STEM Learning: How Can Environmental Issues Stimulate Elementary School Students' Problem-Solving Abilities?

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Abstract. The environment is a crucial issue that requires a holistic and innovative approach in solving every existing problem. STEM (Science, Technology, Engineering, and Mathematics) learning has emerged as an effective framework for integrating scientific concepts in understanding and overcoming environmental problems. This research focuses on the influence of STEM learning on elementary school students' problem-solving abilities, especially those related to environmental issues. Using experimental methods and pre-experimental designs, this research involved 48 sixth grade elementary school students as subjects. The research instruments are tests and observation sheets. The research results show that the P-value (Sig.2-tailed) 0.000/2 = 0.000 is smaller than 0.05. So H0 is rejected and H1 is accepted. Apart from that, based on the results of observations, the average value reached 54.8% or was in the sufficient category. Thus, STEM learning makes a positive contribution in developing elementary school students' problem-solving abilities, especially those related to environmental problems. The implication of this research is the need to implement STEM learning strategies in the basic education curriculum to increase students' awareness and involvement in responding to environmental challenges.

Keywords: Stem, Problem Solving, Elementary.

1 Introduction

STEM (Science, Technology, Engineering, and Mathematics) learning has become the foundation of modern education and plays an important role in shaping students' critical thinking, creativity, and problem-solving abilities. STEM is not only about teaching the subjects of natural science, technology, engineering, and mathematics separately, but

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also integrating them into one comprehensive whole [1][2]. In this context, STEM learning not only prepares students with basic knowledge, but also teaches the skills and concepts needed to solve real-world problems [3][4].

One of the key points of STEM learning is its focus on problem solving [5]. Students are not only taught to remember facts and theories, but they are also actively involved in real situations where they imagine problems that require analytical thinking and creative solutions. [6][7]. This helps students to develop strong problem-solving skills, an ability that is highly valued in the real world [8].

The importance of problem solving in STEM learning is also manifested in the teaching approaches implemented by teachers. They are not just a source of information, but rather a learning facilitator who guides students through the critical thinking process [9]. Teachers ask questions that challenge, stimulate discussion, and direct students' attention to specific aspects of a concept or problem [10].

STEM learning also integrates technology as a tool to improve the problem solving process. Students not only utilize technology to access information, but they also learn to use software and hardware to design innovative solutions. In this way, they are not only consumers of technology, but also creators of technology [11].

In addition, STEM learning encourages students to develop systematic thinking. They are taught to view problems holistically, understand the relationships between various elements, and design solutions that consider long-term consequences [12]. This ability not only applies in scientific and technological contexts, but also in everyday life. Students learn to view challenges as opportunities to grow and develop the skills necessary to cope with the complexities of the modern world [13].

STEM learning also creates opportunities for students to hone their interpersonal skills. Involvement in group projects allows them to collaborate, share ideas, and learn from each other. This not only builds communication skills, but also teaches the importance of working together to achieve a common goal [14][15].

The importance of STEM learning in the development of problem solving is also manifested in its engagement with the real world. Students are often invited to go on field trips to technology companies, research laboratories, or innovation centers [2]. This gives them a first-hand look at how STEM knowledge can be applied in the world of work and how they can contribute to global problem solving.

In an ever-changing global context, the ability to solve problems effectively is key to individual success and societal progress. STEM learning provides a strong foundation for the development of these skills, producing a generation that is not only proficient in science, technology, engineering, and mathematics, but also able to face complex challenges with creativity, courage, and sharp analytical thinking. [16][17]. Thus, STEM learning is not just about filling students' heads with facts, but also about shaping their minds to become competent and innovative problem solvers in an ever-evolving world.

Based on the explanation above, it can be concluded that STEM learning is very important to develop, especially at the elementary school level. Apart from that, problem solving can be a means of student learning in training students' sensitivity to every problem that arises in their lives. Therefore, researchers are interested in conducting research with the title STEM learning: How can environmental issues stimulate elementary school students' problem-solving abilities?

2 Method

This research uses quantitative methods with pre-experimental design, pre-test and post-test one group design [18]. This method was chosen because there were no control variables and without a comparison group. The research design is as follows:

$$O_1 \; X \; O_2$$

Information:
O_1 = pretest
X = treatment
O_2 = postest

The subjects in this research were sixth grade students in elementary school, with a total sample of 48 students. To be efficient in conducting research, samples were not chosen randomly and were assumed to have similar characteristics. The instrument was created based on a planned learning design, tested for field validity, and validated by experts. The instruments used include test questions and observation guidelines.

