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The Influence of Guided Inquiry Models on Science Process Skills

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Abstract

Preliminary observations of researchers related to science process skills in grade IV elementary school showed low results. This is due to the learning methods carried out by the teacher still applying conventional learning so that students are passive in learning. The purpose of this research was; (1) to determine the effect of guided inquiry learning models on students 'science process skills and (2) determine the magnitude of the influence of guided inquiry learning models on students' science process skills. This research uses a quantitative research approach that is a quasi-experimental method with a research design used pretest-posttest control group design. This design involves two groups of subjects; guided inquiry model was employed in experimental class and the other class received conventional learning model. The results of this study indicate that the guided inquiry model influences students' science process skills and there are differences in students' science process skills between the experimental class and the control class. In conclusion, the guided inquiry model succeeded in improving the science process skills of students.

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INTRODUCTION

Science learning is a knowledge that is obtained and developed based on experiments (inductive) and based on theory (deductive). There are two things that are inseparable from the natural sciences, namely science as a product and science as a process. Science as a product in the form of factual, conceptual, procedural, and metacognitive knowledge, and Natural Sciences as a process that is scientific work. According to Juhji (2016) it is suggested that science is a rational and objective knowledge about the universe and all its contents. The most important goal of science education is to teach students how to be involved in investigations and allow individuals to use science process skills (Aktamis et al., 2008).

Indriati (2012) argues that Natural Science is knowledge gained through data collection by experimentation, observation, and deduction to produce an explanation of a phenomenon that can be trusted.

Learning is a process of communication between educators and students, or between students in verbal and nonverbal ways to assist student learning processes (Rifa'i & Anni, 2012). Natural Science is human effort in understanding the universe through proper observations on targets, using procedures, and explained with reasoning so as to get a conclusion (Susanto, 2016). Separately, Wisudawati & Sulistiyowati (2015) state that by learning science students are expected to be able to understand nature and be able to solve problems they encounter in the natural environment. So, learning science in elementary school is learning about knowledge related to nature and daily activities around students that involve scientific activities that are observing, exploring, asking, associating, and concluding (Hanifah, 2016).

Based on observations about learning science in SDN Tlogowungu 01 and SDN Tlogowungu 03, the teacher teaches science material by the lecture method, asks questions to students, and does not relate to the surrounding environment. There were only a few students who were interested in learning, only a few students were very enthusiastic about answering questions and the teacher did not invite other students to enthusiastically ask questions in learning. It is found that 65% of students have not reached completion, while the remaining 35% of students who have reached completeness in the content of science. The students of fourth grade SDN Tlogowungu 01 consisted of class IV, 20 students, 10 male students, 10 female students. Whereas SDN Tlogowungu 03 with the fourth grade totaled 20 as well with a comparison of the number of male students 11 and the number of female students 9. This had an impact on the students' science process skills which were low. It was obtained by students' science process skills data from observation showing of 20 students at SDN Tlogowungu 01 the average science process skills are only 30.45. While at Tlogowungu SDN 03 the average science process skills in science learning are also only 30.40. This shows the low science process skills of students in learning science.

This is consistent with the results of studies that conventional teaching and more reliance on textbooks can be responsible for increasing students' negative attitudes about science (Hacieminoglu, 2009) and teachers do not teach about science process skills in advance and do not encourage students to search (Ergul et al. 2011). Sujiono (2014) in his research stated that the science learning that was carried out did not activate students, causing students to be passive in learning.

Based on the findings of problems in the field, certain learning approach is needed to pursue students actively involved in learning. This refers to the standard process that is demanded by the government in learning. To strengthen the scientific approach, integrated thematic (thematic between subjects) and thematic (in a subject) need to be applied to learning based on disclosure/research or discovery/inquiry learning (Permendikbud No. 22 of 2016).

Inquiry-based learning is the process by which students engage in their learning through investigation of ideas, questions, or problems.

Investigations conducted can be in the form of laboratory activities or other activities that can be used to gather information. The process includes gathering information, building knowledge, and developing a deep understanding of object being investigated.

Inquiry-based learning or science-based inquiry explains various philosophical, curricular, and pedagogical approaches to teaching. The requirement is that learning must be based around student questions. Pedagogy and curriculum require students to work independently to solve problems rather than receive direct instruction of what must be done from the teacher. The teacher is seen as a learning facilitator and not a container of knowledge. Therefore the teacher's work in the inquiry learning environment is not to provide knowledge, but rather to help students throughout the process of finding their own knowledge (Aceska et al., 2016).

