The Effect of Application of Experiment Method with STEAM Approach on Science Learning Outcomes in Elementary School Students

Anindita Historiana Putri[1*]; Diva Agistia Nur Azizah[2]; Dinda Putri Rahmanda Sari[3]; Sholita Amirah Qudsyi[4]; Ricky Setiawan[5]

[1,2,3,4,5]*Teacher Education for Elementary School, Universitas Negeri Surabaya, Indonesia*
[1*]*Corresponding email: anindita.21074@mhs.unesa.ac.id, Phone number: 0823 xxxx xxxx*

Article History:
Received: Jun 08, 2024
Revised: Jul 31, 2024
Accepted: Dec 15, 2024
Online First: Jan 05, 2025

Keywords:
Electricity,
Elementary School,
Experiment,
Science,
STEAM.

Kata Kunci:
IPA,
Listrik,
Percobaan,
Sekolah Dasar,
STEAM.

How to cite:
Putri, A. H., Azizah, D. A. N., Sari, D. P. R., Qudsyi, S. A., & Setiawan, R. (2025). The Effect of Application of Experiment Method with STEAM Approach on Science Learning Outcomes in Elementary School Students. *Edunesia : Jurnal Ilmiah Pendidikan, 6*(1), 90-104.

Abstract: This study intends to analyze the impact of applying the experimental method with the Science, Technology, Engineering, Art dan Math (STEAM) approach on the learning outcomes of science on the material of electrical energy sources for class VB students at SDN Panjunan Sidoarjo. This study uses a quantitative approach with a pre-experimental design type called a one-group pre-test-post-test design. The study sample consisted of 19 students. Data were collected using tests and analyzed using parametric statistical tests paired t-tests with normality tests as prerequisite tests. The average pre-test score was 57.63, while the average post-test score was 76.68. Through the paired t-test, the results were obtained in the form of an asymp value. Sig (2-tailed) 0.000 (less than 0.05), so it can be concluded that applying the experimental method with the STEAM approach affects the learning outcomes of class V students at SDN Panjunan Sidoarjo. Thus, evidence was obtained that using experimental methods with the STEAM approach in science learning activities significantly contributed to optimizing science education outcomes for elementary students because it actively involved students in gaining meaningful experiences.

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh penerapan metode percobaan dengan pendekatan Science, Technology, Engineering, Art dan Math (STEAM) terhadap hasil belajar IPA materi sumber energi listrik pada siswa kelas VB di SDN Panjunan Sidoarjo. Penelitian ini menggunakan pendekatan kuantitatif dengan rancangan *Pre-Eksperimental Design* tipe *One Group Pre-test-Post-test Design*. Sampel dalam penelitian sejumlah populasi yang berjumlah 19 siswa. Data dikumpulkan menggunakan tes dan dianalisis menggunakan uji statistik parametrik *paired t-test* dengan uji normalitas sebagai uji prasyarat. Hasil analisis menunjukkan bahwa terdapat peningkatan hasil belajar setelah menerapkan metode percobaan dengan pendekatan *STEAM* dalam pembelajaran. Nilai rata-rata *pre-test* adalah 57,63 sedangkan nilai rata-rata *post-test* adalah 76,68. Melalui uji *paired t-test* diperoleh hasil berupa nilai asymp. sig (2-tailed) 0,000 (lebih kecil dari 0,05) sehingga dapat disimpulkan bahwa penerapan metode percobaan dengan pendekatan STEAM berpengaruh terhadap hasil belajar siswa kelas V SDN Panjunan Sidoarjo. Dengan demikian, diperoleh bukti bahwa penggunaan metode percobaan dengan pendekatan STEAM dalam kegiatan pembelajaran IPA memberikan kontribusi yang tinggi dalam meningkatkan hasil belajar IPA siswa sekolah dasar. Metode percobaan dengan pendekatan STEAM ini dapat melibatkan siswa secara aktif dalam kegiatan pembelajaran sehingga mereka dapat belajar dengan mendapat pengalaman yang bermakna.

https://doi.org/10.51276/edu.v6i1.970

A. Introduction

National Education System Law, Law No. 20 of 2003 (SISDIKNAS) Article 1 Paragraph (1) explains that education is an intentional effort to conduct learning activities that can involve students enthusiastically developing their capability to attain the reformation of the Indonesian education system (Kristiandari et al., 2023). In the current century, students and educators must be able to accommodate innovations in science and technology (Anggraini & Hudaidah, 2021). This is quite a challenge for the world of education because it must produce quality output that can master these 21st-century skills (Helga et al., 2024). The education system in Indonesia must be able to continue to make updates to create education that is up to date.

