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The Influence of Inquiry Learning Models Containing STEAM to Improve the Science Process Skills

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Abstract: Science process skills as an approach is very important, due to it fosters experience in science learning process. This study aims to analyze the influence of STEAM-based inquiry learning models on students' science process skills. The type of research used is experimental research. The research design used is a quasi-experiment with a nonequivalent control group design. The research data were collected using test techniques using pretest and posttest questions of science process skills, non-test techniques in the form of observation sheets of learning implementation, and observation sheets of science process skills. The data analysis technique used was percentage analysis of the learning implementation sheet and science process skills observation sheet, hypothesis prerequisite test in the form of normality test and homogeneity test, hypothesis testing with independent sample t-test, and effect size test. The results of the independent sample t-test test have a significance value of 0.013 <0.05, which shows a significant difference between the experimental and control classes. The magnitude of the treatment effect is measured by the effect size test, resulting in a value of 0.642, which is included in the strong category. Based on the analysis results, it can be concluded that the STEAM-based inquiry learning model significantly affects students' science process skills.

Keywords: Inquiry; Science Process Skills; STEAM

Introduction

Education is one of the important aspects to improve human resources and is one of the keys to success in national development in Indonesia. Education is an element that cannot be separated from human life during its development. The existence of human observations of objects and events in the surrounding environment makes the realization of a science that studies nature which is currently known as Natural Science (known with IPA). Science is a scientific study that focuses and explains natural phenomena and their interactions including the interaction of matter and energy and involves biotic and abiotic components (Abidin et al., 2021). Science includes a series of interrelated concepts with parts of concepts that have developed because of experiments and observations (Ilhami, A & Permana, 2023). Science as a scientific discipline and application in people's lives makes learning science important.

Science learning is the interaction between learning components in the form of a learning process to achieve goals in the form of predetermined competencies (Wisudawati & Sulistyowati, 2014). Science learning contains four elements, namely attitude, process, product, and application so that students can experience the learning process as a whole and understand natural phenomena through problem solving activities and scientific methods (Agustiana, 2014). The nature of science is the body of knowledge, the way of

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investigating, the way of thinking, and the interaction of science, technology, and society. However, the nature of science applied in schools, especially in the assessment of students, is only guided by the achievement of science as a body of knowledge so it has not paid attention to other aspects. This is supported by research which states that this problem is because teachers have not maximally developed authentic assessment instruments according to the measured aspects (Suwandani et al., 2020).

Science learning needs to be learner-centered because science is not just mastery of a collection of knowledge but is a process of discovery. However, science learning is still teacher-centered, only conveying material without involving students' activeness in the discovery process. This is supported by Firmansyah & Jiwandono's research which states that science learning still uses a teacher-centered learning approach to provide material explanations to students (Firmansyah & Jiwandono, 2022).

Science learning should be carried out by providing direct experience to students through scientific methods to find science concepts. In fact, science learning has not provided direct experience to students in the form of activities to carry out scientific methods that encourage students to think scientifically so that they can discover science concepts independently. Science learning emphasizes providing direct experience to develop competencies to explore and understand the surrounding environment scientifically (Ananda & Abdillah, 2018). Science learning, which emphasizes providing direct experience, is used to develop competencies to explore and understand the surrounding environment scientifically (Wilujeng, 2020). Science learning is expected to provide knowledge development skills (psychomotor), and scientific attitude abilities (affective) (Trianto, 2014). The existence of these problems causes the lack of development of science process skills possessed by students. This is in accordance with the research of Rahmasiwi et al. that low science process skills are caused by learning that emphasizes mastery of concepts and has not explored science process skills due to the lack of optimization of learning that involves the role of students in the classroom (Rahmasiwi et al., 2015).

Science process skills are skills that foster students' ability to apply scientific methods in discovering, understanding, and developing science (Khotimah & Kuntjoro, 2019). Low science process skills will affect the knowledge received by students, so that science learning becomes less meaningful because it only knows and memorizes knowledge. Thus, a learning model that can improve science process skills is needed.

One of the learning models that is suitable for solving problems since students' science process skills are still low is the inquiry learning model. The inquiry model is a learning model in which during the learning process, the educator is a source of information to provide extensive guidance and learning instructions to students (Anam, 2017). The series of activities in the inquiry learning model emphasizes the activeness of students to have learning experiences in finding material concepts (Zagoto, 2022). The inquiry-based learning model is a learning model that is worth considering because learning in this model does not only emphasize the acquisition or discovery of answers, but encourages students' curiosity in searching, searching, and developing further study and analysis (Sari, 2019).

The inquiry learning model has been widely used in previous studies to improve students' science process skills, so researchers try to link the inquiry learning model with the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach. This is because there have not been many studies that discuss integrating inquiry learning models with STEAM, which is one form of 21st-century learning related to soft skill development, so it is expected to develop students' science process skills further. STEAM does not only ask students to memorize theory, but students will be encouraged to be more active in practicing how to solve problems based on the understanding they already have. The STEAM approach can motivate learners to learn and explore skills in their own way (Sartono et al., 2020). Science learning is better to contain STEAM aspects. However, science learning does not yet contain STEAM aspects because there are still many teachers who do not understand and find it difficult to implement STEAM-filled science learning. This is supported by research by Efwinda et al., which states that some science teachers are familiar with the STEAM approach but still do not have in-depth knowledge to implement the STEAM approach (Efwinda et al., 2021). Based on this description, a study was conducted by applying the STEAM-BASED inquiry learning model as a form of 21st-century learning related to soft skill development so researchers raised a study with the title "The Influence of Inquiry Learning Models Containing STEAM to Improve the Science Process Skills" which aims to analyze the influence of the STEAM-based inquiry learning model on students' science process skills. The objectives of this research is to analyze the influence of STEAM-based inquiry learning models on students' science process skills.