Research conducted by Suduc (2015) in his article entitled 'Inquiry Based Science Learning in Primary Education', states that inquiry-based learning is proven to stimulate student motivation; assist students in constructing meaning; and gaining scientific knowledge. Whereas other research conducted by şimşek & Kabapinar (2010) states that inquiry-based learning in grade 5 science has a positive impact on students' conceptual understanding and science process skills, but does not make any difference in their attitudes towards science.

Thus the use of guided inquiry models provides opportunities for teachers to change their role in learning activities. In guided inquiry the teacher presents questions, students investigate using the designs/procedures selected by students, the designs/procedures referred to are the methods and solutions (Bell et al., 2015).

In line with the research, facts found by Maretasari (2012) that the application of laboratory-based guided inquiry models has a significant positive effect on learning outcomes and scientific attitudes that are more effective on science process skills and student motivation. Suduc (2015) in his research also found that inquiry-based learning was proven to stimulate student motivation, assist students in constructing meaning and gain scientific knowledge. The application of guided inquiry learning has a significant influence on scientific behaviors and attitudes exhibited by students towards learning science and technology (Sever & Guven, 2014).

Inquiry-based learning can increase motivation and interest in learning science (Wanga, 2015). Inquiry-based learning can also improve students' scientific process abilities (Bekiroglu, 2014). Based on the results the previous studies, it can be concluded that guided inquiry learning can be used as a solution to the problem of the lack of motivation and science process skills of fourth grade students that occur in SDN Tlogowungu 01 and SDN Tlogowungu 03. For this reason it is important to conducted research on the influence of guided inquiry models towards science process skills.

The use of inquiry models in this study is to assist students in understanding the science process skills in learning science class IV elementary school. The process is important in learning activities. The learning process that is conduct properly will produce good learning outcomes as well. For this reason, in science learning the science process skills can be used to get better learning outcomes. Science process skills are special skills that simplify learning science, activate students, develop students' sense of responsibility in their own learning, improve learning conditions, and teach them research methods (Karamustafaoğlu, 2011).

According to Fould (1996), process skills include: identifying and defining the variables concerned, interpreting, changing, and analyzing data, planning and experimental design, and formulating hypotheses. Process skills consist of basic process skills and integrated process skills. Devi (2010) states that basic process skills include: observing, measuring, concluding, predicting, classifying, and communicating. Whereas integrated process skills include controlling variables, interpreting data, formulating hypotheses, defining variables operationally, and designing experiments. Basic

process skills are the foundation for training more complex integrated skills.

The purpose of this study is to determine the effect of guided inquiry learning models on students 'science process skills and determine the magnitude of the influence of guided inquiry learning models on students' science process skills.

METHOD

Quantitative research approach was conduct in this reserach. A quasi-experimental method with a research design used pretest-posttest control group design was employed. The population in this study was all fourth grade students in Tlogowungu Subdistrict, Pati Regency in the academic year 2019/2020. The sample in this study was determined using purposive sampling technique, which is sampling technique by establishing special characteristics, namely: (1) Schools originated from SDN accredited A and implementing the 2013 curriculum of Tlogowungu Subdistrict in Pati Regency in the academic year 2019/2020; (2) Schools have almost equal numbers of students; (3) Schools have almost the same test scores; (4) The school is in a contiguous environment.

Based on the above considerations, SDN Tlogowungu 1 and SDN Tlogowungu 3 were selected as the research samples. Furthermore, simple random sampling technique was conducted to determine the experimental class and the control class so that the results of class IV SDN Tlogowungu 01 as the control class and SDN Tlogowungu 03 as the experimental class.

RESULTS AND DISCUSSION

The results of the research described in this chapter are oriented to the research objectives outlined in the background of the problem, namely to determine the effect of guided inquiry learning on the science process skills of grade IV elementary school students in learning theme 1 "Beautiful Togetherness", sub-theme 1 "Diversity of My Nation's Culture" (learning 1 and 3) and sub-theme 2 "The Beauty of Togetherness" (learning 1 and 3). The research data that are presented in the form of analysis prerequisite test data and research result data.

