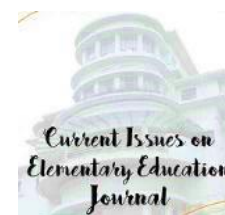




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Improving science process skills using the STEM (science, technology, engineering, and mathematics) learning model on environmental preservation business material for fifth grade elementary school students

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ABSTRACT

Society must be able to adapt in various ways due to the rapid progress of science and technology in the era of globalization. One of the components is education, which is fundamental for the progress of a country. Science process skills are skills for developing the perspective needed to build natural science. This research was conducted to see whether science process skills improved after applying the STEM learning model to environmental conservation business materials, in class V students at SDN 1 Ciledug located in the city of West Bandung. This research was carried out by designing a pretest-posttest group and using a science process skills test, based on the indicators that had been designed. Data analysis to determine differences in perceptions regarding improving students' science process skills, before and after implementing the STEM learning model. The results of data analysis show that science process abilities have increased on the topic of environmental conservation efforts with the application of the STEM learning model. The resulting score with the average value of science process skills increased from application of 40.51 to 85.11. This improvement in skills can be seen from the N-Gain result value of 0.75 which is in the high classification. Thus, the research results that have been presented suggest that teachers can use the STEM learning model as an alternative in science subjects, especially to improve science process skills.

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1. INTRODUCTION

The 21st century is an era filled with various competitions in the fields of life. Society must prepare itself to compete and survive amidst rapid developments. By helping to build a new civilization that forms an increasingly advanced order of life, the education sector is a step in which human resources can be increased. The national education system is influenced by rapidly changing developments. Better quality education is greatly influenced by professional teachers, who play an important role in improving the quality of education (Husain & Kaharu, 2020). Teachers must also be able to teach students to improve life skills, which can effectively meet the challenges of everyday life (Prameswari & Lestarinigrum, 2020).

In order to achieve this, every student has the opportunity to acquire 4C skills. These skills will help students face the challenges of the 21st century. Human resources are faced with education which must shape and create the next generation, which has skills that can be developed. The 4C skills consisting of critical, thinking, creative, collaborating and working together are known as skills that students are expected to have (Wardani & Ardhyantama, 2021). Learning Natural Sciences (Science), being a very important field, is also considered difficult, where this learning can combine 4C skills (Monica et al., 2021).

Learning science is an important subject that will help students progress to the next level, by providing the knowledge and foundation. Science learning refers to natural events, this can help students understand nature, learn to think critically, work and behave scientifically (Utami, 2020). By using a scientific approach and perspective, students gain an understanding of ideas, principles and facts that can be implemented in daily life through science learning (Nisah et al., 2021). Not only that, science teaching and learning activities involve practicums, which give students the opportunity to test and apply theory, which can be done both in the laboratory and outside the laboratory. According to Nurika et al. (2022), that practicum provides students with the opportunity to explore concepts, theories and principles in scientific activities and prove that these theories can be applied with scientific process skills. Engagement in science process skills is the first step needed for students to keep up with advances in science and technology. The basic abilities obtained by students will help students prepare superior natural resources.

These skills will also be a provision for developing students into individuals who are capable and able to compete (Wahyuningsih & Fatonah, 2021). Science process skills are certainly very important for every student, because they will have the skills to use scientific methods in the science process, ultimately gaining new knowledge (Ariyansyah & Nurfathurrahmah, 2022). According to Yuliati & Susianna (2023), the basic skills of science process skills consist of observing, communicating, classifying, measuring, concluding and predicting. With the help of teachers during the learning process, students can learn science process skills (Yunita & Nurita, 2021). Therefore, the ability to carry out scientific processes is important for students, this is because it can provide basic skills to develop themselves when facing challenges in routine life.

Even though these skills are considered important, at the elementary school level there are still many students who do not have good science process skills, nor have they mastered aspects of the science process. This is relevant to the research of Hariandi et al. (2023), that this skill is still in a low classification due to the learning mechanism using a learning model that is not oriented towards science process skills. Meanwhile, according to Farida (2021), students' science process skills are still not optimal because students cannot explain certain events, identify differences, compare objects, and convey information that students know, either orally or in writing to classmates or teachers, using learning models. does not vary

during the learning process. Under these conditions, the use of learning models does not vary throughout the teaching and learning interaction process, especially those related to the development of science process skills, so it is important to consider learning models that are accurate and successful to help advance students at the elementary school level.

In deciding on an accurate learning model, which will have a big impact on the learning process in growing science process skills in students. A learning model that is suitable and holds the key to science learning is the STEM learning model. STEM is a learning model that provides greater relevance. A learning model that prioritizes solving problems in daily life, and shows ideas, principles, techniques that are applied to produce products, procedures and systems that are beneficial to human life (Amalia et al., 2023). In line with the opinion of Yusuf et al. (2022), STEM helps students collect, analyze and understand how problems relate to each other.