The STEAM approach is one of the efforts to realize the aspirations of 21st-century skills education. STEAM-based learning is a pedagogical approach emphasizing the bond between knowledge and skills of science, technology, engineering, art, and mathematics (Mu'minah & Suryaningsih, 2020). The STEAM approach can facilitate students to contribute actively to learning activities by creating a product based on their innovation (Arsy & Syamsulrizal, 2021). Through this approach, students are equipped to cultivate creativity and critical thinking skills so that this understanding can be utilized to resolve problems and make decisions for human progress.

The STEAM approach in elementary schools is often implemented in advanced classes through science subjects. Natural Science Learning, or what is usually known as Science Learning, is one of the compulsory learning subjects taught, with no exception for the elementary school level. The STEAM approach can guide students in advancing their scientific understanding of nature because natural science learning emphasizes providing direct experience and knowledge (Yuliati, 2017). Science learning with the STEAM approach facilitates students' concrete and abstract thinking to participate actively during learning activities (Sari & Sutihat, 2022).

At the elementary school level, especially in grade 5, phase C, one of the educational contents delivered to provide direct knowledge to students is the material on electrical energy sources. Electricity is one of the things that is familiar to students. In every line of life, they are familiar with electricity for cooking, turning on lights, turning on fans, and other things. Currently, humans are dependent on electricity. Therefore, in the learning outcomes of grade 5 phase C that have been determined, learning about this electrical energy source is given. The content of these learning outcomes explains that students recognize the origins and types of energy and describe the transformation of energy in daily life scenarios (such as heat, electricity, sound, and light).

In learning, a teacher should be qualified to select teaching strategies, media, and educational tools to facilitate students' learning (Yusuf, 2020). The experiment method is the correct method for learning science in elementary school. The experiment method is a method that creates teaching and learning interactions that can help students understand the material because they are actively involved during learning activities (Solikati, 2021). This method can help students understand the material of electrical energy sources with a

https://doi.org/10.51276/edu.v6i1.970

concrete example of electricity stringing activities with a battery source. The method is able to develop science process skills by triggering curiosity and proving directly by students (Dewi et al., 2021).

At SDN Panjunan, the implementation of science learning has used the experimental method, but the experimental method still cannot optimally cover the learning material of electrical energy sources. The experiments carried out are still limited to making electrical circuits with a battery source on a board. The experiments still cannot provide concrete examples of using electrical circuits that students have designed. Therefore, the science learning of electricity material in class V SDN Panjunan still cannot facilitate 21st-century skills because it has not implemented the STEAM approach.

The STEAM approach used in the material of electrical energy sources in phase C students of grade 5 SDN Panjunan is carried out through experiments in making electric flashlights from used bottles. Through this experiment, students gain new knowledge and are taught to recycle used plastic bottles into other useful products. The electrical energy source is an alternative energy source in the form of a battery that converts chemical energy into electrical energy. Batteries were chosen because they can store electrical energy sources for a determined length of time and can be relied upon to operate electronic equipment that is portable or can be carried everywhere. This is necessary because the flashlight should be practical to be the main consideration in its manufacture, so that is the underlying reason we chose the trial of making an electric flashlight using a battery energy source.

Several previous researchers have conducted similar research, such as Zulaekho (2020), applying experimental strategies to increase motivation in science learning the theme of events in life for VA class students of SD Negeri 2 in Rembang District. Then Rezkillah & Prasetyo (2023) also suggested that the experimental method had a positive effect concerning the advancement of science literacy capabilities and cognitive development results of elementary school students in Cakranegara District, where students acted as engineers who carried out a project with several factors that caused the experimental method to be successful. Another researcher, Nuzula et al (2022), showed that the execution of the experimental method is feasible to use in learning because it can contribute to better academic results and train grade VI students of SDN 1 Kateng to reconstruct their knowledge independently. Research conducted by Masus & Fadhilaturrahmi (2020) states that the experimental method can improve science process skills in third-grade students of SD Pelangi School, as indicated by the increasing percentage of students' science process skills.

Learning with experimental methods can be done with the STEAM approach, as in the research conducted by Nasrah et al (2021) regarding STEAM learning (Science, Technology, Engineering, Art, and Mathematics), which is effectively applied in science learning for fourth-grade students at SD Pertiwi Makassar. This effectiveness is seen from the completeness of student academic progress, activities in learning, and student responses to good learning. Similar research by Setiawan et al (2021) used the STEAM approach to develop a science learning tool about our theme of best friend's environment,

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which, after being tested, received valid results and excellent qualifications for use in learning. Mu'minah (2021) mentioned in her research that the execution of STEAM in 21st-century learning develops students' cognitive aspects and competencies to address the issues of the globalized era ahead. Research by Khoiriya et al (2023) regarding the key element of the STEAM approach can also improve analytical thinking skills and science knowledge in learning science for fourth-grade students of SD Anak Saleh Malang.

