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The Effect of The Discovery Learning Model on Science Process Skills of Fifth Grade Students

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Abstract. 21st-century education emphasizes the importance of science process skills for students to be able to compete in the academic world and be ready to face challenges in the industrial era 5.0 This study aims to examine the effect of the discovery learning model on the science process skills (KPS) of grade V students. This study is included in the quantitative research with an experimental method using a true experimental design, a pretest-posttest control group design. The subjects of this study were grade V students, with samples selected using simple random sampling techniques. Several techniques and tools were used to collect data, namely tests (multiple-choice questions), unstructured interviews, observations (using observation guidelines), and documentation (using smartphones). The collected data were analyzed using descriptive and inferential statistical analysis. The analysis showed a negative effect of -73% of the discovery learning model on students' science process skills. Thus, the discovery learning model is less effective when applied to the material on human digestive organs in grade V A MIN 1 Filial Pontianak in the 2023/2024 academic year.

Keywords: discovery learning model; natural science; science process skills

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INTRODUCTION

Science learning is a method of systematically learning to understand nature. Science involves mastery of skills, knowledge of facts, conceptions and principles, and the discovery process through learning experiments (Hernawati et al., 2018; Idris et al., 2022; Prabowo, 2015). 21st-century education reinforces this and expects students to have Science Process Skills (SPS) to compete in the academic environment and face the industrial era 5.0 (Apeadido et al., 2024; Prayitno et al., 2017; Sakdiah et al., 2022). An organization under the auspices of the Organization Economic Cooperation and Development (OECD) called the Program for International Student Assessment (PISA) is an educational survey conducted every three years on the education system and students' abilities. In the 2022 Program for International Student Assessment (PISA), Indonesia's science literacy score was ranked 383, 64th and 74th out of 81 countries (OECD, 2023). Meanwhile, in the 2018 PISA results, Indonesia's science literacy score was ranked 396, 73rd out of 79 countries (OECD, 2019). This fact reflects a decline in the science literacy of Indonesian students in the last three years. Science literacy is influenced by one factor, namely the school environment, such as teaching methods, teacher

facilities and infrastructure, as well as teaching materials and science education media (Jufrida et al., 2019). Therefore, this is related to the ability of students to practice science practices at school. Oma (2021) stated that the low value of students' science process skills is the process of learning science at school. At the primary school level, there is a tendency to apply an approach that emphasizes memorization and memorization of material, and the learning process is still more focused on the role of the teacher (teacher-centred) based on teaching materials from existing books.

According to Sayekti & Kinasih (2018), the main obstacle in applying Science Process Skills (SPS) is that although some SPS indicators have been included in the Learning Implementation Plan, teachers' understanding of SPS is still not fully reflected. Teachers have not implemented learning in accordance with the lesson plans they have designed. In fact, SPS is considered the core and one of the characteristics of science that distinguishes it from other materials. This is in line with the opinion of Anisa et al. (2023), who stated that in MIN throughout Pontianak city, teachers only assess based on the report of students' experimental results. Sometimes, the evaluation of learners' SPS is also related to their ability to illustrate concepts related to science through pictures. Although this includes one of the basic aspects of science process skills, namely communication, teachers still do not specifically assess other aspects of science process skills.

The results of direct observation and interaction through interviews with the fifth-grade teachers at MIN 1 Filial Pontianak show the same thing, where in the learning process, the teacher refers more to teaching materials rather than following the relevant stages of the lesson plan. In the skills assessment, the learning process only trains the communicating aspect. Although there is an effort to communicate the material, the interview results show that the grade V teachers have not fully trained the learners' SPS. Considering the information that has been presented, it seems important to adopt a learning model that can inspire learners to develop SPS. Developing creative or innovative learning models is relevant to real life, motivating learners to think creatively to discover new things. One creative and innovative learning model option that can be applied is discovery-based learning (Hafifah, 2019).