According to Setiawan et al. (2020), the aim of the STEM learning model is to design students to be competitive and ready to work according to their skills. In STEM model learning, teachers help solve global problems and teach skills that students must have in the future, and are useful for students in facing challenging problems (Nurkanti & Darta, 2019). The STEM learning model has several main elements in learning, namely STEM focuses on real issues or problems, STEM is inquiry in nature which encourages students to be creative and innovate, STEM applies creativity, effectively and contextually, STEM allows students to correct failures in learning and build abilities. work together (Fatmawati & Fitriana, 2022).

By using the STEM learning model, it is hoped that students can easily master science process skills, especially in science learning. Because this STEM model prioritizes students' learning skills that are significant to real life, which has a good impact in achieving deeper insights regarding critical ideas in various scientific disciplines.

2. METHODS

The method used in this research is quantitative experimentation. According to Creswell (2012), quantitative experiments are procedures in quantitative research testing an idea or practice to determine its effect on an outcome. This research used a Pre-Experimental design, which was carried out in a one-group pretest-posttest design. According to Sugiyono, (2013), a pretest is carried out before treatment, so that the results of the action can be known more specifically, because it can be assessed before and after the action.

O₁ × O₂

Figure 1 The One Group Pretest Posttest Design

In the picture above, based on the picture, O₁ before X is a pretest regarding the results of science process skills before being given treatment, The subjects of this research were grade V elementary school students at SDN 1 Ciledug. The data collection technique is in the form of a science process skills test instrument. To process data by carrying out descriptive analysis, normality test, t-test, and N-Gain with the help of IBM. SPSS.

3. RESULTS AND DISCUSSION

3.1 Results

The results of research in elementary schools prove the level of science process skills, as can be seen from the results of the pretest and posttest data obtained. Pretest data is obtained from giving test questions to students before being given special treatment. Posttest data was obtained after the class received treatment, which involved the STEM learning model. In this study, there was only one class with 37 students. The results of this test were assessed through essay questions totaling 8 questions, then descriptive analysis was carried out on the pretest and posttest results, to determine the highest and lowest scores as well as the average score of the pretest and posttest results. So that the output results are obtained, as follows:

Table 1. Descriptive Value Results

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Pretest	37	6	75	1499	40.51	15.298
Posttest	37	63	100	3149	85.11	8.844

It is known that the results of the pretest data regarding science process skills tests, on environmental conservation business material in science subjects in class V. The minimum score on the pretest results was 6, this confirms that some students do not understand well and do not know about the material being tested. Meanwhile, the maximum score on the pretest results was 75, this shows that students already have sufficient understanding of the topic being tested. However, this cannot be used as a basis for knowing whether students' understanding has reached the best level, because many students still get unsatisfactory results or are declared not to have passed. This means that improvements are needed to increase students' understanding maximally and more deeply.

After knowing the students' initial abilities and understanding, next action is given, namely implementing learning using the STEM learning model. The minimum score on the pretest results was 63 and the maximum score was 63

100. This shows that students' understanding is relatively high, because students succeeded in understanding the material on environmental conservation efforts using the STEM learning model. Then, the average score between the pretest and posttest has a difference between the two of 44.6. Thus, differences in scores were found given treatment using the STEM learning model, by looking at the comparison of minimum, maximum, mean and standard deviation scores.

Testing Prerequisite Analysis

Below is the normality test calculation:

Table 2. Normality Test

	Shapiro Wilk		
	Statistic	df	Sig.
Pretest	.959	37	.191
Posttest	.946	37	.072

This test is to indicate whether a group of data has a normal distribution or not. Based on the table above, the pretest results obtained were $0.191 > 0.05$ while the posttest results were $0.072 > 0.05$. This shows that the data is normally distributed or meets the requirements.

T-test

After carrying out the prerequisite tests, a t-test was then carried out to determine whether the STEM learning model influenced science process skills. In the mean difference test used, namely the Paired Samples T-test, with the provisions of the hypothesis test with significance (2-tailed) <0.05 which means H_0 is rejected, H_1 is accepted and significance (2-tailed) >0.05 then H_0 is accepted, H_1 is rejected. Below are the results of the t-test:

Table 3. Average Difference Test Results

	t	df	Sig. (2-tailed)
<i>Pretest-Posttest</i>	-15.351	57.644	0.000

Based on the table above, it shows that the resulting data is a value of less than 0.05, which means that the difference between the two average pretest-posttest results is obtained. This is because the treatment given has had a real impact on the variables being measured, with valid and reliable measuring instruments for measuring the variables studied. Thus, H_0 is rejected and H_1 is accepted, meaning that there are significant results in the science process abilities of class V students after implementing the STEM learning model.