The test instrument used to measure students' problem solving skills consists of 5 questions with indicators of identifying problems, understanding problems, gathering solutions, proving solutions and reviewing. Meanwhile, observation guidelines include indicators of involvement in projects, innovation and creativity and collaboration team. The research procedures include:

Table 1. Research procedures

Preparation	Implementation	Evaluation
Literature study, determining research subjects, making instruments, and testing instruments.	Providing treatment through STEM learning and observing students during learning.	Data collection, processing and analysis using SPSS 23.

The data collected includes quantitative and qualitative data. Quantitative data was obtained from pretest and posttest. Pretest and posttest data were processed using SPPS 23 software through normality test, homogeneity test and t test. Meanwhile, qualitative data is obtained from observations which are then analyzed and explained through descriptions.

3 Result And Discussion

The results of data processing and analysis using SPSS 23 are as follows.

Table 2. Results of analysis of problem solving abilities

Data Type	Pretest	Postest
N	48	48
Mean	4,42	6,31
Std. Deviation	2,631	3,471
Std. Error Mean	0,258	0,382
Normality test	Sig.	0,084
	Information	Normal
Homogeneity Test	Sig.	0,106
	Information	Homogeneous
T Test	Sig.2-*tailed*	0,000
	Information	Significant

After carrying out normality and homogeneity tests, the data obtained were normally and homogeneously distributed. For the next stage, a paired sample t test was carried out with a significance level of $\alpha = 0.05$. The P-value (Sig.2-tailed) 0.000/2 = 0.000 is smaller than 0.05. So H_0 is rejected and H_1 is accepted. Thus, STEM learning can improve elementary school students' problem-solving abilities on environmental issues.

STEM learning provides a holistic approach involving science, technology, engineering, and mathematics in improving students' problem-solving abilities. Students learn to apply scientific concepts in identifying, associating, and finding solutions [19]. Currently, there is an urgent need to develop learning methods that not only provide knowledge, but also actively involve students in solving problems in their daily lives [20]. Additionally, STEM can develop critical and creative thinking skills. In this context, focusing STEM learning on environmental issues can be an important step to improve students' problem-solving abilities at the elementary school level.

The aspects observed in the observation instrument are related to involvement in projects, innovation and creativity and collaboration team. The recapitulation of student observation results during learning activities is as follows.

Table 3. Percentage of Student Observations

Aspect	Aspect	Aspect
involvement in the project	55,6%	Enough
innovation and creativity	52,8%	Enough
collaboration team	56,1%	Enough
Average	54,8%	Enough

The involvement aspect in the project averaged 55.6%. This aspect looks at student activity in projects or assignments that require the application of concepts and motivation in completing STEM-based projects or assignments. In STEM projects, student involvement creates deep and meaningful learning experiences. Students are not only recipients of information, but also play an active role in designing, implementing and

disseminating their own projects. . This not only builds deep understanding, but also shapes students into independent and innovative learners [21][22].

Meanwhile, the innovation and creativity aspect averaged 52.8%. What is observed in this process includes how innovative and creative the project is in providing solutions to problems. STEM learning stimulates creativity, links concepts to everyday life, and empowers students as agents of change who care about the sustainability of their environment [23][24].

In the aspect of teamwork, the average reached 56.1%. This aspect looks at team collaboration in achieving a common goal in a STEM project or assignment. If averaged it reaches a value of 54.8% or is in the sufficient category. By collaborating in teams, students also improve communication and cooperation skills. Students learn to appreciate each other's roles, solve problems together, and contribute to the overall success of the team [25]

Through the application of STEM, students are expected to develop essential problem-solving abilities to face future challenges. Choosing environmental issues as the focus of STEM learning has multiple positive impacts. First, it provides students with an in-depth understanding of the environmental challenges facing the world today [26]. Second, students are invited to develop innovative solutions to these problems. Issues such as climate change, pollution and sustainability take center stage, allowing students to experience the direct impact of their learning [27]. Elementary school is the initial period in a student's educational development. In this period, the foundation of cognitive and social skills is built [28]. STEM learning at the elementary school level provides long-term benefits because it forms the basis of scientific understanding and problem-solving skills. In addition, children at this age tend to have great curiosity, so interesting STEM learning can stimulate their interest in science and technology [29].

4 Conclusion

By focusing STEM learning on environmental issues, elementary school students can develop problem-solving skills, spark scientific interest, and provide a deep understanding of environmental challenges. Based on the P-value (Sig.2-tailed) 0.000/2 = 0.000, the value is smaller than 0.05. So H_0 is rejected and H_1 is accepted. Based on the results of observations, it shows that the average value reaches 54.8% or is in the sufficient category. So in general, STEM learning can provide benefits in developing elementary school students' problem-solving abilities, especially regarding environmental issues.

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