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The Effect of *STEAM* on Student Learning Activities in Elementary School

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Abstrak

Rendahnya aktivitas belajar siswa kelas V MIIT Al-Mubarak Langsa terkait IPA dikarenakan kurang aktifnya siswa pada pembelajarn sehingga perlu adanya pendekatan yang dapat meningkatkan aktivitas belajar siswa *STEAM*. Penelitian ini bertujuan untuk mengetahui pengaruh *STEAM* terhadap aktivitas belajar siswa pada pembelajaran IPA kelas V MIIT Al-Mubarak Langsa tahun ajaran 2022/2023. Jenis penelitian ini adalah penelitian kuantitatif. Seluruh siswa kelas V MIIT Al-Mubarak Langsa yang berjumlah 34 siswa merupakan populasi sedangkan sampel penelitian ini yaitu siswa dari dua kelas yaitu 17 siswa kelas VA sebagai kelas eksperimen dan 17 siswa kelas VB sebagai kelas kontrol. Teknik pengumpulan data dalam penelitian ini berupa lembar observasi, dengan analisis data menggunakan *SPSS 24*. Pengujian

hipotesis menggunkan Uji t Independent Sampel Test. Berdasarkan uji hipotesis dari aktivitas belajar pada kelas eksperimen dan kelas kontrol menyatakan thitung > ttabel yaitu 20,873 > 2,036 dan nilai signifikan 0,00< 0,05. Maka dapat disimpulkan bahwa H_O ditolak dan Ha diterima pada taraf signifikasi α=0,05 yang artinya terdapat pengaruh pendekatan *STEAM* terhadap aktivitas belajar siswa.

Kata kunci: Aktivitas, Belajar siswa, IPA, STEAM

Abstract

The low learning activity of grade V students of MIIT Al-Mubarak Langsa related to science is due to the lack of active students in learning so that it is necessary to have an approach that can increase student learning activities STEAM. This study aims to determine the effect of STEAM on student learning activities in science learning grade V MIIT Al-Mubarak Langsa in the 2022/2023 school year. This type of research is quantitative research. All fifth grade students of MIIT Al-Mubarak Langsa totaling 34 students are the population while the sample of this study is students from two classes, namely 17 VA class students as the experimental class and 17 VB class students as the control class. Data collection techniques in this study were in the form of observation sheets, with data analysis using SPSS 24. Hypothesis testing using the Independent Sample Test t test. Based on the hypothesis testing of learning activities in experimental and control classes, the tcount> ttable is 20.873> 2.036 and a significant value of 0.00 <0.05. So it can be concluded that HO is rejected and Ha is accepted at the significance level α=0.05, which means that there is an effect of the STEAM approach on student learning activities.

Keywords: Activity, Student Learning, Science, STEAM

INTRODUCTION

21st century learning focuses not only on academic achievement but also on the development of higher order thinking skills such as critical thinking, creativity, collaboration and problem solving. This is in line with the view of Trilling, B & Fadel, (2009), which emphasises that modern education should be oriented towards 21st century skills, so that learners can adapt quickly to global developments. According to OECD (2020), educational approaches that emphasise the contextual application of knowledge will be more useful in helping students address future challenges.

In primary school, the application of STEAM is important because children are at a developmental stage where curiosity and creativity need to be encouraged to become the foundation of their future skills. Therefore, learning that incorporates STEAM elements will help students build basic science and technology literacy skills, as well as social skills such as co-operation and communication (Halim, A., & Risdianto, 2021). But according to research

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(Wahyuni, 2021), low student engagement in science learning is often caused by monotonous teaching methods and lack of interactive elements. This shows the need for innovation in the teaching and learning process, using more active and interesting methods (such as STEAM) to increase student engagement. Further Research (Rachmadtullah, R., Zulela, M.S., & Suryaman, 2020) showed that the STEAM approach can improve the critical thinking skills of elementary school students through interactive and contextualised activities.

In the context of MIIT Al-Mubarak Langsa, low student learning activity is one of the main challenges in science learning. Observations made in science learning show that many students are passive during the learning process, with little interaction between students and teachers, and minimal use of innovative learning media or methods. Therefore, this research is needed to explore the *STEAM* approach as an effort to improve student learning activities.