1. Prerequisite Test

a) Normality Test

The first stage after the results of the pretest results of the science process skills of the experimental class and the control class were collected, then the data normality test was carried out using the normality test formula through the Liliefors test (Kolmogorov-Smirnov) using SPSS version 21, this was done to find out if the pretest data were derived from data normally distributed or not. The form of a hypothesis for normality test is as follows. H_0: data come from normally distributed samples. H_1: data not from normally distributed samples.

The criteria used to reject or not reject H_0 based on the P-value are as follows. If P-value < α, then H_0 is rejected. If the P-value is $\geq \alpha$, then H_0 is accepted. The normality test results of the control class and the experimental class as in Table 1.

Table 1. Pretest Normality Test for Science Process Skills

Normality Test	Experimental Class	Control Class
Sig. Kolmogorov-Smirnov	0.148	0.200
α	0.05	0.05
Information	Normally	Normally

Based on Table 1 it can be seen that the results of the science process skills pretest of the experimental class students have a Sig of normality test value of 0.148 which is greater than the value of α = 0.05. This shows that the experimental group pretest data came from

normally distributed data or H_0 was received. In the control class after the normality test has a Sig value of 0.200 is greater than the value of α = 0.05, this shows that the control group pretest data is normally distributed or H_0 is accepted. Therefore, it can be said that the experimental class and control class data are normally distributed.

b). Homogeneity Test

Homogeneity test is carried out to investigate whether homogeneity is fulfilled or not in variance or group. The hypotheses for homogeneity testing include the following. H0: Both variances are the same. H1: Both variances are different. The criteria used to determine the homogeneity of the pretest are as follows. H0 is accepted if the significance is ≥ 0.05. H1 is rejected if the significance < 0.05. The following homogeneity test results are presented in Table 2.

Table 2.Pretest Homogeneity Test for Science Process Skills

		Levene's Test for equality of Variances	
		F	Sig.
Pretest	Equal variances assumed Equal variances not assumed	0.445	0.822

Based on Table 2 the homogeneity test of the experimental group and the control group has a Sig value of 0.822, this shows that H_0 was accepted because Sig > 0.05, meaning that the experimental group and the control group came from the same variance.

2. Hypothesis Test

a**) Test Difference of Two Averages**

T test was conducted to determine whether there were differences in the average or not of the results of the posttest of the two groups, namely the experimental group that had been treated using guided inquiry learning and the control group with conventional learning. The hypothesis for the t test is as follows. H_0: There is no difference in the average science process skills of students between the experimental group and the control group. H_1: There are differences in the average science process skills of students between the experimental group and the control group.

The criteria used in the t test are as follows. H0 is accepted if the significance is ≥ 0.05. H0 is rejected if the significance <0.05. The results of the calculation of the independent sample t-test on students' science process skills can be seen in Table 3.

Table 3. Posttest Test of Science Process Skills

Sig. 2 tailed	α	Mean	
		Experimental	Control
0.00	0.05	77.70	63.48
Information		There are differences in the average science process skills of students	

The t-test posttest from Table 3 can be seen that the significance value shows the number 0.00 < 0.05. This proves that there are differences in the average value of students' science process skills in the experimental class and the control class after learning. In the mean box it can be seen that the mean of the experimental class shows results of 77.70, while the control class shows results of 63.48. This shows that the average science process skills of students in the experimental class are higher than the average science process skills of students in the control class.

The results of the analysis of the science process skills of the control class and

experimental class students are presented in Figure1.