Method

Research Type and Design

The type of research used is experimental research. The research design used is a quasi-experiment with a nonequivalent control group design (Sugiyono, 2018).

Table 1. Nonequivalent Control Group Research Design

Group	Pretest	Treatment	Posttest
Experiment (A)	TA_1	Science learning with STEAM-based inquiry learning model (X)	TB_1
Control (B)	TB_1	Science learning with discovery learning model (Y)	TB_2

Time and Place of Research

The research was conducted at one of the junior high schools in Sleman in July-December of the 2023/2024 academic year in the odd semester.

Population and Sample

The population in this study were all seventh-grade students in one of the Sleman area junior high schools; as many as 191 students were divided into 6 classes from VII A-VII F. Sampling in this study using cluster random sampling technique so that two classes were obtained, VII E as an experimental class totaling 31 students and VII F as a control class totaling 32 students so that the total sample amounted to 63 students.

Instruments and Data Collection Techniques

Learning instruments consist of teaching modules and student worksheets. The research instruments consisted of pretest and posttest questions about science process skills, observation sheets of learning implementation, and observation sheets of science process skills. The test technique used in this study was pretest and posttest questions of science process skills on temperature and heat material. Written tests in the form of multiple-choice questions with as many as 20 items to measure the results of the treatment, namely the students' science process skills. Multiple choice questions are arranged with Bloom's domain from C2 to C5 levels. The non-test technique used in this study is an observation sheet of learning implementation and a sheet of science process skills.

Data Analysis Technique

Learning Implementation Observation Sheet Analysis. The implementation of learning activities was analyzed by finding the percentage value. After obtaining the percentage value, it can be grouped into several categories according to the criteria in Table 2.

Table 2. Learning Implementation Category Criteria

Score	Category
X > 80%	Very Good
60% < X ≤ 80%	Good
50% < X ≤ 60%	Enough
20% < X ≤ 40%	Not Enough
X < 20%	Very Low

Science Process Skills Observation Sheet Analysis Analysis of science process skills is done by finding the percentage value. After obtaining the percentage value, it can be grouped into several categories according to the criteria in Table 3.

Table 3. Science Process Skills Category Criteria

Score	Category
86 - 100 %	Very Good
76 - 85 %	Good
60 - 75 %	Enough
55 - 59 %	Not Enough
≤ 54 %	Very Low

Hypothesis Test

Before conducting hypothesis testing, a hypothesis prerequisite test is carried out with a normality test and homogeneity test. The normality test determines whether the data for each variable to be analyzed is normally distributed. The variance homogeneity test determines the uniformity (homogeneity) of the variance of samples taken from the same population. After that, hypothesis testing was carried out using the independent sample t-test test and the magnitude of the influence was analyzed using the calculation of the effect size value with Cohen's d formula:$V = \frac{\sum s}{n(c-1)}$ with $s = r - lo$; lo is the lowest validity rating score; c is the highest validity rating score; and r is the number given by rater

Result and Discussion

This study aims to analyze the influence of STEAM-based inquiry learning models on students' science process skills. The research data were obtained from the pretest-posttest results of science process skills observations of science process skills and observations of learning implementation. The effect of the treatment given is seen by giving a pretest at the beginning of the meeting before getting the material and a posttest at the end of the meeting after getting the material. The research data obtained were then analyzed through the hypothesis prerequisite test in the form of normality test and homogeneity test, then hypothesis testing using independent sample t-test and effect size test. Then, the learning implementation and science process skills observation sheets were analyzed by finding the percentage value.

Implementation of Learning Activities

The results of observations of learning implementation for experimental and control classes are presented in Table 4.

Table 4. Learning Implementation Observation Results

Group	Meeting to-				Average (%)	Description
	1 (%)	2(%)	3(%)	4 (%)		
Experiment	92.31	100	100	96.16	98.08	Very Good
Control	92.31	100	96.16	88.46	94.23	Very Good

Based on Table 4, it can be seen that the results of the analysis of the implementation of learning in the experimental class using the STEAM-based inquiry learning model have an average of 98,08, and the control class using the discovery learning model has an average of 94,23. This shows that learning activities during the study went very well and the learning process carried out by teachers and students was in accordance with the syntax in the teaching module that had been prepared as the research instrument used.

Learning activities in this study took place for 4 meetings with Learning Outcomes (CP) in accordance with the Merdeka Curriculum in Phase D, namely, students can measure the amount of temperature caused by given heat energy, as well as being able to distinguish heat insulators and conductors. The learning model applied is STEAM-based inquiry. This is done by involving the five aspects of STEAM in learning. STEAM learning (Science, Technology, Engineering, Arts, and Mathematics) is an integrated learning approach from various disciplines: science, technology, engineering, arts, and mathematics (Amran et l., 2021).