Previous studies have shown that the *STEAM* approach has a positive impact on student learning. One study that supports the effectiveness of *STEAM* was conducted by (Brier, Jennifer, 2020) which showed that this method can increase student learning activities through group activities, disputes and direct experiments. The research argues that the integration of art in *STEAM* provides a space for students to express their creativity while learning science and technology concepts in more depth.

The importance of STEAM education approaches has been widely recognised in various studies. Beers (2021) explained that the application of STEAM not only improves students' understanding of scientific concepts but also develops 21st century skills such as critical thinking, creativity, communication, and collaboration, which are indispensable for facing future challenges. Through STEAM, students are encouraged to connect the theories learned with practical situations, so that abstract concepts are easier to understand.

Kelley, T. R., & Knowles (2016) emphasised that an integrated approach involving science, technology, engineering, arts and mathematics is essential for building deeper conceptual understanding. They state that students' participation in STEAM-based projects gives them the opportunity to think creatively and solve problems effectively. However, although STEAM provides many benefits, its application in primary schools in Indonesia is still limited. Pratama dan Santosa (2021) explained that in many schools in Indonesia, especially in rural or remote areas, STEAM implementation still faces many challenges, such as lack of resources and lack of

teacher training. This is especially important for schools like Al-Mubarak Langsa in the Ministry of Industry and Information Technology that lack adequate infrastructure and technical support.

In addition, Dewi dan Yuniarti (2020) found that STEAM education also has a positive impact on students' creative thinking skills and science literacy, which are important elements in mastering science in modern times. However, although STEAM provides many benefits, its application in primary schools in Indonesia is still limited.

This research is a quantitative study conducted to determine the effect of the *STEAM* approach on student learning activities in class V of MIIT Al-Mubarak Langsa. All grade V students in this school were used as the study population, with two classes divided into experimental and control classes. The experimental class used the *STEAM* approach in science learning, while the control class used a conventional approach. The results of the study are expected to provide an empirical picture of the effectiveness of *STEAM* in improving student learning activities in elementary schools.

The novelty of this research lies in the application of the *STEAM* approach in primary schools located in the Langsa region, Aceh. Most *STEAM*-related research is conducted in urban areas or in countries with more developed education systems. Therefore, this study makes a new contribution in the local context, by evaluating how the *STEAM* approach can be applied in schools that have limited resources and technological support. In addition, this study will also measure the impact of *STEAM* on students‘ engagement in science learning, as well as how this approach can encourage students’ learning activities in the classroom. This research is expected to provide input for education policy makers in Indonesia regarding the importance of implementing *STEAM* in the basic education curriculum.

This study aims to measure how much influence the *STEAM* approach has on the learning activities of fifth grade students at MIIT Al-Mubarak Langsa. Specifically, this study aims to: determine the difference in learning activities between students taught with the *STEAM* approach and students taught with the conventional approach. Secondly, to identify the factors that influence the effectiveness of *STEAM* in science learning in grade V. Then provide empirical data that can be used as a reference for other schools in Indonesia who want to adopt the *STEAM* approach in science learning.

At the primary level, students are at a stage of cognitive development where interactive and contextualised learning is essential to build their understanding of basic concepts. The

STEAM approach provides a solution to fulfil this need by integrating various disciplines and arts, so that students can learn through hands-on experiences and real-world applications. *STEAM* learning allows students to: Critical and Creative Thinking: *STEAM* encourages students to think critically in solving problems, as well as use creativity in finding solutions. Collaboration and Communication: In *STEAM*, students often work in groups to complete projects, which helps them develop collaboration and communication skills. Project Based Learning: Students are encouraged to complete projects that are relevant to their daily lives so that they can see the connection between science concepts and their practical applications. Given this need, the application of *STEAM* in primary schools, especially in science learning, is very important. This study is expected to provide empirical evidence supporting the importance of *STEAM* adoption in Indonesian schools.