Derived from past research that has obtained favorable results, this study will examine the implications of employing experimental methods with the STEAM approach to examine the outcomes of science learning materials on electrical energy sources in VB class students at SDN Panjunan Sidoarjo. Therefore, the problems can be formulated as follows: (1) does the experimental method with the STEAM approach affect the learning outcomes of VB grade students at SDN Panjunan on the material of electrical energy sources? (2) how does the experimental method with the STEAM approach affect the learning outcomes of VB grade students at SDN Panjunan on the material of electrical energy sources? Thus, this study was conducted to determine whether the STEAM approach's experimental method can affect the learning outcomes of VB grade students of SDN Panjunan on the material of energy sources. Specifically, the focus of this study was to gain and determine comparative data on learner achievements before and after the experimental method was applied. Then, the data comparison is used to test whether or not the experimental method has an effect.

B. Method

This study combines quantitative methods with experimental research type. Experimental research is research aimed at (1) testing the proposed hypothesis, (2) predicting events in the experiment, and (3) drawing generalizations about the relationship between variables (Winarni, 2018). Experimental research is conducted by manipulating the alteration of independent variables while controlling other significant factors and evaluating the impact on the dependent variable (Rukminingsih et al., 2020). This study has two variables: the independent variable, which is the application of the experimental method, is highlighted with the STEAM approach, and the dependent variable in terms of student achievements.

This study applied a pre-experimental design with a one-group pre-test-post-test arrangement for the experimental method.

Table 1. Design One Group Pre-test-Post-test

Group	Pre-test	Treatment	Post-test
Experiment	O2	X	O2

O1 : pre-test score
X : Treatment

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O2 : post-test score

The experimental group is the group that receives treatment. In this research project, the experimental group and the research sample were 19 class VB SDN Panjunan Sidoarjo students. All students will be given the same treatment, namely implementing the learning process using the experimental method with the STEAM approach. The research outcomes will be revealed by analyzing the differences between the pre-test and post-test results.

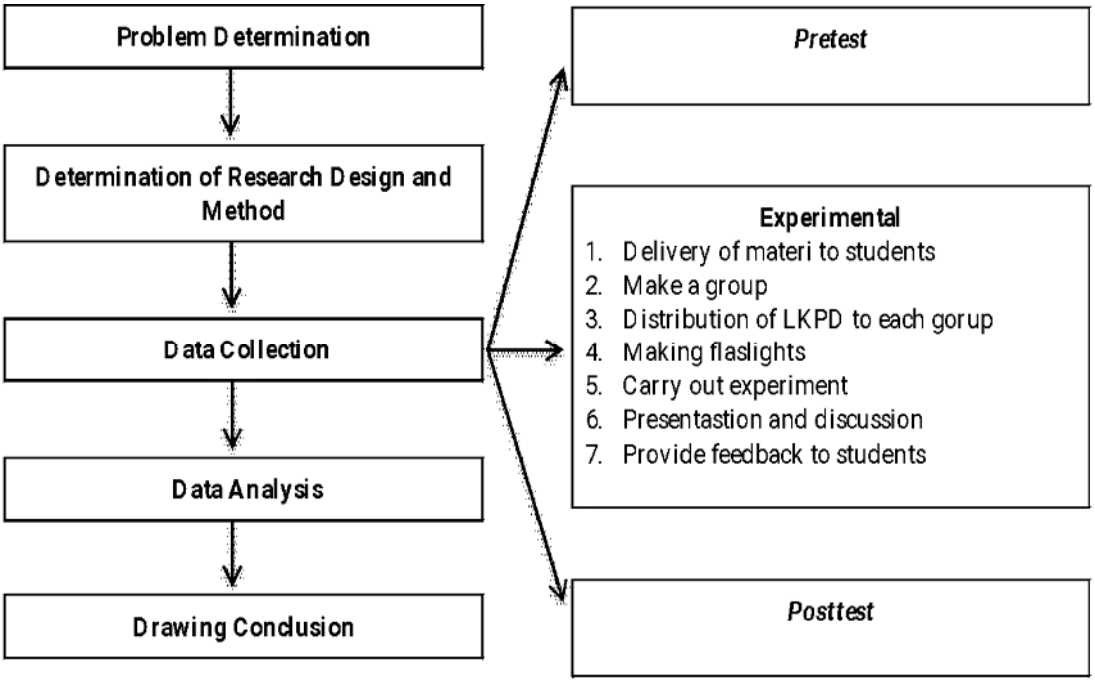

Figure 1. Research Framework

Quantitative research involves testing theoretical concepts by quantifying variables and analyzing data with statistical procedures (Paramita, 2021). As the measuring tool, the research used a written assessment, which included fifteen multiple-choice questions. Before being given to students, the teacher validated the questions by filling out a 1-5 Likert scale questionnaire. The questionnaire contains eight questions, namely (1) the questions are by the indicators, (2) the material asked is by the competencies measured, (3) the material is structured, concisely, and effectively, (4) the material avoids providing any guidance toward the correct answer, (5) The material is free of double negative constructions, (6) pictures, charts, tables, diagrams, and other visuals are clear and serve a functional role, (7) logical answer choices in terms of material, (8) the extent of the response choice formulation is relatively the same. In addition to teacher validation, the questions were also tested using the validity test. The questions' validity was tested through the Pearson Correlation test, which analyzes the correlation between each question's score and the total score obtained from the respondent's answers. A question is valid if the calculated R-value exceeds the R table. Conversely, a question is said to be invalid if the R-value is