The discovery learning model, otherwise known as the discovery learning model, is defined as a way of learning that aims to understand conceptions, intentions, or interrelationships through a perceptive process, resulting in a decision (Marisya & Sukma, 2020). Discovery learning is obtained from actively involved individuals, especially when learning concepts are discovered through their mental processes. The discovery learning model associates students with a serious way of independently obtaining and investigating their knowledge (Ahmad et al., 2021; Liando; 2021; Mastuang et al., 2017). The impact of this process is an increase in memory sustainability. Discovery learning can also train analytical thinking skills and the ability to solve problems independently. This model can be implemented in various community contexts. The discovery learning model is a form of coaching that is built to ensure that students gain knowledge through direct experience, through the discovery of previously unknown concepts from the learning component (Azhad et al., 2022; Pratiwi et al., 2022). By referring to the theory presented previously, it can be concluded that the discovery learning model is a learning model whose way of learning is by independently discovering the concept of learning material.

According to Ardiansyah (2014), SPS includes the ability to process information that allows children to obtain and build concepts, theories, principles, laws, and facts. The process of science is derived from the stages scientists carry out when conducting scientific research, including planning, conducting, and communicating research. SPS involves their skills in applying the scientific method to discover, develop, and obtain scientific information (Hartati et al., 2022; Nadia et al., 2021; Risda et al, 2023). SPS can be explained as the ability mastered by science scholars to acquire and communicate their expertise (Prahani et al., 2021; Wedyawati & Lisa, 2019; Zainuddin et al., 2020). This expertise involves the use of thinking, reasoning, appropriate and successful activities to achieve these goals and creative aspects. SPS is a scientific approach or activity that aims to improve knowledge or models to improve cognitive, interactive, and physical competencies derived from internal basic skills (Nurhuwaida et al., 2022; Septantiningtyas et al., 2020). From some of the theories mentioned, the conclusion is that SPS is the ability to process and obtain information through planning, implementing and communicating the results, involving thinking, reasoning and creativity. This is to increase competence in himself.

Implementing the Discovery Learning Model affects Science Process Skills at the elementary school level (Hafifah et al., 2019; Mahmudah, 2022) and at secondary schools (Handayani et al., 2017). Based on the literature on implementing the discovery learning model from 2012 to 2021, this model can positively impact science learning (Syaifulloh et al., 2022). Therefore, further research was conducted on the effect of the implementation of the discovery learning model on the science process skills of grade v students on the material of human digestive organs. This study aims to describe the effect of the Discovery Learning Model on the Science Process Skills of Grade V students on the material of human digestive organs at MIN 1 Filial Pontianak in the 2023/2024 academic year.

METHOD

This research was conducted at MIN 1 Filial Pontianak in the odd semester of the 2023/2024 academic year. This study uses quantitative research by applying the experimental method according to Sugiyono (2021), which states that the experimental method is an additional method used to determine the effect of independent changes (treatment) on the dependent variable (results) under controlled conditions. The experimental research design applied in this study is a true experimental design, with a pretest-posttest control group design. Sugiyono (2021) states that this structure comprises two randomly selected groups. Then, we were subjected to a pre-test to assess the initial conditions and detect whether there was a significant difference between the experimental and control groups. Based on this statement, this research compares two groups: the experimental group and the control group. Therefore, the experimental class refers to the class that uses the discovery learning model. In contrast, the control class is the class that is applied with the scientific approach, as seen in Figure 1.

R	**O_1**	**X**	**O_2**
R	**O_3**		**O_4**

Figure 1 Pretest-posttest control group design

(Sugiyono, 2021)

Description:
O1 dan O3: SPS of students before treatment
O2: SPS of students after treatment
O4: SPS of students who were not treated
The effect of discovery learning on SPS is (O2 - O1) – (O4 - O3).