Factors causing the problem of low student learning activity are caused by low student motivation, lack of active student roles in teaching and learning activities. (Fatmawati, Dyas, 2015). In the teaching and learning process, students are less active. Where students still lack the courage to ask questions, express opinions, and their activities only listen to books, do problems in front of the class, do exercises given by the teacher, and group discussions. In delivering learning materials, teachers use conventional learning (Rahmadani, Normala, 2017).

Based on the above problems, it is necessary to find a solution to overcome these student difficulties, for this reason, teachers need to design learning that is interesting and fun, so that students learn more relaxed and active, so that it can attract student learning interest. Student learning activeness is one of the important indicators of the success of the learning process. Low student activeness is often a problem faced by teachers in the learning process, especially in subjects that require conceptual understanding and analytical skills, such as science. According to (Mayer, 2020), learning that does not involve students directly often causes their interest in learning to decline. Therefore, a learning strategy is needed that can increase student activeness and motivation so that the learning process becomes more effective and meaningful.

The *STEAM* (Science, Technology, Engineering, Art, Mathematics) approach has been proven as one of the effective solutions in improving students' activeness and engagement in learning. This approach is designed to facilitate students in connecting academic concepts with practical applications in everyday life. By using *STEAM*, students are directly involved in

learning activities, which allows them to think critically, work together in teams, and solve problems relevant to the real world. (Mayer, 2020).

According to Suci Rahmadani (2023) internal factors include physiological factors, such as the student's physical condition, and psychological factors, such as interest, motivation, and perception of the material being studied. External factors include support from the surrounding environment, such as the role of parents, teachers, teaching methods, and social support from peers at school. The *STEAM* approach is considered capable of influencing both of these factors. From the internal side, *STEAM* increases students' interest in learning through interesting projects and experiments that connect learning materials with real applications. Externally, *STEAM* encourages student engagement in groups and collaboration with peers, which makes students feel more motivated and challenged (Green, 2021).

There are several studies that support the *STEAM* approach, one of which, research Brown, (2021) which showed that students who engaged in *STEAM* learning had higher academic achievement and showed improvement in class participation. Then the research conducted by Kim (2022) found that the *STEAM* approach combined with project-based learning improved students' analytical skills and made learning more interesting. While the research (Wahyuni, 2021) concluded that the application of *STEAM* can improve students' comprehension skills in science materials and strengthen student involvement in the learning process.

METHODS

This research is quantitative research, which focuses on collecting and analysing data in the form of numbers with the aim of testing hypotheses and finding relationships between variables (Sugiyono, 2017). This research uses quantitative methods with the type of quasi-experiment, where this research involves giving treatment to the independent variable to see its effect on the dependent variable (Mirda, 2022). The researcher chose this method because it cannot fully control or strictly randomise groups, which causes limitations in controlling external variables (Creswell, 2014).

Arikunto (2016) mentioned, selection in quasi-experimental research, is done with probability sampling techniques to give each member of the population an equal chance of being selected as a sample. Probability sampling can be used to reduce bias in sampling and increase the external validity of the research. This technique is commonly used in quantitative research to

minimise bias in sample selection and allow generalisation of research results to a wider population. (Sugiyono, 2017)(Fraenkel, J. R., Wallen, N. E., & Hyun, 2011).

The population in the study were all fifth grade students of MI IT Al-Mubarak even semester of the 2022/2023 academic year totalling 34 students. The sample in this study was divided into two classes, namely classes VA and VB (Bagus Sumargo, 2020). The sampling technique in this study used Probability sampling technique, which is a sampling technique by providing equal opportunities for all members of the population. In this study, the sample consisted of two groups, namely experimental and control classes. Samples taken VA class students as an experimental class totalling 17 students, while VB class as a control class totalling 17 students.

Table 1 Research sample

No	Class type	Student count
1	Experimental class	17
2	Control class	17

The instrument used by researchers uses an observation sheet. With the aim of obtaining direct information about student activities in the learning process with the *STEAM* approach (*Science, Technology, Engineering, Art, Mathematics*). The *STEAM* approach is effective in developing critical thinking, problem solving, and collaboration skills in students. (Lotta C. Larson & Teresa Northem Miller, 2011). Observed activities include visual, listening, writing, speaking, mental, motor and emotional activities, all of which are integrated in learning activities involving *STEAM* components, according to (Bruce Joyce, 2022), all of which are measured by indicators compiled in the observation sheet. The student learning activity observation sheet contains 10 questions.