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smaller than the R table value. Meanwhile, the reliability of the question is determined based on the results of the alpha value. A question is considered reliable if the Cronbach's alpha value is more than 0.6.

The validity and reliability tests apply only to the questions used as the instrument for data collection. The results of working on the questions before and after the treatment are the study's results. The study results were examined using the paired t-test statistical analysis to evaluate the effect of the treatment. This test helps to determine if there is a variation in the average scores before and after the treatment. If the Sig value. (2-tailed) < 0.05, then there is a difference after treatment, but if the Sig value is. (2-tailed) > 0.05, and then there is no difference after treatment. In research that uses paired t-tests, data normality is the main requirement. Therefore, researchers also conducted a normality test using the Shapiro-Wilk test. This test is most effectively used to detect normality in samples of around seven to fifty. In this study, the sample used was nineteen. The data follows a normal distribution if the significance value is higher than 0.05 and an abnormal distribution if the significance value is lower than 0.05.

C. Result and Discussion

Result

This study employs a quantitative methodology to facilitate the gathering of data, which is then analyzed using statistical techniques. As the data is collected through written test items, it is essential to assess both validity and reliability. A paired t-test is applied to test the hypothesis. However, before conducting this test, data normality must be verified as a prerequisite. Thus, the normality test is performed prior to the paired t-test. The results of each test conducted are outlined below.

1. Validity Test

Validity refers to the assessment that determines the accuracy and reliability of a measuring instrument. An instrument is deemed valid when it precisely measures the intended variable (Widodo et al., 2023). In this research, the instrument being tested consists of twenty multiple-choice questions. Through the validity test using SPSS, it can be determined whether the questions are valid. A question is deemed valid if the calculated R-value exceeds the R table value.

On the other hand, a question is considered invalid if the calculated R-value is lower than the R table value. Since ten students, n = 10, answered the questions. For n = 10 with a significance level of 0.05, the R table value is 6.325. Below are the validity test results performed using SPSS for Windows 26.0.

Table 2. Validity Test Results

Question Number	r_{Count}	Question Status
1	0,645	Valid

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Question Number	r_{Count}	Question Status
2	0,761	Valid
3	0,869	Valid
4	0,752	Valid
5	0,800	Valid
6	0,761	Valid
7	0,800	Valid
8	0,669	Valid
9	0,728	Valid
10	-0,175	Invalid
11	0,058	Invalid
12	0,771	Valid
13	0,800	Valid
14	0,350	Invalid
15	0,856	Valid
16	0,771	Valid
17	0,761	Valid
18	0,071	Invalid
19	0,302	Invalid
20	0,761	Valid

Based on the information above, it is evident that five question items are invalid: items number 10, 11, 14, 18, and 19. These items are deemed invalid because their calculated R-value is lower than the corresponding R table value (0.632). In contrast, the remaining fifteen items are considered valid, as their calculated R-value exceeds the R table value (0.632). Therefore, the questions selected for the pre-test and post-test will be the fifteen valid items, specifically items 1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 13, 15, 16, 17, and 20.

The research instrument, which included questions, was also reviewed and validated by the 5B SDN Panjunan homeroom teacher. The instrument used for validation was a Likert scale questionnaire, with scores ranging from 1 to 5. Two aspects were evaluated: content and construction. The teacher reviewed the following items from the questionnaire:

1. The questions are directly related to the indicators.
2. The material addressed is relevant to the competencies being assessed.
3. The subject matter is clear, concise, and well-formulated.
4. The material does not lead to biased or specific answers.
5. The questions are free from double-negative statements.
6. The images in the questions are easy to understand and serve their purpose.
7. The answer options are logical and related to the content.
8. The range of answer options is consistent.

The validation results for the question instrument, consisting of 10 multiple-choice questions, yielded a score of 32 out of 40, representing 80%. This score meets the "valid" criteria, allowing the questions to be used to assess student performance.