The study population was class V students in the odd semester of the 2023/2024 academic year at MIN 1 Filial

Pontianak, totalling 157 people. The samples of this study were 27 students of class V A and 31 students of class V D. Group A was the experimental class that received the discovery learning model treatment, while the control group used the scientific approach. The sampling technique in this study was simple random sampling, which is a simple technique because sample members are randomly selected from the population without regard to the strata that may exist in it (Sugiyono, 2021).

Data collection techniques are in the form of tests and non-tests. In this study, the type of test used was a multiple-choice test. The number of questions given is 15 in the pre-test and post-test; each question is different. However, the purpose of each question is the same, which contains indicators of basic science process skills, as seen in Table 1.

Table 1 Classification of SPS questions based on indicators

No	SPS indicators	Question Number
1.	Observing	1,2,3
2.	Measuring	4,5,6
3.	Classify	7,8,9
4.	Predicting	10,11
5.	Concluding	12,13
6.	Communicating	14,15

While non-test techniques and tools are in the form of observation and documentation. The researcher acts as a teacher, which allows him to observe students directly in the learning process. While the data collection tool is an observation guideline, which is in the form of a checklist. The fifth-grade teacher observes or assesses the researcher in the learning process activities. In addition, taking pictures in the form of photos was also carried out as part of the observation. This study uses documentation in the form of student data, syllabus as a reference when making lesson plans, teacher lesson plans, and other documents. While the document data collection tool is a smartphone.

Data analysis techniques include an instrument test, a descriptive test, an inferential test, and an effect size test. The instrument test uses content validity testing. Content validity in this study includes learning instruments (lesson plans) and assessment instruments (tests). The validity test was conducted to determine the validity of the instrument and the stages of validity testing using the Gregory test with two expert judgment By analyzing the validity of two experts by applying the Gregory formula as follows:

$$Content\ Validity = \frac{D}{A+B+C+D} \quad \dots (1)$$

Description:
CV = Content Validity
A = Both raters disagree (Low Relevance)
B = First rater agrees, second rater disagrees (High-Low Relevance)
C = First rater disagrees, second rater agrees (Low-High Relevance)
D = Both raters agree (High Relevance)
(Larasati & . Syamsurizal, 2022)

The validity criteria for the Gregory test can be found in Table 2.

Table 2 Validity criteria of gregory's test

Validity Coefficient	Validity Level
0.91 – 1.00	Very High
0.71 – 0.90	High
0.41 – 0.79	Fair
0.21 – 0.40	Low
0.00 – 0.20	Very Low

(Putranadi et al., 2021)

Based on the content validity test using the Gregory test, the results of the learning instruments (lesson plans), both experimental and control, and the assessment instruments (tests), both pre-test and post-test, are 1.00 values, meaning that the level of validity is very high. Thus, it is feasible to use.

Furthermore, the descriptive statistical test to explain the SPS pre-test and post-test scores in the control and experimental classes. The analysis was carried out with the help of SPSS Statistic Version 25 software for Windows. In this study, information is presented in tabular format to facilitate understanding and

explain the meaning of the data. Categorization of the level of mastery of SPS using the SPS average assessment criteria adapted from Nurhasanah (2016), which can be observed in Table 3.

Table 3 Category of SPS assessment

Percentages	Categories
81 - 100	Very Good
61 - 80	Good
41 - 60	Fair
21 – 40	Deficient
0 - 20	Very Poor

(Nurhasanah, 2016)

Furthermore, to calculate the average value of students' SPS can be done using the following formula (Fitriana et al., 2019):

$$\text{Average} = \frac{total\ score}{\text{number of students}} \quad \ldots (2)$$

Calculate the percentage of SPS aspects using the following formula (Nurhasanah, 2016):

$$\text{Percentage}(\%) = \frac{\text{Average score}}{\text{Maximal score}} \text{x}100 \ldots (3)$$

There are two categories in inferential statistics: parametric and non-parametric. However, before that, it is necessary to analyze the prerequisite test first to determine which hypothesis test (parametric or non-parametric test) to use. The prerequisite tests in this study used normality tests and homogeneity tests. The hypothesis test uses a parametric test (independent sample t-test) if the data is normal and homogeneous and a non-parametric test (Mann Whitney) if the data is not normal and homogeneous. Each test involves the Shapiro-Wilk test with the help of IBM SPSS Statistics 25 software. This selection is based on the number of respondents less than 50 people (N < 50) (Fadhillah, 2023). The effect size test categories are in Table 4.

