The Influence of STEM Approach on Mathematical Literacy Skills of Elementary School Students During the Covid-19 Pandemic

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Abstract. This study was driven by the low mathematics learning results of primary school kids during the covid-19 epidemic, which resulted in weak mathematical literacy abilities. As a result, a deliberate effort to improve mathematical literacy was required. The STEM method is one strategy that is associated with the development of mathematical literacy. The researchers wanted to determine if the STEM approach affected pupils' mathematics literacy skills during the Covid-19 epidemic. This was a quasi-experimental study with 40 students, with 20 in the control group and 21 in the experimental group. In essays, the data gathering tool included mathematics literacy exam questions. The N-gain mean difference test was combined with the Mann-Whitney U test for data analysis. According to the calculation findings, Sig. (2-tailed) received a score of 0.038, which is smaller than the significance level = 0.05. So that H0 is rejected. The average mathematical literacy skill of elementary school students who studied using the STEM approach and those who studied using the conventional approach was shown to be different in this study. Those who studied with a STEM approach had a higher average score than students who studied with a conventional approach.

Keywords: STEM · Mathematical Literacy · Elementary school · Covid-19

1 Introduction

The evolution of Industry 4.0 has a bearing on the evolution of human life [1]. Following that, the manual life process is converted to a computer-based learning process [2]. Furthermore, the Industry 4.0 era has an impact on the social life system, which no longer considers distance or time when interacting [3]. This era has also had an impact on education. Students' mindsets and behaviors in the learning process are being influenced by Industry 4.0 [4]. The conventional learning process must be transformed into a modern technology-based learning process. As a result, the era of industry 4.0 has a considerable impact on human life processes.

Students must not only be able to master knowledge but also have a variety of abilities in the era of industry 4.0 in the learning system [5, 6]. This is because, in the future,

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students will be confronted with complex problems that will necessitate a variety of problem-solving skills. Literacy skills are one of the skills required in the 4.0 industry era [7]. Literacy is defined as the ability to comprehend information completely [8]. After that, literacy is broken down into various components, one of which is mathematical literacy skills.

Mathematical literacy is one of the skills that students must have in order to formulate, interpret, and apply mathematical concepts to a variety of mathematical relationships [9, 10]. In everyday life, mathematical literacy can also be defined as the ability to develop numerical and spatial thinking skills in order to solve mathematical problems [11, 12]. Mathematical literacy is a set of fundamental mathematical skills that may be applied in everyday life [13, 14]. This indicates that in the course of solving problems, mathematical literacy skills are responsive to numerous life concepts. As a result, every student in the era of the industry 4.0, including elementary school students, needs to develop digital literacy skills.

The development of mathematical literacy abilities should be a part of every learning process. Although the learning approach during the COVID-19 epidemic was home-based, primary school children' mathematics literacy abilities require improvement. During the COVID-19 epidemic, teachers must be able to create instructional innovations that will improve students' mathematical literacy skills. Teachers must be able to use technology 4.0 to construct learning experiences that increase the mathematical literacy of primary school children.

However, previous research has found that the home learning process for elementary school students is still not working effectively [15, 16]. There are still problems with the learning system. Many teachers use the WhatsApp application to carry out their learning processes at home. The teacher utilizes the WhatsApp application to distribute assignments and materials to students. Students also use the application to submit answers by capturing their responses. As a result, the researchers performed observations in one of Padang City's public elementary schools to learn more.

According to observations, teachers continue to carry out the learning process at school, but students continue to do so at home. It was also discovered that the teacher transmitted learning materials and assignments to students over WhatsApp, and that the students submitted the assignments. During the recapitulation of assignments, it was discovered that only around half of the students had completed the task. The researcher then conducted interviews with the teacher to obtain additional information. The teacher indicated in the interview that many learning objectives were not achieved due to the home learning system. Students were bored with this type of learning approach, but the teacher was powerless to do anything about it. When asked about the results of learning mathematics, the teacher revealed that just 23% of students passed the midterm exam, with an average score of 58.67. The researcher next instructed the teacher to offer students questions with mathematical literacy indicators on the same day. The researcher then looked into the subject and discovered that elementary school students' mathematics literacy skills had an average score of 45.34.

The results of observations, interviews, and preliminary ability tests reveal that elementary school students have a low level of digital literacy. Low mathematical literacy skills are the consequence of a learning process that is not adapted to the needs of elementary school students. As a result, we require a solution to address this issue.

Implementing the STEM learning process by integrating the learning system from home is one solution that can be implemented. STEM is a learning process following the industry 4.0 era that combines science, technology, engineering, and mathematics [17]. STEM is learning that can integrate these four components into active and contextual learning [18, 19]. The researcher's basic assumption is STEM can improve students' mathematical literacy because mathematical literacy can be understood through an active learning process and relates to students' real lives. Therefore, the researcher wanted to find out whether STEM learning had an influence on the mathematical literacy skills of elementary school students during the covid-19 pandemic.