Data analysis in this study used t-test, which is a statistical technique to test whether there is a significant difference between two groups. Before conducting the t-test, prerequisite tests such as normality test and homogeneity test were conducted to ensure that the data fulfilled the necessary analysis assumptions (Field, 2013). The use of SPSS in this analysis simplified the calculation process and helped ensure the accuracy of the results.

RESULT AND DISCUSSION

Based on the observation results, it can be seen that student learning activities increased significantly in classes that used the STEAM approach compared to classes that used conventional methods. In the experimental class using the STEAM approach, the total score of learning activities reached 1555 with an average of 91.47 which was categorised as very good. In contrast, the control class using the conventional learning approach only achieved a total score of 1085 with an average of 63.82, which is in the sufficient criteria. These results indicate that the application of STEAM has a positive impact on increasing student engagement and learning activities. Recent research by Lestari dkk (2021) supports these findings, where the STEAM approach is proven to be effective in increasing students' learning engagement and motivation through interactive project-based learning. Through STEAM, students are encouraged to think critically and be creative, which ultimately results in increased student activity and understanding of the subject matter.

In addition, a study by Permana, S., & Setiawan (2022) showed that the STEAM approach is able to improve students' critical thinking skills and creativity, especially in science subjects. They found that this method allows students to apply the concepts learnt in a real context, thus making learning more meaningful and relevant. This is reflected in the observation results where the experimental class with the STEAM approach showed a much higher learning activity score compared to the control class. Furthermore, Maulana, A., & Putri, (2023) in their study argued that the STEAM approach supports the development of a range of student skills, including problem solving and collaboration. They noted that students' active engagement in STEAM-based learning helps them develop the abilities needed to face real-life challenges, thereby increasing the effectiveness of learning. Thus, this observation data is in line with recent studies that show that the STEAM approach can effectively improve students‘ learning activities and engagement, which greatly affects students’ learning outcomes.

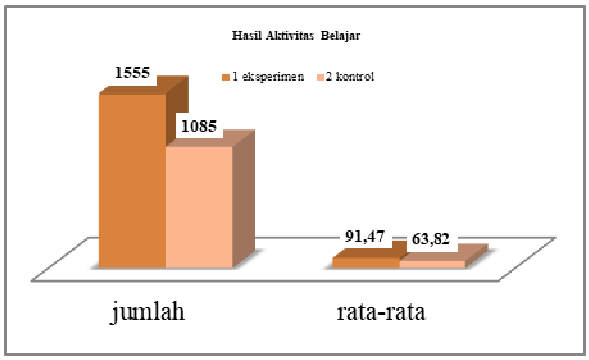
So the table shows that the experimental class in student learning activities in the learning process using the Science Technology, Engineering, Art, Mathematics (*STEAM*) approach is higher than the control class. The results of the student learning activity observation sheet can be seen in table 2 as follows:

Table 2. Observation Results of Student Learning Activities

No	Class	Amount	Average	Criteria
1	Experimental class	1555	91,47	Very good
2	Control class	1085	63,82	Medium

For more details, please see the picture below.

Figure 1. Learning Activity Results



Furthermore, to determine the effect of the *STEAM* approach there are student learning activities measured using the t-test, before the t-test is carried out, first the prerequisite test is carried out, namely the normality test, homogeneity test, and independent sample t-test hypothesis test. This test uses SPSS 24.

Normality and Homogeneity Test Results

Based on the results of the normality test, for all data on student learning activity observation sheets in the experimental class shows that the shapiro wilk sig value is 0.321> 0.05 while in the control class shows a shapiro wilk sig value of 0.098> 0.05. So the conclusion of this distribution states normal. While based on the results of the homogeneity test, it is known that the sig value of Besed on Mean in experimental and control class students is 0.202> 0.05, then as the basis for decision making on the homogeneity test above, it can be concluded that the observation sheet of student learning activities of experimental and control classes is the same or homogeneous..