Table 4 Criteria of *effect size* test

Magnitude *d*	Interpretation
$0.8 \leq d \leq 2.0$	High
$0.5 \leq d < 0.8$	Medium
$0.2 \leq d < 0.5$	Low

Becker (2000) in Firdaus and Sari (2018)

The *Cohen's effect size test d* formula used in this study is:

$$d = \frac{M_{experiment} - M_{control}}{\sqrt{\frac{SD\ control^2 + SD\ experiment^2}{2}}} \quad \ldots (4)$$

Description:

d = Cohen's d effect size

$M_{experiment}$ = Average of experiment score

Mc_{ontrol} = Average of control score

$SD_{experiment}$ = Experiment deviation standards

SDk_{ontrol} = Control deviation standards

(Kristiana & Radia, 2021)

RESULT AND DISCUSSION

The results showed that the average value of the pre-test control group was 50.54, and the post-test test was 57.42. Meanwhile, the average value of the experimental group pre-test test was 62.22, and the post-test test was 55.80. To be clearer, Figure 2 shows this.

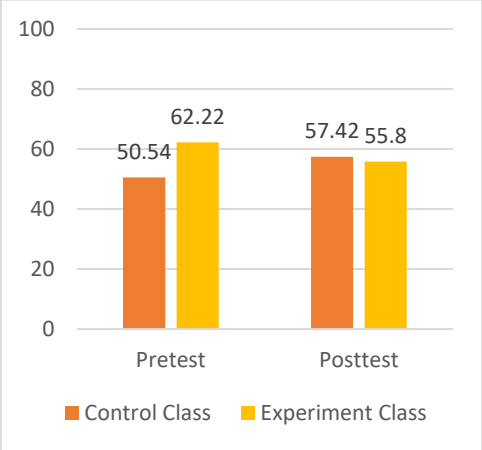

Figure 2 Result of the research

Figure 2 shows that the experimental pre-test value is greater than the control pre-test value, and the control post-test value is greater than the experimental post-test value. Therefore, the control group scores better than the experimental class when viewed from the average data.

The learning was conducted in class V D of MIN 1 Filial Pontianak, and only the scientific approach was used to support the learning. About 31 learners in the control class participated in this study. It is known that the average value of pre-test scores of students in the control group was 50.54, including in the sufficient

category. The average post-test score was 57.42, and it was also included in the sufficient category. Calculating the difference between the post-test and pre-test scores, it is known that the value of 19 students increased and the value of 7 students decreased. This shows that the SPS of most students in the control group has increased. In conclusion, learning in the control class with a scientific approach can improve students' science process skills. This finding shows that applying the scientific approach effectively improves students' SPS (Febriana, 2016). In line with the opinion of Nurhikmah et al. (2020), applying the scientific approach impacts the SPS of elementary school students.

The assessment per aspect of SPS of control class students can be seen in the following bar chart in Figure 3.

Figure 3 Mean score per aspect of SPS Pre-test and Post-test Control

Based on Figure 3, the average assessment in the control class shows a very high increase in the conclusion aspect, with a percentage reaching 41.94% calculated from the difference value. In addition, there is an aspect that has decreased, namely the prediction aspect, with a percentage of 33.87%.

This is based on the results of observations, where some learners can conclude the material that has been learned through presentations by two learners whom the teacher guides. However, there are still some learners who have not been able to answer correctly from questions related to the concluding aspect. As stated by Istiyani et al. (2018), the possibility of this happening can be caused by the inability of students to listen to the teacher's explanation properly or influenced by differences in the ability to absorb lessons among students in one class.