The science aspect is divided into 3 parts: procedural, factual, and conceptual. The procedural science aspect at the first meeting is an experiment to make a simple thermometer, the second meeting is a practicum on measuring temperature using a thermometer, the third meeting is a practicum related to the type of heat of substances and an investigation of conduction, convection, and radiation events, and the fourth meeting is an investigation of conductor and heat insulator materials. The conceptual science aspect of temperature and heat material is divided into the definition of temperature and temperature measurement tools at the first meeting, various thermometer scales (centigrade, reamur, fahrenheit, and kelvin) at the second meeting, the definition of heat and heat transfer by conduction, convection, and radiation at the third meeting, and conductors and heat insulators at the fourth meeting. Factual science aspects in this material include temperature measurement in daily interests, utilization of heat transfer in daily activities, and application of conductor and insulator principles in household appliances. The application is in accordance with (Munawar and Roshayanti, 2019), who states that the application of science in schools is learning whose application of science is related to daily life, such as the surrounding nature, natural phenomena, and oneself.

The technology aspect generally utilizes learning images and videos, the use of the internet to access and work on pretests and posttests through Google Forms, and the use of the internet to access learning resources independently, such as Google and YouTube. In addition, the implementation of learning with the help of learning media, such as PowerPoint and LKPD, is shown through the LCD projector. When reviewed at each meeting, the first meeting lies in the use of the working principle of thermometers in making simple thermometers, namely the use of plasticine to close the remaining space of the bottle cap that is still open, the second meeting lies in the use of thermometers in measuring temperature, the third meeting lies in the use of thermometers in measuring temperature and the use of stopwatches in measuring time, and the fourth meeting in the utilization of household technology in the form of kitchen tools for experiments. The existence of good utilization of tools in an experiment can develop students' motor skills. This is in accordance with Munawar et al. who state that technology science refers to using equipment and developing basic motor skills (Munawar and Roshayanti, 2019). Through this science, learners can find out how to use a tool.

The engineering aspect is generally carried out by conducting experiments and evaluating the results of the work obtained. When reviewed at each meeting, the second and third meetings have other activities that lie in preparing three legs, wire, and gauze, bunsen, and spirit burner into a series of tools for heating substances. Learning activities in engineering are in accordance with Munawar et al., who state that engineering in learning is related to the ability to design, assemble, and operate something to solve a problem (Munawar and Roshayanti, 2019).

The art aspect is carried out differently at each meeting. The first meeting lies in cutting out paper to make a simple thermometer scale, perforating the bottle cap according to the size of the diameter of the straw used, and drawing the design of a simple thermometer. Then, the second meeting lies in the process of drawing a comparison of temperature conversion results in centigrade, reamur, fahrenheit, and kelvin scales, and the third meeting lies in the process of making a comparison graph of measuring the temperature of the water and cooking oil at every minute until it reaches a certain temperature. In addition, the fourth meeting lies in drawing the design of the conductor and insulator experiments carried out. Learning activities in art are in accordance with Munawar et al. that art skills in this learning are recognize and showing works and activities related to art, such as folding, drawing, and others (Munawar and Roshayanti, 2019).

The mathematics aspect is generally implemented by presenting quantitative data. When reviewed for each meeting, the first meeting lies in measuring the volume of hot water, ordinary water, and cold water, making a simple thermometer scale using a ruler, and observing the results of temperature measurements using a simple thermometer on hot water, ordinary water, and cold water. Then, the second meeting lies in measuring the volume of water to conduct experiments, observing the results of temperature measurements using a thermometer, and calculating the temperature conversion to several thermometer scales according to the temperature obtained. Furthermore, the third meeting lies in measuring the volume of water and cooking oil for experiments, observing the results of temperature measurements using a thermometer, and observing the results of time measurements using a stopwatch. The fourth meeting lies in measuring the volume of water for experiments and measuring the number of nails that fall in the experiments carried out. Learning activities in the mathematics aspect are in accordance with Munawar et al. which forms an application of mathematics, such as measuring and recognizing patterns Munawar and Roshayanti, 2019).

Using the syntax of the inquiry learning model combined with STEAM is in line with Fitriansyah et al. that one of the learning approaches that can facilitate the achievement of mastery of scientific attitudes and scientific work is STEAM in the inquiry learning model (Fitriansyah et al., 2021). In addition, STEAM is an active learning activity through inquiry by promoting various ideas and perspectives from various disciplines where STEAM combines the disciplines of science, technology, engineering, art, and mathematics (Cohrssen and Garvis, 2020). Based on this, the syntax of the STEAM-based inquiry learning model is obtained as follows.

a. Problem orientation

This syntax contains 2 aspects of STEAM, namely science and technology. The science aspect lies in the concepts in the given problem orientation. The technology aspect lies in using images or videos as learning media to convey problem orientation to students using an LCD projector.

b. Formulating problems

This syntax contains 1 STEAM aspect, namely science. The science aspect lies in the concepts contained in the questions found by learners based on problem orientation. This will be the focus of learning to be completed during the learning process.

c. Develop a hypothesis.