This research is supported by Ammatullah et al2019.'s discovery that STEM can improve high school students' physics learning results [20]. Although the two studies share certain similarities, such as the utilization of STEM in the learning process, this study is unique. During the Covid-19 outbreak, the purpose of this study is to determine the impact of STEM instruction on primary school students' mathematical literacy skills. The purpose of this research was to see how STEM instruction affected primary school kids' mathematics literacy skills during the Covid-19 pandemic.

2 Research Methodology

This research is quantitative in nature. In this quasi-experimental investigation, a non-equivalent control group design is used. There are two sorts of research variables in this study: independent variables and dependent variables. The STEM approach is the independent variable, while students' mathematical literacy is the dependent variable. The following is the study's design (Fig. 1).

This research was conducted in the third grade of a public elementary school in Padang. Students in the experimental class will learn by using the STEM approach while students in the control class learn using conventional methods. The test instrument uses mathematical literacy ability questions given at the beginning and end of the action. This will serve as both a pre- and post-test. The data analysis technique uses the Mann-Whitney U-test calculation.

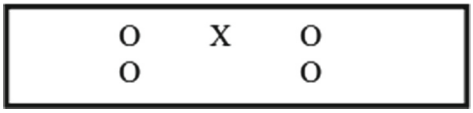

Fig. 1. Non-equivalent Control Group design. Annotation: X = treatment using the STEM approach. O = Pre-posttest of mathematical literacy.

3 Results and Discussion

The purpose of this study is to examine the impact of STEM curriculum on primary school children' mathematics literacy skills during the Covid-19 epidemic. The preliminary research was carried out by administering a pre-test to two groups of pupils for normalcy testing. However, analyses revealed that the two sets of data were not regularly distributed. The Mann-Whitney test was then used to assess the difference between the averages of the experimental and control classes. The Sig. (2-tailed) received a score of 0.042 based on the calculations. If this score indicates that the number is less than the level of significance = 0.05, Ho is rejected. This computation demonstrates that there is no difference between the experimental averages and control classes before each class is given treatment.

After each class received treatment, the pre-test and post-test scores for elementary school students' mathematical literacy skills were calculated. The calculation uses N-Gain. The Table 1 shows the results of the calculations.

The post-test results were processed after each class had received treatment. The post-test data is not normally distributed when the normality test is calculated. The Mann-Whitney test was then used to determine whether there was a difference in the mean N-gain. According to the test, there were differences in elementary school students' mathematical literacy abilities between those who studied using the STEM approach and those who studied using the conventional approach. H0 is rejected based on the test results, which show that the sig. (2 tailed) is 0.038 less than the significance level = 0.05. This number indicates that the two classes have an average difference.

According to the test, elementary school students who learn using the STEM approach improve their mathematical literacy skills more than those who learn using the conventional approach. According to the N-Gain test, students who study using the STEM approach have an N-Gain value of 0.68, whereas those who study using the conventional way have an N-Gain value of 0.48. This demonstrates that students who learn utilizing the STEM approach have better mathematical literacy skills than students who learn in a conventional way.

The findings of this study are supported by Utami et al.'s research, which found that the STEM approach has an impact on high school students' physics learning outcomes [21]. A distinctive finding in this study is that it demonstrates how the STEM approach can help elementary school students improve their mathematics literacy skills.

Table 1. Short cut keys for the template

	Experimental class				Control class			
	Total students	Min. Score	Max. Score	Average	Total students	Min. Score	Max. Score	Average
Pre-Test	20	6	19	12,1	20	2	15	11,55
Post-Test	20	11	20	16,5	20	10	20	15,65
N-gain	20	0,12	1	0,50	20	0,21	1	0,276

Students in elementary school learn through real-world objects in their surrounding environment [22]. Elementary school students differ from students at other levels in that they are still learning from simple things, requiring a learning process to balance the pattern of development [23]. This research shows that using a STEM approach can help pupils improve their mathematical literacy skills in elementary school. STEM is a method that combines the four components of science, technology, engineering, and mathematics [24, 25]. STEM can support students enhance their digital literacy skills since it teaches contextual maths. STEM education enables students to acquire mathematics not only to understand mathematical concepts, but also to teach mathematics and apply it to real-life situations. Students will be shaped by STEM to have a solid understanding of science. As a result, STEM learning can help elementary school pupils enhance their digital literacy skills.

4 Conclusion

Based on the Mann-Whitney test, the sig. (2 tailed) is 0.038, smaller than the significance level = 0.05. So that H0 is rejected. This indicates that the two experimental classes and the control class have an average difference. According to the N-Gain test, the N-Gain value of the class who studied using the STEM approach was higher than the N-Gain value of the class who studied using the conventional approach.

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