Table 4. Descriptive N-Gain Test Results

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
N-Gain_Score	37	.46	1.00	27.93	.7548	-13278
N-Gain_Persen	37	46.38	100.00	2792.85	75.4825	13.27813

Based on the table above, measuring the magnitude of the increase in science process skills was obtained through the N-Gain test on the pretest and posttest results, with a total of 37 students, producing an average of 0.7548 on the N-Gain Score and 75.4825 on the N-Gain Percentage. on high criteria. This is influenced by students who have achieved high scores on science process skills tests, with significant progress in environmental conservation business material.

3.2 Discussion

The use of STEM models in science learning can influence science process skills. This is produced by tests that have been analyzed. The initial test proved that science process skills were still low, and many received incomplete grades. This happens because students do not know the material tested in the pretest, have different abilities in understanding the questions, and students' readiness to face the questions can have an impact on the test assessment. In the final test results, students have a strong understanding of the topics tested after the test, as well as knowledge and experience relevant to these topics, so that students can answer posttest questions well. Apart from that, students have prepared themselves to learn more so that the results are better than before and of course students have been given a STEM learning model treatment.

This increase occurred due to students' success in working on test questions which included science process skills. According to Sanjaya (in Udju et al., 2023), the learning experience provided by teachers can enable students to construct information into knowledge schemes, which can contribute to students' success in taking science process skills tests. In line with that, according to Munengsih et al. (2021), success is also influenced by the existence of instruments designed to measure skills in the form of student learning achievements, several skills, elements that are considered to have a relationship with the success of the teaching and learning process at certain achievements. Supported by Suryaningsih & Nisa (2021), stated that there are positive results from learning innovations

that use STEM learning models in learning activities that are able to support science process skills. Apart from that, according to Aprilia & Anggaryani (2023), the implementation of the STEM learning model went better after implementing this learning model. This increase shows that the application of the STEM learning model is higher than other learning models (Hariandi et al., 2023).

Changes in science process skills were also observed by researchers in the field, the result of which was that from one meeting to another during class, students initially felt awkward, confused, and unfamiliar with STEM-related activities. At the next meeting, students begin to know how teachers help students have habits to acquire science process skills. Not only receiving material, but also the process starting with identifying problems, determining concepts, communicating, planning, and finally students are directly involved in discussion and collaborative activities to create work in the form of products that are relevant to the material to be studied. This is in line with Rahmayanti et al. (2022), revealed that there is a relationship between effectiveness and increased student success, meaning that the level of learning success will increase if student achievement is high. This increase shows that science process skills are starting to develop and form when they are directly involved, and can encourage students, to make a product (Yusuf et al., 2022).

Apart from success for the students themselves, the application of an accurate and appropriate STEM learning model has succeeded in influencing students' skills to carry out the process better. By using this model, students are designed to create products to be worked on in groups, which can encourage students to participate in the learning process (Kelana, et al, 2024). Students will not get bored with the assignments or processes given. It is best for students to plan a product by solving identified problems that can then be communicated. This is useful for practicing problem solving skills, fostering creativity, working together, communicating actively, and practicing critical thinking. In line with Eliyana (2020), direct learning activities that focus on forming students' process skills make students more immersed in the process. This is because students are involved in the science process which must use students' intellectual thinking. In manual skills, learning includes using tools, materials and assembling tools. In social skills, being able to communicate with each other in teaching and learning activities, such as asking questions, discussing observation results, and communicating. In line with the opinion of Pontoh et al. (2023), learning activities in which students participate actively, in order to improve their abilities so that they can learn new things, through interpreting the results of observations of an object they encounter. Students experienced significant improvement in terms of students also being active in asking questions. Supported by Kezia & Debora (2020), this is because they can directly learn information by asking a question, so they can better understand and master the topic material taught well by the teacher.

Thus, the STEM learning model has an influence on students in improving students' science process skills, as can be seen from the pretest-posttest results which have increased results on each indicator of students' science process skills, especially the topic of environmental conservation efforts. This increase occurred because students worked on test questions and followed the steps of the STEM learning model applied to students which included science process skills.

5. CONCLUSION

Based on the presentation of research results in efforts to improve science process skills using the STEM model, material for environmental conservation efforts can be concluded that:

- a. By using the STEM learning model, fifth grade students at SDN 1 Ciledug demonstrated increased science process skills in environmental conservation business material. This is shown by the pretest and posttest results having a difference of 44.6. Apart from that, the N-Gain test is 0.75 which is included in the high classification, and the t-test results are less than 0.05, which means that H_0 is rejected and H_1 is accepted, there are significant results in the ability of class V science process skills after implementing the model. STEM learning.
- b. The use of this STEM model provides positive results on the results of science process skills, because in the process it helps students understand science learning, requires students to solve problems, provides opportunities to convey ideas in the form of making products, participate directly in an experiment, train communication skills and processing a problem.

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