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2. Reliability Test

After the questions have passed the validity test conducted by both teachers and SPSS, the next step is to perform the reliability test. Reliability refers to the consistency of a series of measurements or instruments when repeated testing yields similar results. A test is considered highly reliable if it consistently produces the same results. The measurement outcomes should remain stable (relatively the same) when administered to the same subject, regardless of who conducts the test, when it is conducted, or where it takes place (Widodo et al., 2023). Reliability is usually represented by a coefficient, where a higher coefficient indicates more dependable results. An AA reliability test using SPSS can be performed to determine whether a question is reliable. The reliability of a question is confirmed if its Cronbach's alpha value is above 0.6. Below are the results of the reliability test conducted.

Table 3. Reliability Test Results

Cronbach's Alpha	N of Items
.896	20

From the results above, it is clear that all the questions intended for testing are reliable. This is evidenced by a Cronbach's alpha value of 0.896, which exceeds the threshold of 0.6.

3. Data on Student Learning Outcomes Before and After Treatment (Pre-test and Post-test Values)

Questions that have passed the validity and reliability tests can be used to measure student abilities. The questions were distributed to students before the implementation of learning activities as a form of pre-test and after the execution of learning as a form of post-test. The pre-test activity seeks to identify the students' initial understanding purely before the execution of the treatment.

Table 4. Comparison of Pre-test and Post-test Results

Number	Name	Pre-test Score	Post-test Score
1	ABZ	67	90
2	ADL	60	67
3	AKB	60	73
4	DBY	60	73
5	DMS	60	90
6	FHN	73	83
7	FN	67	83
8	HFS	47	80
9	LLA	67	73
10	MLN	53	83
11	NFH	40	57

https://doi.org/10.51276/edu.v6i1.970

Number	Name	Pre-test Score	Post-test Score
12	OCH	40	57
13	OZL	87	93
14	RFK	53	83
15	RFY	60	83
16	RZK	47	77
17	TSN	47	77
18	YMN	60	83
19	YG	47	90

The data in Table 4 shows a marked difference between the pre-test and post-test scores. Each student's score on the post-test increased, and no one scored below 50.

4. Data Normality Test

The pre-test and post-test scores obtained from these students must be tested for normality to check for the normality of the data distribution. According to Nuryadi et al (2017), the normality test evaluates if the sample data exhibits a normal distribution. This study must use customarily distributed data. This normally distributed data shows that the samples' distribution does not have significant differences, so researchers can be more objective.

For the normality test, this study utilized the Shapiro-Wilk test. This test is most effectively used to detect normality in samples of around seven to fifty. In this study, the sample used was nineteen. Data is normally distributed if the significance value is >0.05 and abnormally distributed if the significance value is <0.05. The following results of the normality test with the help of SPSS 26.0 for Windows can be seen in the following table.

Table 5. Normality Test Results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.158	19	.200	.937	19	0.233
Post-test	.190	19	.070	.906	19	0.63

Based on the Shapiro-Wilk normality test using SPSS, it can be seen that the pre-test normality test results have a significance value > 0.05, which is 0.233 > 0.05, which means that the pre-test data is usually distributed. Meanwhile, the post-test normality test results also have a significance value > 0.05, which is 0.066 > 0.05, which means that the post-test data is also normally distributed.

5. Paired T-test

Once the normality of the data distribution is established, a paired sample t-test is used to determine the difference before and after the special treatment. The following

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results of the paired sample t-test test with the help of SPSS 26.0 for Windows can be seen in the following table.

Table 6. Comparison of Average Values through Paired T-Test Test

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test	57.63	19	11.814	2.710
	Post-test	78.68	19	10.226	2.346

Based on this data, the average student score before the experiment's execution to make a simple electric flashlight was 57.63. Meanwhile, the average value of students following the experiment's application to make a simple electric flashlight is 78.68. Therefore, applying the experiment to make a simple electric flashlight can improve students' mean scores in understanding the material.

Table 7. Paired T-test Results

Paired Samples Test					
		Paired 95% Confidence Interval of the Upper	t	Df	Sig. (2-tailed)
Pair 1	Pre-test – Post-test	-15.976	-8.712	18	.000

Based on the paired sample t-test, the Sig. (2-tailed) < 0.05, which is 0.000 < 0.05, which means that there is a difference in the average value of the Natural Science chapter on electricity after the experiment to make a simple electric flashlight so that this experimental method is appropriate to be applied in order to boost the learning results in Natural Science subjects on electrical energy sources for grade 5.

Discussion

This study is centered on evaluating the influence of the experimental method's implementation with the integration of the STEAM approach on educational results of electrical energy source material of class VB SDN Panjunan students. In this study, the experimental method was carried out after students made flashlights from used bottles. This flashlight-making is the execution of the STEAM approach to learning.