This syntax contains 1 STEAM aspect, namely science. The science aspect lies in the science concept contained in the hypothesis submitted by students based on the formulation of the problem that has been prepared and the knowledge they already have. This is a consideration for experimenting to prove whether a hypothesis is correct.

d. Conduct experiments

This syntax contains 4 aspects of STEAM, namely science, technology, engineering, and mathematics. The science aspect lies in the experiment associated with the learning outcomes to be achieved. The technology aspect is related to the tools and materials used during the experiment, such as thermometers and stopwatches that utilize technological advances. The engineering aspect lies in the ability of students to find the truth of a hypothesis by carrying out the specified work steps. The mathematics aspect is contained in measuring, writing, and processing quantitative data.

e. Concluding the lesson.

This syntax contains 1 aspect of STEAM, namely science. The science aspect relates to the concepts that learners find after implementing learning.

f. Communicating

This syntax contains 1 STEAM aspect, namely art. The art aspect can appear during the learning process in the form of communicating the data obtained in other forms, for example, from table form to graph form. In addition, students also communicate the results of the work obtained in front of the class so that question-and-answer interactions arise between teachers and students or students with other students.

The application of STEAM-based inquiry learning models can help students improve science process skills because this learning will be a special attraction to find the interrelationship of disciplines with one another, especially in solving a problem in everyday life. In addition, the maximum involvement of students in the learning process is also a factor in improving students' science process skills. This is in accordance with (Seranica et al., 2019), which states that the inquiry learning model is a learning model that makes students actively participate in obtaining scientific knowledge by conducting investigations to get answers to the problems presented and STEAM learning makes students appreciate art and science simultaneously.

The Influence of the STEAM-Based Inquiry Learning Model to Improve Science Process Skills

Science process skills involve students' ability to gain knowledge based on an event so that the learning outcomes achieved are in the form of the ability to do scientific work or scientific research, communicate the results of scientific research, and behave scientifically. Science process skills include acquisition processing skills so that students can discover and develop concepts, theories, principles, laws, and facts. This is in accordance with Juraini & Gunadana that science process skills foster students' ability to apply scientific methods in discovering, understanding, and developing science (Juraini and Gunada, 2016). In addition, it focuses on developing learners' skills in processing knowledge and discovering and developing the necessary facts, concepts, and values on their own.

The average results of the pretest and posttest for the experimental and control classes are presented in Table 5.

Table 5. Average Score of Science Process Skills Test Results

Class	Pretest Value	Posttest Value
Experiment	60.32	73.39
Control	55.94	67.34

The results of the analysis of each aspect of science process skills for experimental and control classes are presented in Table 6.

Table 6. Average Score for Each Aspect of Science Process Skills

Aspects of Science Process Skills	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Observe	46.77	59.68	42.19	54.69
Asking Question	62.5	77.42	59.38	71.88
Proposing a hypothesis	50.54	75.27	46.88	68.75
Conducting Experiment	61.94	73.55	57.50	68.63
Interpret	61.30	77.42	56.25	71.88
Applying Concepts	68.28	77.96	64.06	71.35
Communicate	58.06	66.13	53.13	59.38

The improvement of science process skills was measured using pretest and posttest questions that were prepared according to the aspects and indicators of science process skills. Comparative analysis of the average pretest and posttest scores of experimental and control classes is presented in Figure 1.

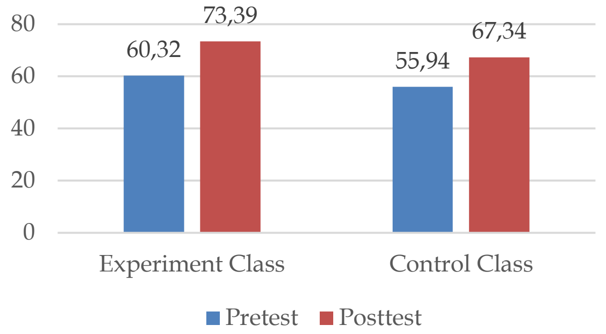

Figure 1. Comparison Diagram of the Average Pretest and Posttest Scores

Based on Figure 1, it can be seen that the experimental class and control class have different average values. When viewed from the average value of the pretest, the experimental class has a higher average value of 60.32. In contrast, the control class has an average value of 55.94 so the difference in the average value of the pretest between the experimental class and the control class is 4.38. After the two classes were given different treatments, namely the STEAM-based inquiry learning model in the experimental class and the discovery learning model in the control class, the results obtained in the experimental class also had a higher average posttest value of 73.39. In contrast, the control class only had an average value of 67.34 so the difference in the average posttest value between the experimental class and the control class was 6.05. When viewed from the difference in the average value of the pretest and posttest in each class, the experimental class has a difference in average value of 13.07 with higher results than the difference in average value in the control class, which is 11.40.

The average and percentage results of the science process skills observation sheet for the experimental and control classes are presented in Table 7.

Table 7. Average Value and Percentage of Science Process Skills

Experiment Class					Control Class
Average	Percent- (%)	Category	Average	Percent (%)	Category
7.29	45.56	Very Low	5.68	35.55	Very Low
9.67	60.49	Enough	7.40	46.29	Very Low
12.29	76.81	Good	9.25	57.81	Not Enough
14.12	88.31	Very Good	10.43	65.23	Enough

The results of the analysis of each aspect of science process skills for experimental and control classes are presented in Table 8.