In class V A MIN 1 Filial Pontianak, learning in the experimental class was treated using the discovery learning model. A total of 27 experimental class students participated in this study. So, it is known that the average pre-test value of students in the experimental class is 62.22 which is included in the good category, while the average post-test value is 55.80, which is included in the sufficient category. Therefore, the calculation of the difference value (posttest-pretest) was carried out; the result was that eight students increased while 15 other students decreased in value. Thus, it can be

assumed that most students in the experimental class showed a decrease in the average score on science process skills. Thus, the discovery learning model is not suitable for the experimental class.

One of the factors causing the low SPS in the experimental class was the students' lack of interest in the teacher's explanation of how to complete the task. They were busy on their own, even though the teacher had warned them to pay attention to the explanation and instructions of the group task they had to do. This is an important point and the first step to understanding the instructions well. Adiningsih et al. (2019) argued that students' understanding is a factor that affects SPS. The understanding of students referred to here refers to their initial understanding of the practicum before it is carried out. This can impact students' confusion about the process of practicum activities, especially because this activity is the first time it has been implemented. This is in line with the opinion of Mukaramah et al. (2020), who state that the expectations contained in this model can be inappropriate if faced with students accustomed to old learning methods. The assessment per aspect of SPS of experimental class students can be seen in Figure 4.

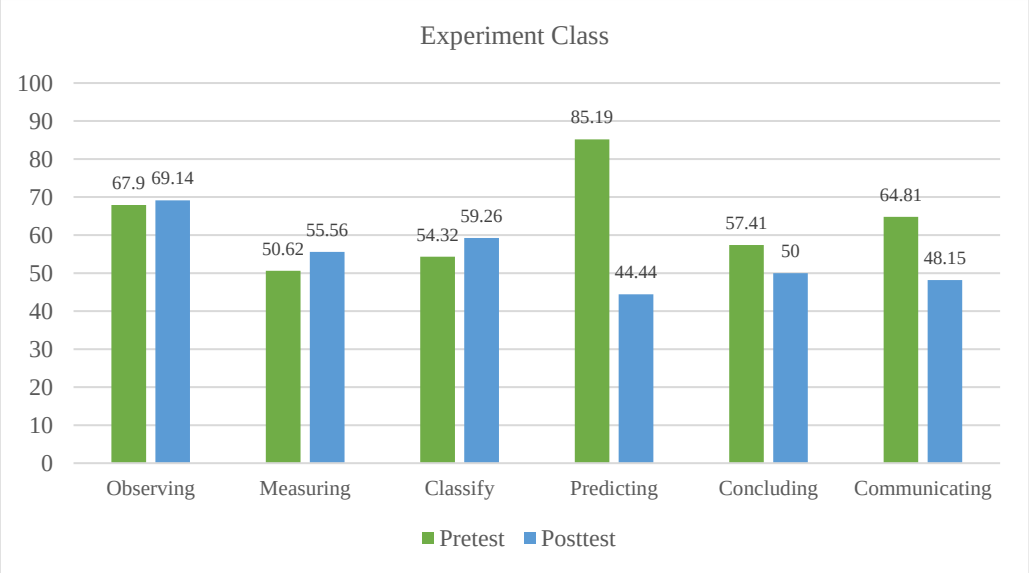

Figure 4 Mean score per aspect of SPS Pre-test and Post-test Experiment

Based on Figure 4, it is known that the aspects that experienced the highest increase compared to other aspects were the aspects of measuring and classifying, with a percentage increase of 4.94% from the calculation of the difference value. Meanwhile, the aspect that experienced the highest decrease was predicting, with a percentage decrease of 40.75%.

This is due to the observation that many group assignment results are still wrong. In addition, it is supported by the results of interaction through interviews with students, wherein the aspect of predicting, they tend to answer questions by guessing because they are not careful in reading the questions and do not fully understand the questions because they are in a hurry. In line with the opinion of A'yun & Retnawati (2022), errors in answering questions arise due to students' lack of thoroughness and lack of checking again the extent to which their answers match the question.