Table 8. STEAM Analysis of the Activity of Making Flashlights from Plastic Bottles

STEAM Elements	Implementation
Science	Use of science concepts on electrical energy sources
Technology	Use of batteries as a source of electrical energy
Engineering	Assembling electrical circuits
Art	Decorate the flashlight body with paper, paint, etc.
Mathematics	Measurement

https://doi.org/10.51276/edu.v6i1.970

The teacher uses the experimental method with the STEAM approach by the teacher following specific steps. First, the pre-test can be implemented by giving a question sheet to be completed by students individually. Second, the implementation of the treatment. In executing the treatment, the following steps were taken: (1) the teacher introduced material on electrical energy sources, (2) the teacher organized students into groups of 4-5, (3) the teacher handed out LKPD, (4) students created electric flashlights as instructed in the LKPD, (5) students performed experiments, (6) students recorded their observations, interpretations, and conclusions from the experiments on the LKPD, (7) students submitted the LKPD, (8) certain groups presented their findings while others responded, and (9) the teacher provided feedback and responses on students' work. Third, the post-test will be implemented by giving an evaluation question sheet with the same questions as the pre-test questions.

Based on the research objectives, two hypotheses were proposed. First, Ho means that applying the experimental method with the STEAM approach has no effect on students' learning outcomes in class VB SDN Panjunan. Second, Ha means that the application of the experimental method with the STEAM approach affects the learning outcomes of students in class VB SDN Panjunan.

Hypothesis testing starts with collecting data, which in this study was gathered using a written test composed of questions. In order to increase the chance of valid and reliable research results, the measuring instrument must also be valid and reliable. The validity of the questions was tested using Pearson Correlation and validation from the teacher. The validity test results showed that of the twenty questions tested, there were fifteen valid and five invalid questions. Invalid questions were not used, so only fifteen questions would be given to students. The reliability of the questions was further evaluated by comparing the alpha value of Cronbach's alpha with 0.6. The question is declared reliable if the alpha is more than 0.6. According to the reliability test analysis in this study, the results showed that twenty questions were reliable because Cronbach's alpha value was 0.896 (more significant than the minimum reference of 0.6). Because the valid questions are only fifteen questions, the questions given to students remain fifteen valid questions.

Once the measuring instrument is confirmed valid and reliable, the questions can be used for the pre-test and post-test. Nineteen class VB SDN Panjunan students attended the pre-test and post-test. The pre-test and post-test findings showed a considerable enhancement in student learning outcomes after applying the STEAM approach's experimental method. This is evidenced by the results of the paired t-test analysis, which shows that the pre-test average value is 57.63 while the post-test average value is 78.68. That is, there is an average increase of 21.05 from the pre-test. In addition, the amp was also found through the paired t-test. The sig value of the research data was 0.000. In the paired t-test test, if the asymp. If the Sig value is smaller than 0.05, Ho is rejected, and Ha is accepted. Conversely, if the asymp. Sig value is more significant than 0.05, then Ho is

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accepted, and Ha is rejected. Therefore, using the experimental method with the STEAM approach impacts the learning outcomes of students in class VB SDN Panjunan.

These results are in agreement with earlier studies conducted by other researchers. Based on Sari's research focused on enhancing science learning outcomes in electrical circuits through experimental methods in Class VI of Pakualam 01 State Elementary School during the 2019/2020 academic year, after applying action research, the results showed that the percentage of students who completed the pre-cycle was 25%, then cycle I was 62.5%, and cycle II was 90.63%. This shows a positive change in learning outcomes after the experimental method was applied to electrical circuit material (Sari, 2021).

Based on research conducted by Solikati regarding improving science learning achievement on simple electrical circuits using experimental methods using class action research, the results showed that the percentage of students who were complete in cycle I was 64%, cycle II 77%, cycle III 86% (Solikati, 2021). The research found a notable increase in science learning outcomes following the experimental method. The action research conducted by Somantri et al. focused on using experimental methods to improve science learning outcomes in grade V elementary students. It showed that the percentage of students who completed cycle I was 37% and cycle II was 92% (Somantri et al., 2018). This shows that this experimental method can improve elementary school students' science proficiency.

Integrating experimental methods with the STEAM approach at SDN Panjunan benefits from several supporting factors that drive successful execution. Rosmalah et al (2022) states that the availability and use of appropriate facilities and infrastructure, accompanied by supportive classroom conditions, will encourage students to take part in learning well. The availability of experimental tools and materials that are easily found in the surrounding environment will facilitate the implementation of learning with this learning method. Due to the selection of methods, approaches, and materials that do not require complex facilities and infrastructure, this experimental project contributes significantly to the success of the research. As observed in previous research, the experimental method with the STEAM approach has proven successful in increasing motivation for student learning outcomes. Using experimental methods with the STEAM approach will help students and teachers so that the learning process can achieve results that correspond with the educational objectives and desired learning outcomes.

