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# Guided Inquiry and Simple Science KIT Media: Their Implications for Students' Science Process Skills

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**ABSTRACT**
*The purpose of this study was to examine how the guided inquiry model affected the science process abilities of university students who studied the basic concept of elementary school-level science. This study utilized a type of quasi-experimental research approach called a one group pretest-posttest design to examine the effect of treatment administered to one group before and after the treatment by a test of science process skills questions. Out of the 182 students enrolled in the Madrasah Ibtidaiyah Teacher Education Study Program at IAIN Padangsidimpuan, 25 students from the fourth semester of 2022 served as the study's samples. Using a paired sample t-test and the SPSS 22.0 program, the study's findings showed that there was a difference in the science process skill scores of the students between the pre- and post-test results. It was discovered that the paired sample t-test had a significance value of 0.168, which was higher than 0.05. In conclusion, the guided inquiry model assisted with simple scientific KIT media was found to have a significant effect on the science process skill scores of students at PGMI IAIN Padangsidimpuan, especially about temperature and heat materials.*

**Keywords**: *guided inquiry, science process skills, simple science media kit*

## INTRODUCTION

As a branch of the sciences, natural science is composed of both processes and products. Natural science as a product is defined as an organized collection of knowledge derived from the study of diverse natural phenomena. This knowledge is represented by rules, theories, concepts, and concept charts. In the meantime, natural science as a process refers to scientific research performed to investigate natural occurrences in addition to finding and creating scientific products using scientific procedures or the scientific method (Carin, A. A, 1997). Because of their relationship, processes and products in natural science thus become two essential components. Laws, hypotheses, and concepts developed via procedures in the form of scientific work completed by science scientists themselves are examples of science products. As a result, a scientist should preferably investigate both the method and the final output as part of the scientific process.

Constructivism theory, which believes that knowledge is the outcome of an individual's cognitive construction through their activities and experiences, is one of the ideas that has been

used in the context of science learning (Sumarsih, 2009). This is consistent with Piaget's definition of learning, which states that learning is the active process of acquiring and finding ideas carried out by an individual in constructing their own knowledge and that it may be applied in a variety of contexts (Suparno, P, 2001). Therefore, in order for students to be able to independently construct the knowledge or concepts they have received through scientific work processes (the scientific method), learning activities involve an active process from the students. Constructivists believe that there are a number of crucial factors that should be taken into account during the learning process. These include the need for a learning orientation that emphasizes life skills or meaningfulness, is constructivist in nature, and encourages students to be active, creative, effective, and to enjoy learning (Akbar, S, 2013). Similarly, Ramdani et al. (2021) assert that creative thinking abilities and academic success are said to be positively connected. Because of this, it is necessary to incorporate the development of creative thinking skills into the learning process. The application of suitable learning models can facilitate the successful development of these skills. The previous assertion suggests that there is a gap between students' academic success and their abilities for creative thought and science process skills. Thus, academic achievement above average will be attained by students who are able to acquire science process skills. So, it can be said that learning activities are contextual and include students directly and actively in the process of constructing their own knowledge. It is also believed that by practicing science process skills, students would be able to apply what they have learned.

Science process skills are typically used to describe the abilities that students should have in order to work with scientists to make scientific discoveries. Science process skills are the ability to learn through the formulation of concepts using scientific procedures that give priority to thought processes (Hasan et al., 2017). In the twenty-first century, science process skills have emerged as one of the most crucial fundamental science abilities that primary school (MI/SD) teachers and prospective teachers must possess. This is intended to give them the ability to plan and carry out lessons that can teach students science process skills during in-class learning activities. These scientific process abilities are directly tied to the scientific procedures that scientists follow when they do specific types of research. Then, the scientific method then entails a number of scientific process skills, including the ability to observe and gather data, measure, organize, classify, formulate hypotheses, make predictions, conduct experiments, analyze data, draw conclusions, create models, and communicate scientifically (Subali & Mariyam, 2013).

Inquiry learning is a type of constructivist learning which can make students active during the learning process. The inquiry learning model is a learning model that requires students' involvement in finding their own answers to the problems they face (Hasbi et al., 2022). Through a scientific approach, students are encouraged to construct their own knowledge in order to be able to understand and apply the knowledge they construct (Asy'syakurni et al., 2015). Moreover, inquiry learning has various characteristics, including learning that is closely related to questioning activities and can be presented through demonstration, experiment, or discussion methods. One type of inquiry learning is guided inquiry in which students are exposed to a problem raised by the teacher (Trowbridge, L. W & Bybee, R. W, 1990). Inquiry learning possibly encourages students to be actively involved in learning so that they can develop the basic scientific work skills that intersect with science process skills in primary and secondary education (Rustaman, N. Y & Rustaman, A, 2003).

