intervention and Cycle 1 Score

Based on the graph above, it can be seen that in cycle I, children's science literacy skills were likely to improve compared to children's science literacy skills in the pre-intervention. This can be seen from the improvement of all children from pre-intervention to cycle I. The average score of children increased from pre-intervention 17.38 to 33.63 from a maximum score of 56. Thus, it can be concluded the result of cycle 1 has not reached the minimum score of the developmental achievement level of 75% of the maximum score of 56 in which its score is 42. It also has not reached the criteria of 71% of the number of children. 14 out of 24 children could only reach the minimum score of 42. The highest score was obtained by RR and NA with a score of 43 which means that it has reached the minimum score of 75% of the maximum score of 56. While the lowest score was obtained by AK with a score of 29 which means that it has not reached the minimum score of the developmental achievement level of 75% of the maximum score of 56, exactly at the score of 42.

In accordance with what is stated above, the researchers continued to cycle II. This was conducted to improve children's science literacy skills to reach the predetermined targets by evaluating and correcting the shortcomings that exist in cycle 1.

Cycle 2

Observation in cycle 2 was carried out to determine the score of science literacy skills obtained by children after giving the action of the Problem Based Learning model. The implementation of cycle 2 focused on the evaluation done after cycle 1. The scores obtained in cycle 2 are as follows:



Picture 3. The Score of Pre-Intervention, Cycle 1 and 2

Children's science literacy skills in cycle 2 increased significantly. This can be seen in the children's average score of 46.04 from the maximum score of 56. In cycle II, all children achieved a minimum developmental achievement score of 42. It means that in cycle 2, this also reached a minimum score of 71% of the number of children. In other words, 14 out of 24 children had successfully reached a minimum score of developmental achievement level of 75% of the maximum score that is 42.

The highest scores were obtained by RR and NA with a score of 54 which means that they reached the minimum score of the development achievement level of 42. While the lowest score was AK with a score of 42, which also seems to have reached the minimum score of the development achievement level of 42. From these results, the researchers agreed that the provision of action was sufficient until cycle 2.

Based on the research data that has been presented previously, starting from pre-intervention, cycle I, then cycle II, it can be seen that there is a significant increase in children's science literacy skills after the actions were applied in the form of using PBL model with various activities and varied media from cycle I to cycle II.

Learning using PBL gives children the opportunity to do directly so that activities are more child-centered, this learning activity trains children to be able to solve problems and gain knowledge independently. The teacher acts as a facilitator and stimulus provider for children. Providing stimulus in the form of problems to children is adjusted to the age stage of children with the theme of problems that exist and are encountered by children in their daily lives (Wulandari & Suparno, 2020). The success of increasing children's science literacy skills because PBL provides an opportunity for educators to become part of the child in an active and fun learning environment.(Tan, O., Chye, S., & Teo, 2009)

In addition, teacher guides children in learning activities through open-ended questions that have been designed as triggers for children to think and get them involved in the group process. In this learning model, children are given the opportunity to undertake new challenges in developing their thinking skills and building their own knowledge. (Hmelo-Silver, 2004)

The increase in children's science literacy skills from pre-intervention, cycle I to cycle 2 shows a fairly high improvement. Based on the results of the reflection of cycle 1, the implementation of the PBL has been carried out in a structured manner. The difference in the actions given in cycle I and cycle 2 lies in the more fun activities and media. The activities of cycle I were chosen to be more challenging with media in the surrounding environment that the children themselves sought and brought from their surroundings. The flow of implementation in cycle 2 also made a system of games or competition so that the enthusiasm and motivation in children was even higher in doing activities with their team. Group formation in cycle 2 was also different randomizing by using games.

The implementation of a more fun PBL model is also the basis for improving children's science literacy. Learning activities are fun involving games, real media from the environment, and the opportunity to do it yourself which previously children rarely had an impact on the rapid increase in their science literacy.

Based on the discussion above, it can be seen that the application of the problem-based learning model can improve children's science literacy skills from pre-cycle to cycle I, and further up in cycle 2 to exceed the success indicator set in this study which is 71%.

CONCLUSION

From the finding and discussion above, it could be summed up that children's science literacy skills increased from the Pre-intervention score with an average score of 17.38 then climbed more highly in cycle I with an average score of 33.63 and further increased in cycle 2 with an average score of 46.04. From these scores it can be concluded that the use of problem-based learning model can improve early childhood science literacy skills.

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