D. Conclusion

Applying the experimental method with the STEAM approach is the right step to raise student learning standards to understand electricity. The application of this experimental method can enhance student understanding and help them navigate more easily to understand better how electricity works that they use in everyday life through guided electrical stringing activities. This indicates that students' comprehension of the material increases when they can actively participate in the learning process. Students also

https://doi.org/10.51276/edu.v6i1.970

need to experiment directly so that they not only understand the concept theoretically but also have the opportunity to gain meaningful experience.

Considering the study's outcomes, evidence was obtained that the integration of experimental methods and the STEAM approach in science learning activities significantly boosted elementary school students' science performance. The experimental method with the STEAM approach can actively involve students in learning activities so that they can learn by getting meaningful experiences. Through meaningful experiences, the material becomes more embedded in students. Therefore, the insights gained from this study can be used by teachers and prospective teachers as input to improve the application of more appropriate learning strategies to strengthen student performance in science.

Based on the research results and conclusions, the researcher suggests that teachers apply the experimental method with the STEAM approach in learning science electricity material. These methods have proven effective in improving student learning outcomes by cultivating a student-centered, meaningful approach to learning that encourages active involvement and better understanding of the material. The suggestions that can be given to future researchers are (1) experimental tools should be made from home so as not to spend much time at school, and (2) groups formed consist of 2-3 members so that all members can work and play a role during group activities.

References

Anggraini, W., & Hudaidah, H. (2021). Reformasi Pendidikan Menghadapi Tantangan Abad 21. *Journal on Education*, *3*(3), 208–215. https://doi.org/10.31004/joe.v3i3.363.

Arsy, I., & Syamsulrizal, S. (2021). Pengaruh Pembelajaran Steam (Science, Technology, Engineering, Arts, and Mathematics) terhadap Kreativitas Siswa. *Biolearning Journal*, *8*(1), 24–26. https://doi.org/10.36232/jurnalbiolearning.v8i1.1019.

Dewi, P. Y. A., Kusumawati, N., Pratiwi, E. N., Sukiastini, I. G. A. N. K., Arifin, M. M., Nisa, R., & Kusumawati, P. R. D. (2021). *Teori dan Aplikasi Pembelajaran IPA SD/MI*. Aceh: Yayasan Penerbit Muhammad Zaini.

Helga, M., Untari, M. F. A., & Mulyani, M. (2024). Penerapan Pendekatan STEM pada Pembelajaran Rangkaian Arus Listrik dan Pembangkit Listrik Kelas 5 Sekolah Dasar. *Jurnal Basicedu*, *8*(2), 1068-1077. https://doi.org/10.31004/basicedu.v8i2.7243.

Khoiriya, R. M., Oktarianto, M. L., & Rohmiati, D. P. (2023). Penerapan Pendekatan Steam dalam Pembelajaran IPA untuk Meningkatkan Keterampilan Berpikir Kritis dan Literasi Sains Siswa Kelas IV SD Anak Saleh Malang. *JTIEE (Journal of Teaching in Elementary Education)*, *7*(2), 142-147. http://dx.doi.org/10.30587/jtiee.v7i2.7482.

Kristiandari, C. S. D., Akbar, M. A., & Limiansih, K. (2023). Integrasi Computational thinking dan STEM dalam Pembelajaran IPA pada Siswa Kelas VB SD Kanisius Kadirojo. *INNOVATIVE: Journal of Social Science Research*, *3*(2), 4794-4806.

https://doi.org/10.51276/edu.v6i1.970

Masus, S. B., & Fadhilaturrahmi, F. (2020). Peningkatan Keterampilan Proses Sains IPA dengan Menggunakan Metode Eksperimen di Sekolah Dasar. *Jurnal Pendidikan Dan Konseling (JPDK)*, 2(2), 161–167. https://doi.org/10.31004/jpdk.v2i1.1129.

Mu'minah, I. H. (2021). Studi Literatur: Pembelajaran Abad-21 Melalui Pendekatan Steam (Science, Technology, Engineering, Art, and Mathematics) dalam Menyongsong Era Society 5.0. *Prosiding Seminar Nasional Pendidikan*, *3*, 584–594.

Mu'minah, I. H., & Suryaningsih, Y. (2020). Implementasi Steam (Science, Technology, Engineering, Art and Mathematics) dalam Pembelajaran Abad 21. *BIO EDUCATION : (The Journal of Science and Biology Education)*, *5*(1), 65–73. https://doi.org/10.31949/be.v5i1.2105.

Nasrah, Amir, R. H., & Purwanti, R. Y. (2021). Efektivitas Model Pembelajaran Steam pada Siswa Kelas IV SD. *Jurnal Kajian Pendidikan Dasar*, 6(1), 1–13.

Nuryadi, N., Astuti, D., Utami, S., & M Budiantara, M. B. (2017). *Dasar - Dasar Statistik Penelitian*. Yogyakarta: Sibuku Media.