Guided inquiry learning model is a student-centered learning model aiming to train and develop thinking skills as well as to increase students' learning enthusiasm (C. Dewi et al., 2020). Others assert that in inquiry learning, students have the opportunity to search for and discover the knowledge they are learning so that it will be easier for them to understand the material without memorizing, and the concept they find will be more durable (Fitri & Fatisa, 2019). Meanwhile, Kuhlthau believes that guided inquiry is a learning process that provides students the opportunities to develop investigative skills or to obtain information, increase the understanding

of the subject matter, increase learning motivation, and train students to develop high level thinking abilities through 5M steps, namely observing, asking, collecting information, associating, and communicating (Dewi, 2016). Another opinion expressed by Gulo is related to the stages of the guided inquiry model which begins with asking questions or problems through demonstration activities or presenting certain phenomena. These questions can be asked directly by students or through the teacher's guidance. This is then continued with the stages of formulating hypotheses through group discussion activities, collecting data through experimental activities, and exploring information from various relevant learning sources. However, before data collection activities are carried out, students first hold a group discussion to determine the experimental procedures or steps for the data collection activities. After that, students conduct an analysis of the data collected in order to obtain final conclusions regarding the learning material being studied. This conclusion aims to prove the hypothesis what has been formulated in the previous stage (Trianto, 2007). Therefore, the guided inquiry model can be implemented as an alternative learning model to improve various abilities including students' science process skills. In addition, the stages of the guided inquiry model correspond to the indicators or types of science process skills that are trained and developed for students during the learning process. Therefore, it is important to develop students' science process skills, including the prospective MI/SD teacher students at the tertiary level. This aims to ensure that they are able to master these science process skills so that they can be applied in learning at the elementary school level in the future.

However, the above theoretical review contradicts to the facts that most of the learning or lecture processes are still oriented towards mastering concepts and centered on teachers or lecturers. This means that the lecture process focuses more on improving students' cognitive abilities. In addition, during lecture activities, students are more passive and are rarely facilitated in developing their science process skills. This is based on the results of a preliminary study conducted by researchers through interviews with several students of the PGMI study program, which revealed that the majority of lectures were carried out with direct learning which was centered on lecturers; as a result, students were less active and were not facilitated in developing their various abilities including science process skills, which would be useful in order to achieve the educational goals as well as to improve Indonesia's human resources as a whole. Moreover, education has a crucial role in facing the future which is full of challenges and changing times (Permana et al., 2023).

Based on the background of the problem explained above, the formulation of the problem in this research was how the guided inquiry model assisted by simple science KIT media affected the students' science process skills at the Madrasah Ibtidaiyah (Primary) Teacher Education Study Program of IAIN Padangsidimpuan. Meanwhile, this research aimed to analyze the influence of the guided inquiry model assisted by simple science KIT media on the science process activities and skills of students at the Madrasah Ibtidaiyah Teacher Education Study Program at IAIN Padangsidimpuan.

## METHODOLOGY

This research utilized quasi-experimental methos because the research variables could not be controlled strictly and scientifically following certain rules (Arikunto, 2010). The type of the research design used in this study was the pretest-posttest group design by conducting two-times observation, before (pretest) and after (posttest) the treatment. The difference of the score in the pretest and posttest was assumed to be the influence of the treatment, which was the implementation of the guided inquiry model assisted by the simple KIT science media.

The population of this research was all fourth semester students of the Madrasah Ibtidaiyah Teacher Education Study Program of IAIN Padangsidimpuan in the 2021/2022 academic year, totaling 168 students. The samples of this research were 25 students in PGMI 1

class. These samples were selected using the purposive sampling technique since it was based on classes that had been formed from the beginning, so it was not possible to be chosen randomly by researchers.

Furthermore, the instruments in this research included a validation sheet, a practical worksheet, and the science process skills test. First, a validation sheet of the scientific process skills test was administered to determine the validity level of the questions used in the test. This validation sheet was filled in or completed by expert validators consisting of 2 lecturers possessing the expertise that matched the material tested in the KPS questions. Then, a practical worksheet (LKP) was used to see and assess the implementation of the guided inquiry model assisted by a simple science media kit during learning activities. Then, the test was performed to examine students' science process skills. There were 13 multiple choice questions with four answer choices in this test. The number of questions was adjusted to the KPS indicators and the learning objectives. The KPS test items were prepared by researchers. Then, it was consulted with supervisors, assessed by experts, and tested to measure the validity and reliability of the test. After that, the validity and reliability tests were carried out using the SPSS 22.0 application.

Furthermore, data in this research were collected in two ways: test and non-test. Data from the test, which were the scores of science process skills of prospective MI/SD teacher students were collected twice: during the pretest and posttest. Meanwhile, non-test data, which was related to the implementation of the guided inquiry model assisted by a simple science media kit were collected through an observation using observation sheets. Then, the data were analyzed by using statistical tests, which was the t-test to obtain the difference of the mean score between in the pretest and the posttest (Supardi, 2005).

## RESULT AND DISCUSSION

Based on the data obtained during the pretest and posttest, the researchers conducted a normality test using the SPSS 22.0 application to determine the next type of statistical test to be used. The results of normality test are displayed in Table 1.

