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THE INFLUENCE OF THE GUIDED INQUIRY LEARNING MODEL ON SCIENCE PROCESS SKILLS IN ECOSYSTEM MATERIAL

PENGARUH PENERAPAN MODEL GUIDED INQUIRY LEARNING TERHADAP KETERAMPILAN PROSES SAINS PADA MATERI EKOSISTEM

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Abstract

Science process skills were important for discovering knowledge concepts, but had not been fully trained at MIN 3 Pontianak. The guided inquiry learning model could train these skills. This study aimed to describe the effect of the guided inquiry learning model on science process skills in ecosystem material. The research method was quantitative with a true experimental pre-test and post-test control group design. The sample was taken randomly, with class VB as the experimental class and VA as the control class. The results showed that the guided inquiry learning model had no significant effect on science process skills inferentially, but descriptive analysis showed an increase in the average of these skills. Researchers need to conduct more in-depth evaluations and use more accurate instruments. This research can be the basis for improving science process skills, especially in the aspect of prediction to be higher.

Keywords: *Ecosystem, Natural Science, Guided Inquiry, Science Process Skills*

Abstrak

Keterampilan proses sains penting untuk menemukan konsep pengetahuan, tetapi belum sepenuhnya dilatih di MIN 3 Pontianak. Model guided inquiry learning dapat melatih keterampilan ini. Penelitian ini bertujuan mendeskripsikan pengaruh model guided inquiry learning terhadap keterampilan proses sains pada materi ekosistem. Metode penelitian adalah kuantitatif dengan desain true experimental pre-test post-test control group design. Sampel diambil secara acak, dengan kelas VB sebagai kelas eksperimen dan VA sebagai kelas kontrol. Hasil penelitian menunjukkan bahwa model guided inquiry learning tidak berpengaruh signifikan pada keterampilan proses sains secara inferensial, tetapi analisis deskriptif menunjukkan peningkatan rata-rata keterampilan tersebut. Peneliti perlu melakukan evaluasi lebih mendalam dan menggunakan instrumen yang lebih akurat. Penelitian ini dapat menjadi dasar untuk meningkatkan keterampilan proses sains, terutama dalam aspek prediksi agar menjadi lebih tinggi.

Kata Kunci: *Ekosistem, Ilmu Pendidikan Alam, Inkuiri Terbimbing, Keterampilan Proses Sains*

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1. Introduction

Science is taught in elementary school. Science is a research procedure scientists conduct to find information about natural phenomena (Harefa & Sarumaha, 2020). The word science comes from latin "*scientia*" which means knowledge. This concept has become more specific to Natural Science (IPA) as it was developed in Indonesia. Science not only focuses on knowledge but also encourages students to be active in the process of discovering knowledge (Kelana & Wardani, 2021). According to Permendiknas No. 22 of 2006, the competencies in Elementary School (SD) or Islamic Elementary School (Madrasah Ibtidaiyah/MI) science learning can be separated into 5, namely: (1) mastering knowledge about various types and various natural and artificial environments about their utilization for daily life, (2) developing science process skills, (3) developing insights, attitudes, and values that are useful for students to improve the quality of daily life, (4) developing awareness of the interrelationship between science and technology capabilities and the state of the environment and its utilization for real daily life, and (5) developing students' ability to apply science and technology and skills that are useful in daily life and to continue their education to a higher level. In learning science, students must have science process skills. These skills are important to help them discover scientific concepts independently. Science process skills have a strong relationship with science literacy. Science process skills refer to a versatile set of abilities describing activities scientists commonly perform (Anisa, Tusapipah, Agustin, Sandy, & Setyaningrum, 2023).

There are several ways to measure students’ science literacy. Research by Azizah, Hartoyo, & Sukarno (2023) shows a positive correlation between the two, where the improvement of Science Process Skills (SPS) is directly proportional to improve science literacy. Science literacy is measured through the Programme for International Student Assessment (PISA), a triennial survey by the Organization for Economic Cooperation and Development (OECD) that evaluates the understanding and skills of 15-year-old students. The 2022 PISA results showed a decline in Indonesian students' science literacy score to 383, compared to 396 in 2018, while the global average was 485 in 2022 and 489 in 2018 (OECD, 2023; OECD, 2019). Observations and interviews with the homeroom teacher of MIN 3 Pontianak showed that science learning at the school was not optimal in practicing science process skills. Teachers were more active than students and focused on cognitive learning outcomes. The VA and VB homeroom teachers stated that learning ecosystem materials did not assess process skills due to limited time before the end-of-semester assessment. As a result, teachers emphasize concept understanding rather than training basic science process skills such as observing, measuring, classifying, predicting, concluding, and communicating.