Nuzula, I. F., Wulan, B. S., & Nurhayati, E. (2022). Pengaruh Percobaan Sederhana terhadap Hasil Belajar Siswa pada Tema 2 Subtema 2 di Kelas IV Sekolah Dasar. *Tunas: Jurnal Pendidikan Guru Sekolah Dasar*, *7*(2), 39-47. https://doi.org/10.33084/tunas.v7i2.3146.

Paramita, R. W. D. (2021). *Metode Penelitian Kuantitatif*. Lumajang: Widya Gama Press.

Rezkillah, I. I., & Prasetyo, Z. K.. (2023). Pengaruh Metode Percobaan terhadap Literasi Sains dan Hasil Belajar Kognitif Siswa Kelas V Sekolah Dasar Kecamatan Cakranegara. *Jurnal Ilmiah PENDAS: Primary Educational Journal*, *4*(1), 36–46. https://doi.org/10.29303/pendas.v4i1.2330.

Rosmalah, R., Nurdin, M., & Salam, A. A. (2022). Hubungan Ketersediaan Sarana dan Prasarana di Sekolah dengan Motivasi Belajar Siswa Kelas V SD Inpres 12/79 Lonrae. *JPPSD: Jurnal Pendidikan dan Pembelajaran Sekolah Dasar*, 2(1), 34. https://doi.org/10.26858/pjppsd.v2i1.27087.

Rukminingsih, Adnan, G., & Latief, M. A. (2020). *Metode Penelitian Pendidikan: Penelitian Kuantitatif, Penelitian Kualitatif, dan Penelitian Tindakan Kelas*. Yogyakarta: Erhaka Utama.

Sari, M. D. A. (2021). Peningkatan Hasil Belajar IPA Materi Rangkaian Listrik Melalui Penerapan Metode Eksperimen di Kelas VI Sekolah Dasar Negeri Pakualam 01 Tahun Pelajaran 2019/2020. *Educatif Journal of Education Research*, *3*(1), 188–193. https://doi.org/10.36654/educatif.v3i1.167.

Sari, P. K., & Sutihat. (2022). Pengembangan E-Modul Berbasis STEAM untuk Meningkatkan Kemampuan Berpikir Tingkat Tinggi Pada Pembelajaran Tematik di

https://doi.org/10.51276/edu.v6i1.970

Sekolah Dasar. *Jurnal Pendidikan Sains Indonesia*, *10*(3), 509–526. https://doi.org/10.24815/jpsi.v10i3.24789.

Setiawan, N. R., Wibawa, I. M. C., & Margunayasa, I. G. (2021). Perangkat Pembelajaran dan Lembar Kerja Siswa Berpendekatan Steam-PJBL pada Muatan IPA di Sekolah Dasar. *Mimbar Pendidikan Indonesia*, 2(2), 40–54. https://doi.org/10.23887/mpi.v2i2.37693.

Solikati, N. (2021). Peningkatan Prestasi Belajar IPA Materi Rangkaian Listrik Sederhana dengan Metode Eksperimen. *Jurnal Terapan Pendidikan Dasar dan Menengah*, 1(2), 310–322. https://doi.org/10.28926/jtpdm.v1i2.247.

Somantri, A., Djumhana, N., & Hendriani, A. (2018). Penerapan Metode Eksperimen untuk Meningkatkan Hasil Belajar IPA Siswa Kelas V SD. *Jurnal Pendidikan Guru Sekolah Dasar*, *3*(2), 22-29. https://doi.org/10.17509/jpgsd.v3i2.14065.

Widodo, S., Ladyani, F., Lestari, S. M. P., Wijayanti, D. R., Devrianya, A., Hidayat, A., & Widya, N. 2023. *Buku Ajar Metode Penelitian*. Pangkalpinang: CV. Science Techno Direct.

Winarni, E. W. (2018). *Teori dan Praktik Penelitian Kuantitatif dan Kualitatif: Penelitian Tindakan Kelas (PTK) dan Research and Development*. Jakarta: Bumi Aksara.

Yuliati, Y. (2017). Literasi Sains dalam Pembelajaran IPA. *Jurnal Cakrawala Pendas*. 3(2), 21-28.

Yusuf, Y. (2020). *Buku Ajar Desain Pembelajaran IPA SD*. Jakarta: EduCenter Indonesia.

Zulaekho, S. (2020). Penggunaan Metode Eksperimen untuk Meningkatkan Motivasi Belajar IPA pada Tema Peristiwa dalam Kehidupan bagi Siswa Kelas VA SD Negeri 2 Leteh kecamatan Rembang Kabupaten Rembang. *Jurnal Pendidikan Dasar*, 8(1). https://doi.org/10.20961/jpd.v8i1.41027.