Table 8. Percentage Value for Each Aspect of Science Process Skills

Aspects of Science Process Skills	Meeting to- 1	2	3	4
Experimental Class				
Observe	61.30	72.59	90.32	95.16
Asking Question	66.13	77.42	90.32	96.77
Proposing a hypothesis	64.52	79.03	88.71	91.94
Conducting Experiment	45.16	67.74	83.87	100
Interpret	38.71	53.26	83.87	93.55
Applying Concepts	38.71	50	58.06	93.55
Communicate	29.03	47.09	64.52	74.20
Control Class				
Observe	39.06	51.56	51.56	70.31
Asking Question	48.44	64.06	76.56	78.13
Proposing a hypothesis	48.44	57.81	70.31	75
Conducting Experiment	25	31.25	37.50	53.13
Interpret	31.25	48.44	50	62.50
Applying Concepts	32.81	46.88	59.38	67.19
Communicate	28.75	34.38	49.44	56.88

Science process skills were also investigated through the observation sheet of science process skills arranged according to the aspects and indicators. The percentage analysis of science process skills from the first to the fourth meeting is presented in Figure 2.

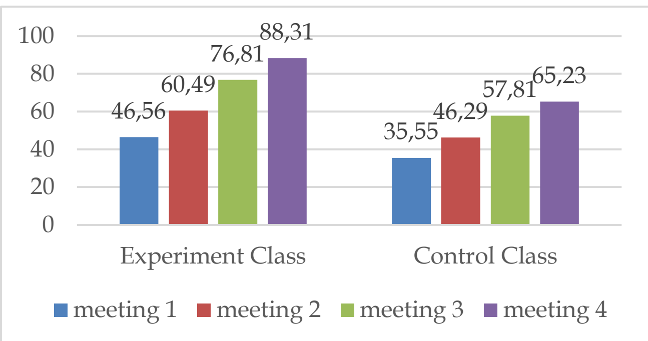

Figure 2. Comparison Diagram of Science Process Skills Percentage Values

Based on Figure 2, the experimental class and control class have different percentage values. When viewed from the percentage value at each meeting, the experimental class has a percentage value that is always higher than the control class. The percentage of students' science process skills in the experimental class by applying the STEAM-based inquiry learning model is 45,56%, 60,49%, 76,81%, and 88,31%, respectively so the percentage increase from the second to the fourth meeting is 13,93%, 16,32%, and 11,50%, while in the control class by applying the discovery learning model is 35,55%, 46,29%, 57,81%, and 65,23% respectively so that the percentage increase from the second to the fourth meeting is 10,74%, 11,52%, and 7,42%. Thus, the science process skills in the experimental class increased from the category of very poor to very good. In contrast, in the control class, it increased from the category of very poor to sufficient.

From each aspect of science process skills, there was an increase in the seven aspects. The analysis results show that the increase is higher in the experimental class than in the control class. That way, the STEAM-based inquiry learning model is not only knowledge-oriented, as indicated by the increase in pretest and posttest scores related to temperature and heat material arranged based on aspects of science process skills but also on the attitudes and skills of students known based on the observation sheet of science process skills.

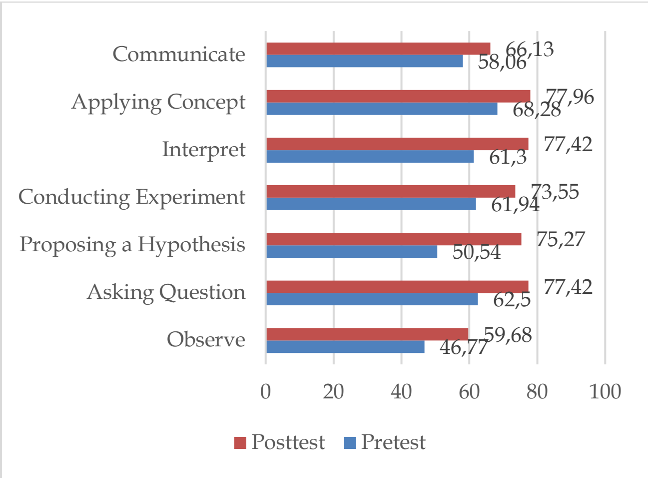

Figure 3. Diagram of the Average Value of Experimental Class Science Process Skills

Based on Figure 3, it can be seen that the aspects of science process skills on the pretest question in the experimental class have the lowest average value located on the aspect of observing, namely 46,77. In contrast, the posttest question in the experimental class has the highest average value on applying concepts, namely 77.96.