Students’ science literacy is still low. Research conducted by Nuayi & Very (2020) shows that teachers' attention to science process skills is still lacking, with learning that tends to be teacher-oriented. Students only receive information without going through a discovery process. This was also found in the research of Karlina, Subkhi, Rahman, & Ratnasari (2024), which showed that students' science process skills had not developed optimally in the school. This is because the learning process and assessment of science process skills are rarely measured in learning. Assessment is prioritized in the cognitive domain, while SPS assessment tends to follow the assessment results in the cognitive domain. This impacts the science process skills of very underdeveloped students in learning activities. Teachers should convey knowledge and prepare situations, encouraging students to actively ask questions, observe, experiment, and discover facts and concepts independently.

Teachers must choose a suitable learning model so that students easily accept it. The guided inquiry learning model can train students' basic science process skills

(Nurhabibah, Hidayat, & Mudiono, 2021). This model provides active opportunities for students to develop science skills through structured steps such as observation, formulating problems, making hypotheses, collecting data, testing hypotheses, and drawing conclusions (Gunawan, Harjono, Hermansyah, & Herayanti, 2019). Based on Adauyah & Aznam (2024), there are 6 guided inquiry learning model syntaxes. The first syntax is orientation, which focuses students' attention and explains the inquiry process. The second syntax is formulating problems. The third syntax is formulating hypotheses, which helps students formulate hypotheses to explain the problem. The fourth syntax is collecting data, which encourages students to collect data to test the hypothesis. The fifth syntax is testing the hypothesis, namely concluding the experiments that have been carried out. The sixth syntax is formulating conclusions.

Furthermore, according to Hakim, Harahap, Sudiansyah, Safitri, Sari, Wibowo, Mufidah, Nopriyanti, Selvianti, Mansur, Adimarta, & Andalia (2023), the characteristics of the guided inquiry learning model are as follows:

a. Emphasizes the involvement of students fully in searching and finding, thus placing students as the subject of learning.
b. In the guided inquiry learning process, the problem is raised by the teacher's guidance.
c. All activities carried out by students are focused on investigating and finding answers to the questions posed to strengthen self-confidence and emphasize the teacher's role as a facilitator and motivator of student learning.
d. Developing the ability to think systematically, logically, and critically is an effort to improve intellectual abilities as part of the mental development process. In this context, students are not only asked to master the subject matter but also emphasize their ability to apply their potential in understanding a particular subject matter.

Moreover, Anggaraini (2022) states that the advantages of the guided inquiry learning model include the following:

a. Increases the attractiveness of learning and makes students participate actively.
b. Students can develop concepts and theories through the investigation and guidance provided by the teacher.
c. The teacher acts as a facilitator who assists students in planning and carrying out investigations.
d. The teacher provides a brief explanation before students conduct experiments, select information, and record any events or problems that arise.

Various studies have examined the guided inquiry learning model on students' science process skills. Gumilar & Wardani (2020) found that guided inquiry learning models affect elementary school students' mastery of concepts, scientific attitudes, and science process skills on the heat transfer material. In addition, the guided inquiry learning model also improves students' science process skills (Nugraheni, Nuryani, & Djumhana, 2019). The guided inquiry model improves science process skills and cognitive learning outcomes on the material of various forces in class IV SDN Dampit 6 Malang Regency (Nurhabibah, Hidayat, & Mudiono, 2021). The positive effect was also seen in grade IV students in Tlogowungu District, Pati Regency, on science material about sound (Puspito, Supardi, & Sulhadi, 2021). The guided inquiry model effectively improves science process skills. Still, teachers must be aware of the advantages and disadvantages of this model and be creative in adjusting methods according to the characteristics of students. This study analyzed the effectiveness of guided inquiry implementation in elementary, junior high, and high school students through a literature study of various studies published in national and international journals (Sulistyani, Indana, & Sudibyo, 2022). The analysis shows that using the guided inquiry model in Biology learning on human excretory system material optimizes students' science process skills (Anggereini, Septiani, & Hamidah, 2019). The effectiveness of the guided inquiry model through the virtual laboratory improves students' science process skills in Physics learning (Gunawan, Harjono, Hermansyah, & Herayanti, 2019).