Independent Sample T-Test Results

The data analysis technique used by researchers in this study is the Independent Sample Test (Sari et al., 2017). The process of drawing conclusions is to see the significance value compared to the value of α (5%). Where the hypothesis used is as follows:

The decision value is based on the probability value:

a. If significant t < error rate (α=0.05), then Ho is rejected, Ha is accepted (significant).
b. If significant t > error rate (α=0.05), then Ho is accepted, Ha is rejected (not significant) (Riyani et al., 2017)

Decision making based on the value of t_{hitung}:

a. If $t_{hitung} > t_{tabel}$ then H_0 rejected H_a accepted (signifikan).
b. If $t_{hitung} < t_{tabel}$ then H_0 rejected H_a rejected (tidak signifikan). (Budiastuti & Bandur, 2018)

The statistical hypothesis used is :

Ho: $\mu_1 = \mu_2$ There is no effect of the *STEAM* approach on student learning activities at MI IT AL-Mubarak Langsa

Ho: $\mu_1 \# \mu_2$ There is an influence of the *STEAM* approach on student learning activities at MI IT AL-Mubarak Langsa (Riyani et al., 2017).

The data used is normal distribution and homogeneity which is a requirement for the independent sample t-test test. The following independent sample t-test results using SPSS are presented in table 3 below

Results Table 3. Independent Sample Test for Learning Activities

	Levene's Test for Equality of Variances		**t-test for Equality of Means**						
								95% Confidence Interval of the Difference	
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper

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Hasil Observasi	Equal variances assumed	1.694	.202	20.873	32	.000	27.647	1.325	24.949	30.345
	Equal variances not assumed			20.873	28.179	.000	27.647	1.325	24.935	30.360

Based on the hypothesis test above, the observation sheet of student learning activities in the experimental class and control class obtained $t_{hitung} > t_{tabel}$ i.e. 20,873 > 2,036 and significant value 0,00< 0,05. Hence the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) accepted. then it can be concluded that there is an effect of the Science, Technology, Engineering, Art, Mathematics (*STEAM*) approach can increase students' science learning activities.

In learning using the *STEAM* approach which trains children's creativity and children's learning activities to be more active in learning, especially science learning in solving a problem, this approach also trains children in group cooperation, students are divided into 3 groups then each group will discuss what they get from the results of the experiment, then from the results of the discussion the students will answer the questions that the teacher has provided on the student worksheet (LKPD) according to what they get from the results of the experiment, then the results of the discussion are presented in front of the class from each group. The advantages of *STEAM*:

a. Train children to think critically, logically, and creatively
b. Children learn without realizing they are learning
c. *STEAM* is packaged in the form of games that are fun for children.
d. Arouse students' curiosity and trigger their creative imagination and critical thinking.(Fathoni et al., 2020)

Not only advantages but in *STEAM* learning there are also disadvantages, namely:

a. Requires a lot of time to complete the learning material
b. Learners who have weaknesses in experiments and information gathering will experience difficulties.

c. The existence of *STEAM* learning can make students less likely to appreciate other subjects that do not use the *STEAM* approach during the learning process. (Mulyani, 2019)

CONCLUSION

Based on the results of the study, it can be concluded that there is a significant effect of the *STEAM* approach on student learning activities in class V MIIT Al-Mubarak Langsa. Based on hypothesis testing using the t-test, the t-count value is greater than the t-table, which indicates acceptance of the alternative hypothesis. This means that the *STEAM* approach is proven to increase student learning activities, both in terms of physical, mental and emotional involvement. Observations during the study showed that students who studied with the *STEAM* approach were more active in the learning process, both in discussion activities, completing tasks, and asking questions. These results also show that the *STEAM* approach can help overcome low student participation in science learning and improve teaching methods that previously tended to be conventional. Thus, this study provides strong evidence that the application of *STEAM* contributes positively to increasing student learning activities and can be used as an effective learning model in the future.

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