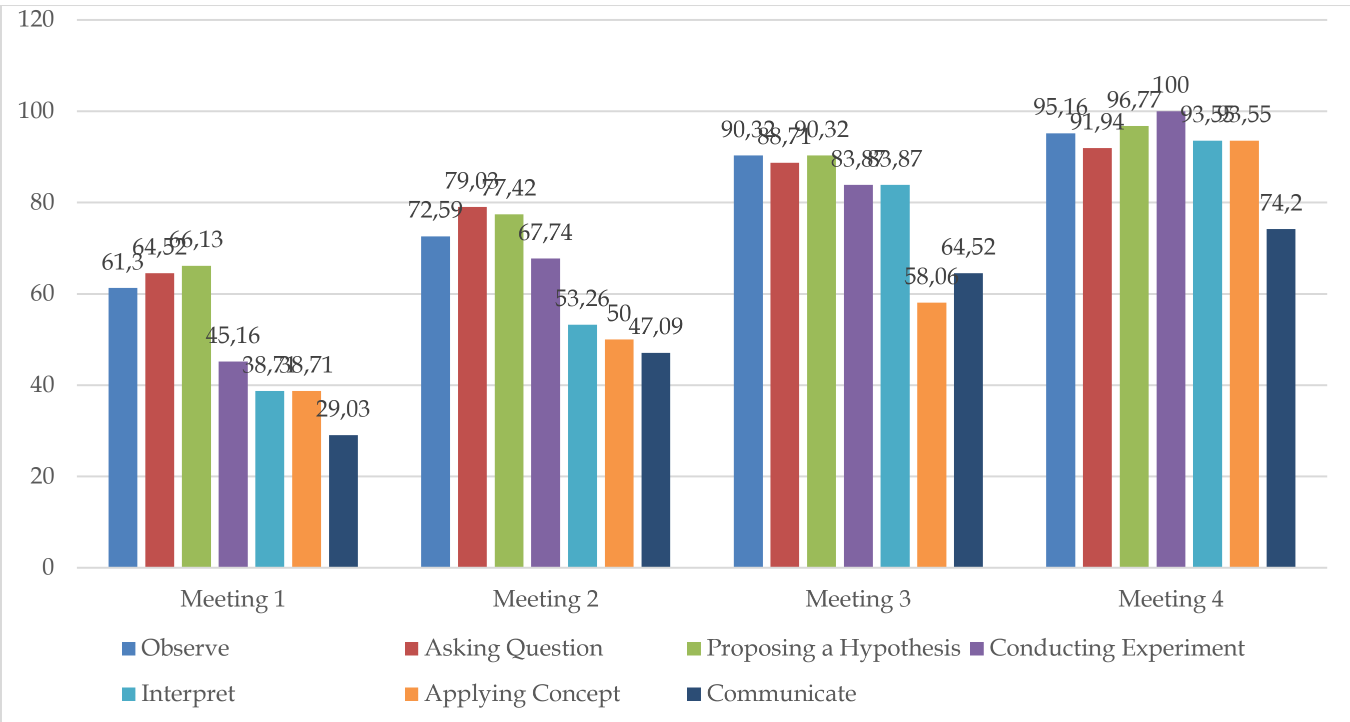

Figure 4. Experimental Class Percentage Value Diagram

Based on Figure 4, it can be seen that the percentage of the science process skills observation sheet shows that the lowest science process skills aspect in the experimental class is located at the first meeting on the aspect of communicating with a percentage value of 29.03%, while the percentage of the highest science process skills aspect in the experimental class is located at the fourth meeting on the aspect of conducting experiments with a percentage value of 100%. This shows a difference in the lowest value at the initial meeting in terms of pretest questions and observation sheets of science process skills.

The lowest aspect in the experimental class based on pretest questions is observing, while based on the science process skills observation sheet, it is communicating. The lowest value in this aspect of observing is seen through the answers of students who still experience many mistakes in answering items containing observing aspects because students are less careful to look at the pictures or read the descriptions in the questions tested. The lowest score on the communicating aspect appears during the learning process, especially when presenting the results of each group's work. Learners who want to convey their work results are only 1-2 in the group, while others do not participate. In addition, learners who did not have the opportunity to present their work also did not want to submit responses or questions to the presenter group so the interaction that occurred during the learning process was still very lacking.

These results also show differences in the highest scores at the final meeting in terms of post-test questions and observation sheets of science process skills. The highest aspect in the experimental class based on posttest questions is applying concepts, while based on the observation sheet of science process skills, it is conducting experiments. The highest value in applying concepts is seen through the answers of students who answer more correctly in items containing aspects of applying concepts. The highest value in conducting experiments appears during the learning process, especially when students are always active in solving problems found by conducting experiments so that these problems can be solved. The two aspects have a relationship because with students doing experiments actively, students can find science concepts independently which causes the material studied, namely Temperature and Heat, to be more easily understood and remembered through the learning that has been carried out. That way, students' learning outcomes will improve.