Previous research has highlighted the application of the guided inquiry learning model to science process skills. However, no study has examined the application of this model to elementary school students learning Biology science with the true experimental method of pre-test post-test control group design. Therefore, this study aims to examine the effect of the guided inquiry learning model on the science process skills of class V students on ecosystem material at MIN 3 Pontianak.

2. Research Method

This research is based on a true experimental design using two groups, namely an experimental group and a control group, which were selected randomly. The participants in this study were fifth-grade students from MIN 3 Pontianak during the academic year 2023/2024. Initial observations revealed that classes VA and VB had low science skill scores, while class VC had high scores. Class VB was assigned as the experimental group, which received guided inquiry learning using ecosystem material. On the other hand, class VA was designated as the control group and received conventional learning with the same material. The research instrument consisted of multiple-choice questions assessing various aspects of science process skills related to ecosystems. The pre-test and post-test questions were different, but they followed the same framework. The instrument's validity was tested using the Gregory test.

The data collected from the instrument was analysed and categorised according to science process skills adapted by Dewi, Subagia, & Redhana (2023) can be seen in the following table 1.

Table 1. Science Process Skills Categories

Percentage (%)	**Category**
85 - 100	Very High
70 - 84	High
55 - 69	Medium
40 - 54	Low
0 - 39	Very Low

The analysis included both descriptive statistical analysis and inferential statistical analysis. The inferential statistical analysis involved prerequisite tests and hypothesis tests. The prerequisite tests consisted of normality tests and homogeneity tests to determine whether parametric or nonparametric statistical tests should be used. The hypothesis testing included parametric statistical tests like independent sample t-tests and nonparametric statistical tests like Mann-Whitney tests to compare the mean scores between the experimental and control classes. The analysis was conducted using SPSS statistic version 25 for windows.

3. Results and Discussion
3.1 Results
3.1.1 Descriptive Statistical Analysis

Descriptive statistical analysis used the help of the SPSS and obtained the results in the output table 2 as follows:

Table 2. Descriptive Statistics Output

	N	Minimum	Maximum	Mean	Standard of Deviation
Pre-test Experimental Class	36	40.00	100.00	67.5922	13.81552
Post-test Experimental Class	36	20.00	100.00	70.3700	20.18590
Pre-test Control Class	35	26.67	100.00	75.4294	17.98892
Post-test Control Class	35	33.33	100.00	75.6186	19.79848

Table 2 shows that in the pre-test in the control class, there was a minimum value of 26.67 and a maximum value of 100, with an average of 75.42, which is included in the high category. In the post-test in the control class, the minimum value was 33.33, the maximum value was 100, and the average was 75.61, which is also classified as high. The experimental class in the pre-test had a minimum value of 40 and a maximum value of 100, with an average of 67.59, and was also included in the high category. In the post-test, the minimum value was 20, the maximum value was 100, and the average was 70.37, also categorized as high. The average score of students' science process skills can be seen in the bar graph shown below:

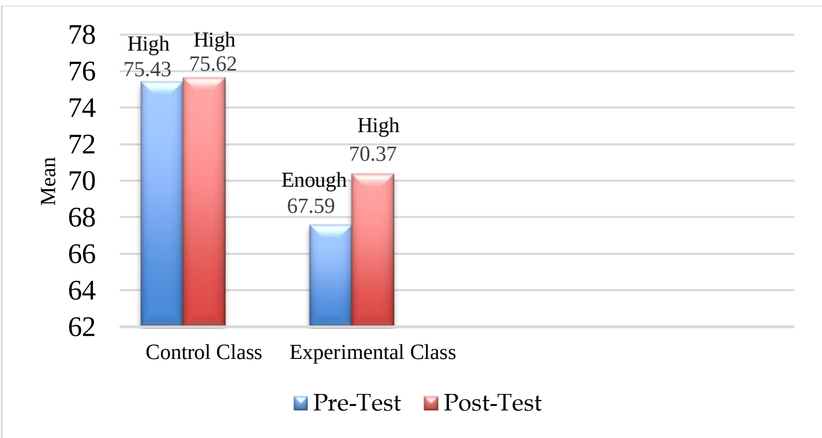

Figure 1. Bar Graph of the Average SPS Score of Students

The science process skills of students in each aspect consisting of observing, measuring, classifying, predicting, concluding, and communicating can be seen as follows:

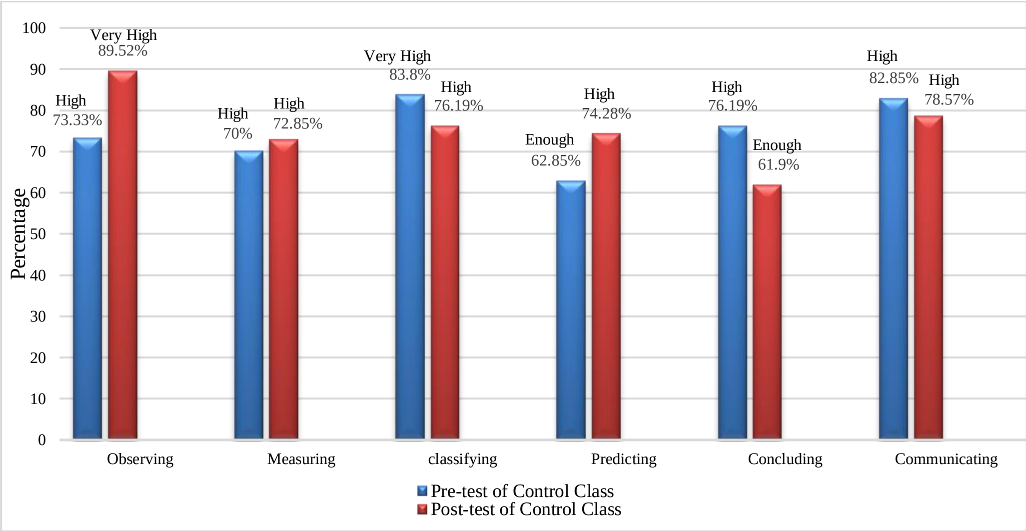

Figure 2. Bar Diagram of Control Class SPS Percentage of Each Aspect

Figure 2 shows the science process skills of each aspect of the control class. The observing aspect of the pre-test reached 73.33% in the high category, and the post-test reached 89.52% in the very high category. The measuring aspect of the pre-test reached 70% in the high category, and the post-test reached 72.85% in the high category. The classifying aspect of the pre-test reached 83.8% in the very high category, and the post-test reached 76.19% in the high category. The predicting aspect of the pre-test reached 62.85% in the enough category, and the post-test reached 74.28% in the high category. The concluding aspect reached 76.19% in the high category and 61.9% in the enough category in the post-test. The aspect of communicating pre-test reached 82.85% in the high category and post-test 78.57% in the high category.