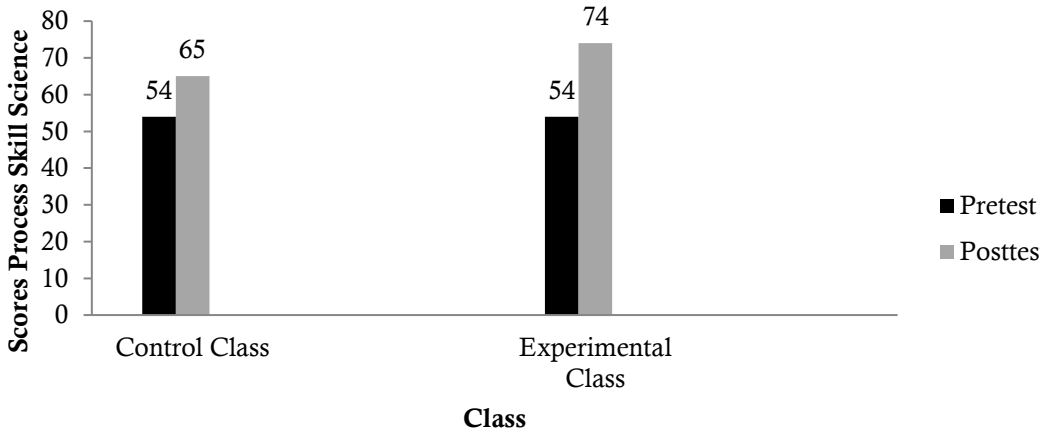

Figure 1. Results of Skill Analysis Science Process

Based on data from Figure 1 the results of the pretest or before learning in the control class obtained an average score of 54, then increased to 64 on the posttest results or after learning with sound material. Meanwhile, the results of the pretest or prior learning with the guided inquiry model in the experimental class with sound material obtained an average score of 54, then increased to 74 on the posttest results or after learning with the guided inquiry models.

b) N-Gain Test

N-Gain Test to determine the difference between the increase in the pretest and posttest scores in the experimental class and the control class. The results of the N-Gain test can be seen in Figure 2

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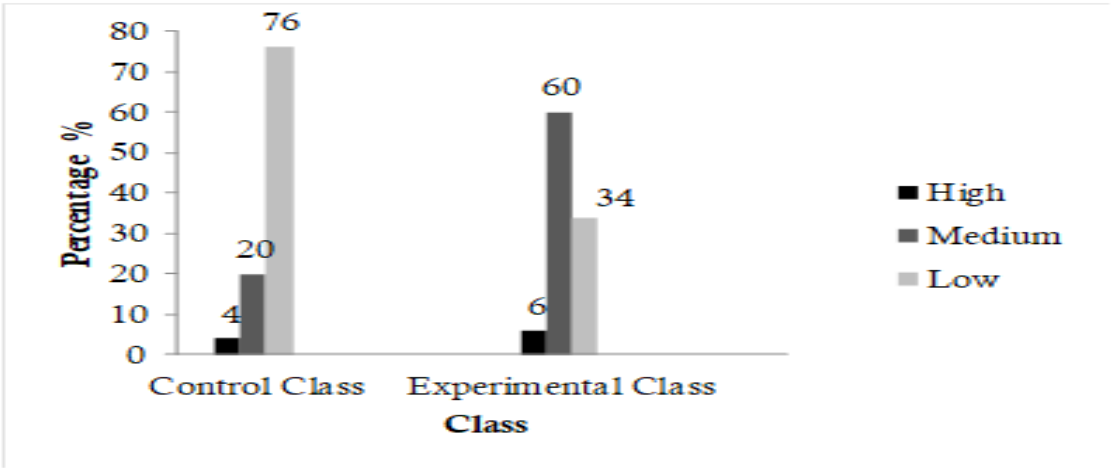

Figure 2. N-Gain Science Process Skills

Based on the data in Figure 2 it can be seen that the science process skills of students in the control class are in the high category by 4%, while in the experimental class by 6%. The science process skills of students in the medium category in the control class were 20%, while in the experimental class it was 60%. The science process skills of students in the category are

sufficient in the control class by 76%, while in the experimental class by 34%. The data of this research in applying the guided inquiry model is in line with research from Sudaryanti (2015) that learning using guided inquiry and structured inquiry approaches is effective for improving critical thinking skills, concept mastery, and science process skills

Furthermore, the comparison of the average N-Gain in the control class and the experimental class is in the control class, the average N-Gain is 0.24 and is in the sufficient category, while in the experimental class the average N-Gain is 0.43 and is in the moderate category. This shows that the acquisition of science process skills of students in the experimental class is better than the control class. The improvement is in line with research conducted by Bekiroglu (2014) that inquiry-based learning can improve students' scientific process abilities.

CONCLUSION

Based on the results of the research that has been described, it can be concluded that guided inquiry model influences students' science process skills. The science process skills of the experimental class students showed an average of 54 included in the low criteria. After receiving treatment with the guided inquiry learning model, students' science process skills showed an average of 74 which included high criteria and there are differences in students' science process skills between the experimental class and the control class. Students' science process skills in the experimental class and the control class after learning that the mean experimental class showed results of 77.70, while the control class showed results of 63.48. This shows that the average science process skill of students in the experimental class is higher than that of the average science process skills of students in the control class.

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