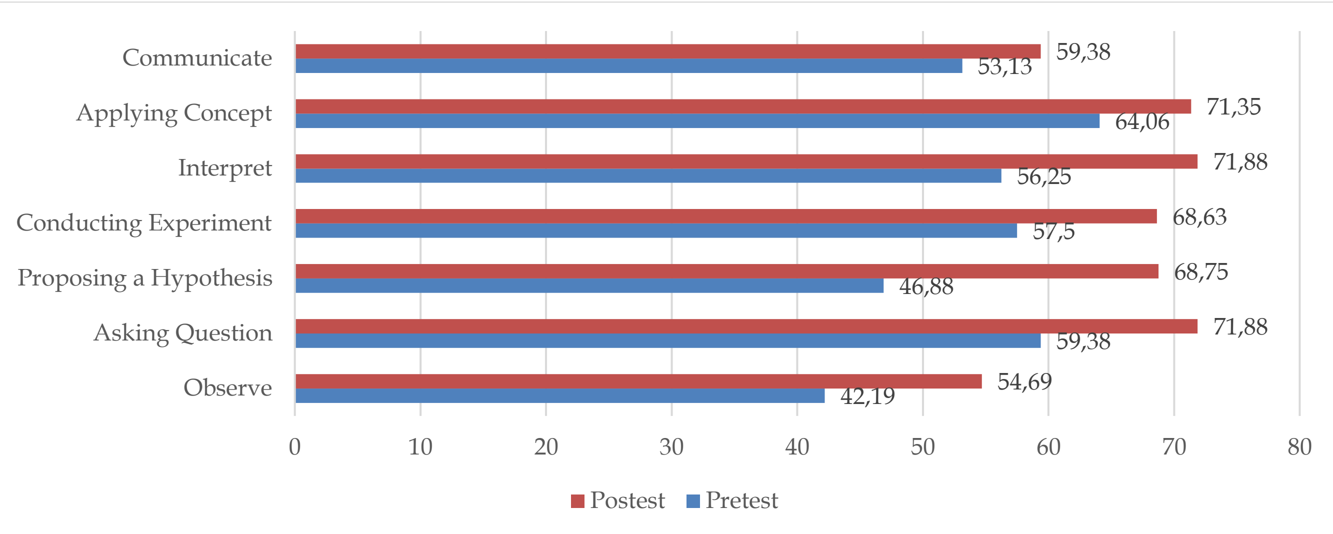

Figure 5. Diagram of the Average Value of Control Class Science Process Skills

Based on Figure 5, it can be seen that the aspects of science process skills on the pretest question in the control class have the lowest average value located on the aspect of observing, which is 42.19, while on the post-test question in the control class has the highest average value located on the aspect of asking questions and interpreting which is 71.88.

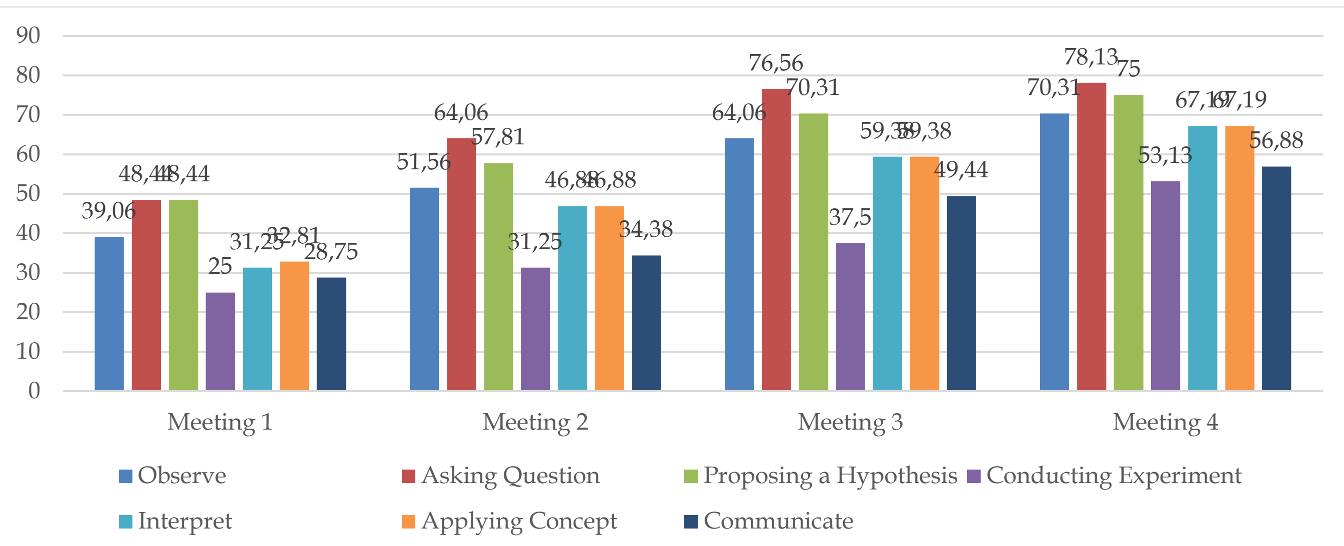

Figure 6. Control Class Percentage Value Diagram

Based on Figure 6, it can be seen that the percentage of the observation sheet of science process skills shows that the lowest aspect of science process skills in the control class is located at the first meeting on the aspect of conducting experiments with a percentage value of 25%, while the highest percentage of science process skills aspects in the control class is located at the fourth meeting on the aspect of asking questions with a percentage value of 78.13%. This shows that there is a difference in the lowest value at the initial meeting in terms of pretest questions and observation sheets of science process skills.

The lowest aspect in the control class based on pretest questions is observing, while based on the observation sheet of science process skills is conducting experiments. The lowest value in this aspect of observing is seen through the answers of students who still experience many mistakes in answering items containing aspects of observing because students are less careful to look at the pictures or read the descriptions in the questions tested. The lowest score on the aspect of conducting experiments appears during the learning process, especially when carrying out the core learning activities which are only carried out by video observation or demonstration. The existence of this form of activity does not support students to develop science process skills in the aspect of applying concepts because students still tend to find information based on others.