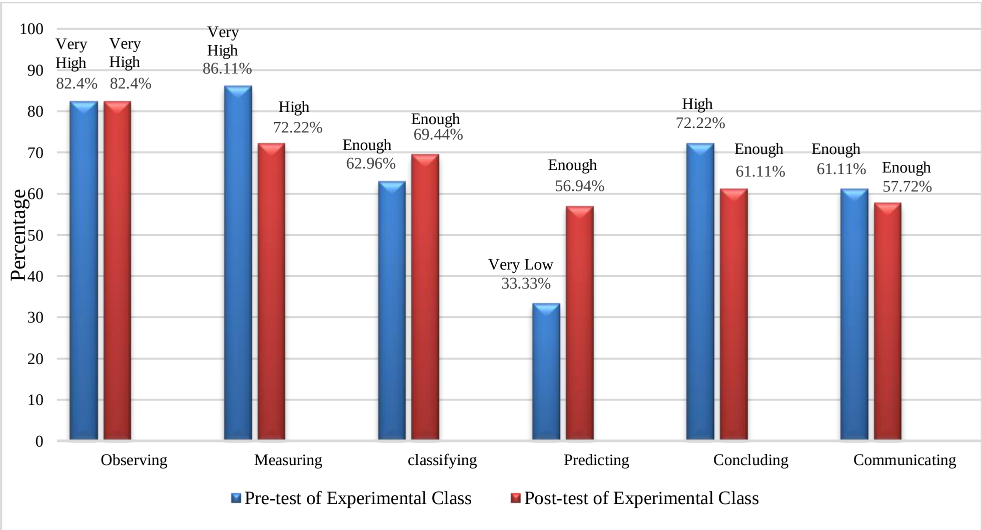

Figure 3. Bar Diagram of Experimental Class SPS Percentage of Each Aspect

Figure 3 shows the science process skills of each aspect of the experimental class. The observing aspect of the pre-test reached 82.4% in the very high category, and the post-test reached 82.4% in the very high category. The measuring aspect of the pre-test reached 86.11% in the very high category, and the post-test reached 72.22% in the high category. The classifying aspect of the pre-test reached 62.96% in the enough category, and the post-test reached 69.44% in the enough category. The predicting aspect of the pre-test reached 33.33% in the very low category, and the post-test reached 56.94% in the enough category. The concluding aspect reached 72.22% in the high category and the post-test 61.11% in the enough category. The aspect of communicating pre-test reached 61.11% in the enough category and post-test 57.72% in the enough category.

3.1.2 Inferential Statistic Analysis

Analysis of differences in the average value of science process skills of experimental and control class students using the Mann-Whitney test with the help of the IBM SPSS obtained the following data:

Table 3. Mann Whitney Pre-test Analysis Output

	Pre-test Students' SPS
Mann-Whitney U	411.500
Wilcoxon W	1077.500
Z	-2.541
Asymp. Sig. (2-tailed)	0.011

Based on the information in table 3, it can be seen that the results of the Mann-Whitney test output show the significance value is 0.011 < 0.05. So, it is known that H_a is accepted, meaning there is a difference in the pre-test results of the experimental class and control classes. So, the next step is to analyze the different data (post-test and pre-test) using the independent sample test.

Data analysis of the difference in the average scores of the experimental and control classes is obtained as follows:

Table 4. Difference Analysis Output of Independent Sample Test

	Levene's Test for Equality of Variances		**t-test for Equality of Means**						
	F	**Sig.**	**t**	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
								Lower	**Upper**
Equal variances assumed	.109	.743	.570	69	.571	2.21808	3.89171	-5.54567	9.98183

Based on table 4, the independent sample test shows a significance of 0.571 > 0.05, which rejects H_a and shows no significant difference between the experimental and control classes.

3.2 Discussion

The results of the descriptive analysis showed that the science process skills of grade V students at MIN 3 Pontianak were quite high using the guided inquiry learning model. The average post-test score of the class was 70.37 and increased by 2.75 from the pre-test. Although the class without the inquiry learning model also had high skills, with an average post-test of 75.62 and an increase of 0.19 from the pre-test in the control class. However, the difference in skill improvement was greater in the class that used the guided inquiry learning model. This study also revealed that the initial ability of experimental class students was lower than that of control class students, but the skill improvement in the class using the guided inquiry model was more significant. These findings indicate that the guided inquiry learning model is more effective in improving students' science process skills compared to conventional learning as shown in figure 2.

The experimental class showed better results in observing, measuring, and classifying, while the control class had better results in inferring. This shows that observing students is good for mastering science process skills. This is also found in the research of Suwardani, Asrial, & Yelianti (2021) that the aspect of observing is the most dominant and reaches the highest value because each learning session of the guided inquiry learning model begins with the observation stage. During the observation process, the teacher provides guidance and direction to students to ensure smooth learning until completion. In this study, the guided inquiry learning process at the orientation stage asked students to observe the pictures on the students' worksheets. Therefore, the aspect of observing students is proven to be trained in the syntax. The observation aspect is the most important part of science process skills. Research Wirayuda (2023) also states that observation ability is a key element in process skills, which is the foundation for developing other process skills, such as measuring, classifying, predicting, drawing conclusions, and communicating. However, the lowest aspect, among others, is the prediction aspect.