In addition, some students find it difficult to answer questions about prediction, so they choose to copy the answers from their classmates. According

to research by Lestari et al. (2022), cheating can occur due to internal factors such as difficulty understanding the material, lack of motivation to relearn, or choosing to copy a friend's work as an easier option.

After knowing that the control and experimental class data are normally distributed and homogeneous, an independent sample t-test (pre-test) is carried out to obtain the results of the Sig value. (2-tailed) Equal variances assumed of 0.008 <0.05 and Sig value. (2-tailed) Equal variances not assumed of 0.009 < 0.05. Therefore, the Sig. (2-tailed < 0.05) then 'Ha is accepted'. Therefore, there are differences in the initial abilities of experimental and control group students.

The difference test is conducted when there is a difference in the independent samples test. Therefore, the difference test was carried out by calculating the post-test value minus the pre-test value, both in the experimental and control groups. The results of the experimental class difference data obtained were 8 students getting an increased value of results, while 15 other students experienced a decreased value. While the control class difference data of 19 students gets an increased value of results, seven other students experience a decreased value.

Furthermore, the normality test of the difference and the homogeneity test of the difference were carried out. So that the results obtained are normally distributed and homogeneous. Therefore, an independent sample t-test was conducted to determine the Sig. (2-tailed) Equal variances assumed of 0.014 <0.05, and the value of Sig. (2-tailed) Equal variances not assumed of 0.015 < 0.05. Because Sig. (2-tailed) < 0.05, then 'Ha is accepted'. In conclusion, there is a difference between the control class, which uses a scientific approach to learning and the experimental class, which uses the discovery learning model.

Suppose it is known that there are differences in data. In that case, the effect size test is carried out to determine how much influence the application of the discovery learning model in the experimental class and the application of the scientific approach in the control class has on students' SPS. The effect size test result is -0.677. Therefore, based on the interpretation of effect size in Table 6, these results are included in the medium category. That is, it can be interpreted that the control class results are 73% better than the experimental class. This shows that the scientific approach can improve SPS by 73% compared to the discovery learning model. Thus, it can be concluded that the discovery learning model is less suitable to be applied in learning the material of human digestive organs in class V A MIN 1 Filial Pontianak in the 2023/2024 academic year.

Comparing the final ability of students between the experimental class that used the discovery learning model and the control class that applied the scientific approach, there was a negative effect of -73%. That is, 73% indicates that the scientific approach is more effective than the discovery learning model. According to Elvianasti et al. (2021), a meta-analysis found that implementing a scientific approach in science education significantly improves learning outcomes, creativity, and problem-solving skills at all levels of education. Therefore, it can be concluded that the discovery learning model is less suitable to be applied to the material of human digestive organs in class V A MIN 1 Filial Pontianak in the 2023/2024 academic year. In line with the views of Iwantoro et al. (2022), the low learning outcomes with the discovery learning model are caused by the long time required by students and teachers, because it involves a process of self-discovery and investigation. The situation in the field shows that with many students, a longer time is needed so that student's

understanding of learning has not been fully achieved.

CONCLUSION

Based on the results of research and discussion about the effect of the discovery learning model on the science process skills of class V students on the material of human digestive organs at MIN 1 Filial Pontianak, the following conclusions can be drawn: 1) the science process skills of students in the control class are shown by the results of the pre-test data of students with an average value of 50.54 and the average value of the control class post-test of 57.42, including in the sufficient category. 2) the results of the pre-test data of students in the experimental class show the science process skills of students in the experimental class. There is an average value of 62.22, including in the good category, and the average value of the experimental class post-test of 55.80, including in the sufficient category. 3) there is a negative effect of -73% of the discovery learning model on science process skills; thus, the discovery learning model is less suitable to be applied to the material of human digestive organs in class V A MIN 1 Filial Pontianak in the 2023/2024 academic year.

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