These results also show that there is a difference in the highest score at the final meeting in terms of posttest questions and observation sheets of science process skills. The highest aspects in the control class based on the posttest questions were asking questions and interpreting, while based on the science process skills observation sheet was asking questions. The highest value in the aspect of asking questions and interpreting is seen through the answers of students who answer more correctly in items containing aspects of asking questions and interpreting. The highest value in the aspect of asking questions appears during the learning process, especially when students are asked to understand a problem orientation that has been prepared in the form of pictures or readings so that students can ask questions to be resolved during the learning process through video observation or demonstration. The two aspects are related because by asking learners to ask questions independently, they will be more interested in solving questions that arise from their own thinking by interpreting information obtained based on video observation or demonstration. That way, although there are differences in the highest aspects that arise based on science process skills questions and science process skills observation sheets, these aspects are interrelated with each other, such as in the experimental class which has the highest value, namely the aspects of conducting experiments and applying concepts, while the control class has the highest value, namely the aspects of asking questions and interpreting.

The application of STEAM-based inquiry learning models can improve students' science process skills in the aspects of observing, asking questions, proposing hypotheses, conducting experiments, interpreting, applying concepts, and communicating. The increase is due to the syntax of the STEAM-based inquiry learning model focusing on students to find problems and solve problems found in everyday life through an experiment/experiment so that students are able to find knowledge independently to become learning that can be found in everyday life. The inquiry learning model means participating or being involved in asking questions, seeking information, and conducting investigations (Hamdayama, 2014). In addition, Morrison states that STEAM is learning that relies entirely on the application of scientific concepts in everyday life (Morruison, 2015).

The learning that has been done can provide opportunities for students to expand their knowledge at the same time as developing science process skills. This condition makes students gain complete knowledge and are more skilled in dealing with real problems. Learning in STEAM in learning can encourage students to be involved in the learning process so as to produce an experience and can solve problems (Asmar and Gunawan, 2019).

The difference in posttest scores is reinforced by proving the research hypothesis through statistical tests. Differences in students' science process skills between experimental and control classes can be known through hypothesis testing using the independent sample t-test test. After fulfilling the hypothesis prerequisite test with normal and homogeneous results, the independent sample t-test can be carried out to test the hypothesis of this study, namely that there is an effect of STEAM-based inquiry learning model on students' science process skills. The results of the independent sample t-test on the posttest scores for the experimental and control classes showed a Sig (2-tailed) value of 0,013 <0,05. This means that there are differences in the science process skills of students between the application of the STEAM-based inquiry learning model and the discovery learning model. The value of the treatment effect was tested using the effect size test. The effect size test results show a value of 0,642 with an interpretation in the strong category. This means that the STEAM-based inquiry learning model has a significant effect on students' science process skills. Inquiry learning can have an influence and cause a positive response to bring students to change. In addition to overcoming boredom or boredom, students are always diligent, enthusiastic, and play an active role in participating in learning so that students are no longer passive and do not just sit still in the classroom during learning but think to find their own answers to what is learned.

The STEAM-based inquiry learning model supports students to feel curious so that it can support the enthusiasm for learning in understanding what is happening, the causes of the occurrence, the impact caused, and trying to overcome it. In addition, students can directly relate, connect, and find solutions to problems that arise so that they will increase students' knowledge. Effective teaching is teaching that is able to produce a quality learning process and is able to trigger students' interest in participating in the learning process and STEAM-based inquiry learning triggers students' interest in exploring, designing, designing, and thinking about an investigation design by reading various reference sources, as well as giving students the freedom to ask questions, discuss and argue so as to create enjoyable learning conditions.

Positive research results are influenced by the STEAM content in it. The existence of STEAM content in learning can increase students' understanding of science, technology, engineering, art, and mathematics. The five disciplines are one of the educational approaches that as a whole become a pattern of problem solving through 21st century learning experiences. This is in accordance with Zubaidah that through STEAM learning can foster skills for students to know many things that can only be seen when doing directly, not by sitting and watching the teacher explain (Zubaidah., 2019). STEAM learning makes learners appreciate art and science simultaneously using many forms of skills, creativity, and imagination when trying to understand various real problems.

STEAM-based learning can also teach students to think critically in making a decision in a creative way so as to help prepare the next generation in facing the times. This is clarified by Farhati that STEAM is a lesson to develop students' abilities so that they can analyze a phenomenon through a scientific approach and Mu'minah & Suryaningsih (2020) who state that STEAM learning can improve students' academic competence and apply it in everyday life (Farhati, 2020; Mu'minah & Suryaningsih, 2021).

Conclusion

The STEAM-based inquiry learning model has a positive effect on the science process skills of junior high school students. This is evidenced by the results of the independent sample t-test test which shows a Sig (2-tailed) value of 0,013 < 0,05 so that it can be seen that there are differences in the level of science process skills of students in experimental and control classes. The effect size test in this study obtained a Cohen's d value of 0,642 which is included in the strong category. In addition, the observation results of students' science process skills in the experimental class have a higher percentage value than the control class. The percentage value of science process skills in the experimental class was 88,31% which was included in the very good category, while in the control class it was only 65,23% which was included in the sufficient category. This means that the STEAM-based inquiry learning model has a significant effect on the dependent variable, namely science process skills.

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The research team contributes to the writing of scientific papers starting from the idea, data collection, analysis and interpretation of the results, article writing, revision, to publication.

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Conflicts of Interest

The authors declare no conflict of interest.

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