The research presented in this text examines the impact of guided inquiry learning model on students' science process skills. The independent sample test conducted did not show any significant difference between the experimental and control classes, as the p-value of 0.571 was greater than the 0.05 significance level. This means rejecting H_a and showing no significant difference between the experimental and control classes. Although there was no significant difference, it was found that the guided inquiry learning model improved science process skills more than the model used in the experimental class. This confirms that the guided inquiry learning model is effective in improving students' science process skills and has a positive impact on science education.

The findings of this study are consistent with previous studies that also show the positive impact of guided inquiry learning models on students' science process skills. One study conducted by Nugraheni, Nuryani, & Djumhana (2019) found that the guided inquiry model improved these skills, while other studies by Nurhabibah, Hidayat, & Mudiono (2021) and Gunawan, Harjono, Hermansyah, & Herayanti (2019) showed an increase in both science process skills and cognitive science learning outcomes. The effectiveness of the guided inquiry model in improving science process skills has been proven, but teachers need to be aware of its advantages and disadvantages and adapt it creatively to suit the characteristics of each student, as highlighted by Sulistyani, Indana, & Sudibyo (2022). Similarly, Siahaan, Lumbangaol, Marbun, Nainggolan, Ritonga, & Barus (2021) used a similar research design and showed no significant difference in science process skills between students taught using guided inquiry with multirepresentation and those taught using traditional guided inquiry.

Contrary to this study, there are previous studies that show that the guided inquiry learning model has a significant influence on students' science process skills. Gumilar & Wardani (2020) found that the guided inquiry learning model had an effect on concept mastery, scientific attitudes, and science process skills in elementary school students studying heat transfer material. Similarly, Puspito, Supardi, & Sulhadi (2021) observed a positive influence on grade IV elementary school students in Tlogowungu District regarding science material about sound. Another study by Anggereini, Septiani, & Hamidah (2019) showed that the application of the guided inquiry learning model had an effect on science process skills and science knowledge.

There are several obstacles in this research, namely:

a. Students are not familiar with the guided inquiry learning model and take longer to complete the task. This was also found in the research of Hidayah, Junus, & Efwinda (2023) that the development of several indicators of science process skills that were less stable at certain meetings was due to differences in practicum topics which according to students when compared to practicum time was less appropriate, this is because students are still not used to and trying to adapt to the model applied.
b. Limited time allocation. Similar findings from previous studies show that guided inquiry has weaknesses in terms of time allocation and effectiveness in larger class sizes (Sulistyani, Indana, & Sudibyo, 2022). Future researchers should plan carefully and provide extra guidance to overcome this obstacle.
c. Lack of student participation, some students did not actively participate in the test because they thought that the post-test score did not affect the report card score. The questions used were multiple choice, thus limiting in-depth understanding and assessment of creativity (Sibiç & Şeşen, 2022). So for future researchers it is recommended to use an instrument in the form of a reasoned multiple choice question or two tier so that students do not just guess but can also provide answers or information so that when measuring science process skills can provide good results. more precise.

This research reaffirms that the guided inquiry learning model has a positive impact on students' science process skills. Although statistical significance was not obtained in this study, this finding is in line with previous studies that have consistently shown the effectiveness of this model in improving science process skills. This occurs due to several factors, such as the way of implementation, student characteristics, and learning environment conditions. Effective learning models are context-dependent and cannot be applied equally to all situations.

4. Conclusion

The results showed that applying the guided inquiry learning model did not affect students' science process skills. The difference between the results of this study and previous studies shows the importance of adjusting the learning model to a specific context. The guided inquiry learning model may not always provide better results if factors such as the way of application, student characteristics, and learning environment conditions are not considered. Therefore, future researchers need to evaluate and explore the research thoroughly and continue to adapt to improve the effectiveness of this guided inquiry learning model, including using more accurate instruments to measure science process skills. This study can be used as a basis for future researchers. The goal is to explore more deeply the aspects that can improve science process skills to be higher, especially in the aspect of predicting students' science process skills.

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