**Table 1. Results of Normality Test of the Pretest and Posttest Score**

| Tests of Normality | | | | | | |
|---|---|---|---|---|---|---|
| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
| | Statistic | df | Sig. | Statistic | df | Sig. |
| PRETEST | .181 | 25 | .034 | .944 | 25 | .181 |
| POSTTEST | .152 | 25 | .140 | .952 | 25 | .276 |
| a. Lilliefors Significance Correction | | | | | | |

In this normality test, researchers used the Shapiro-Wilk significance value since the samples were less than 30 (N<30) with a significance value of 0.181 for pretest data and 0.276 for posttest data; both values were greater than 0.05. Thus, it was concluded that the data were normally distributed (for pretest and posttest data) so that further statistical tests could be carried out using parametric statistical tests in the form of t-tests paired samples.

The science process skills examined in this research consisted of eight types of KPS, namely interpreting data (interpretation), grouping (classification), forecasting (prediction), communicating, hypothesizing, planning experiments, applying concepts or principles, and asking questions. These eight indicators were outlined in the KPS test instrument into 13 multiple choice questions. After the instrument was completed, the researcher performed several stages of instrument validations, starting from construct/content validity, which was carried out by two

experts, to empirical validity through testing the questions on 30 students. The results of the validity test obtained 12 questions of the KPS test. The scores obtained from students' science process skills in the pretest and posttest are presented in Table 2.

**Table 2. The KPS Score in Pretest and Posttest**

| No | Subject Code | Pretest Score | Posttest Score |
|---|---|---|---|
| 1 | TAH | 53.8 | 69.2 |
| 2 | PAS | 38.5 | 84.6 |
| 3 | ANS | 46.2 | 53.8 |
| 4 | YS | 61.5 | 61.5 |
| 5 | AMR | 46.2 | 61.5 |
| 6 | FAZ | 46.2 | 53.8 |
| 7 | RFR | 61.5 | 100.0 |
| 8 | ARS | 46.2 | 53.8 |
| 9 | AHH | 53.8 | 61.5 |
| 10 | SMT | 53.8 | 38.5 |
| 11 | PSL | 46.2 | 53.8 |
| 12 | RNS | 53.8 | 84.6 |
| 13 | ANP | 30.8 | 69.2 |
| 14 | NFS | 46.2 | 38.5 |
| 15 | FAA | 46.2 | 69.2 |
| 16 | IYH | 38.5 | 53.8 |
| 17 | MRR | 61.5 | 69.2 |
| 18 | MDV | 69.2 | 61.5 |
| 19 | NRI | 53.8 | 76.9 |
| 20 | AAN | 61.5 | 61.5 |
| 21 | ASS | 53.8 | 46.2 |
| 22 | SIR | 61.5 | 76.9 |
| 23 | SLB | 69.2 | 61.5 |
| 24 | FRD | 46.2 | 69.2 |
| 25 | RSS | 38.5 | 53.8 |
| Average Score | | 51.4 | 63.4 |

Based on the students' KPS score presented in Table 2, it was concluded that generally, there was an increase in the average score, from 51.4 to 63.4. Meanwhile, the description of individual score revealed that of the total 25 students who took the KPS test, there were 18 students whose scores increased; 5 students experienced declined score while 2 other students got the same score in the pretest and posttest. This indicated that the majority of students experienced an increase in their KPS test scores after the implementation of the guided inquiry model assisted by simple science KIT media. These findings strengthen the research results from Supahar et al., (2017) who conclude that all aspects of science process skills improved significantly during the research. The increase in the KPS score was of course caused by various

factors, including the treatment given during the lecture, which in this research was the implementation of guided inquiry model assisted by simple science KIT media. This was supported by the results of observations conducted during the learning activities, which found that of guided inquiry model assisted by simple science KIT media encouraged students to be actively involved through the learning stages. These findings confirmed that the guided inquiry model assisted by simple science KIT media gave a positive impact on KPS test scores and students' learning activities. This positive impact arose because all students were actively involved during the learning activities, especially through the practicum activities which were performed by applying the stages of guided inquiry model Furthermore, students could directly observe the phenomena related to the learning material through these activities so that it could train and improve their science process skills. This is relevant to the characteristics of the science process skills, in which it involves all students' abilities in acquiring knowledge based on phenomena (Andani & Utami, 2019). In addition, Defianti et al., (2022) concluded that practicums during the learning process can train students' science process skills so that they were able to master the indicators of science process skills. Moreover, conducting practicum activities in learning using simple science KIT media can raise students' learning motivation which is shown through their responses during learning so that they can improve their thinking abilities and science process skills. This finding is in line with a statement asserted by Manurung & Panggabean (2020). They suggest that the use of learning media can provide learning experiences that are appropriate to students' level of cognitive development.

Next, after conducting the prerequisite test such as the normality test, the researcher executed a paired sample t-test in order to see the effect of implementing guided inquiry model assisted by a simple science KIT media on the improvement of the students' KPS score. The paired sample t-test was performed to the pretest and the posttest scores with a sample size of 25 students. The results of paired sample t-test of the students' KPS scores are displayed in Table 3.

**Table 3. Results of Paired Sample t-test Obtained from Students' KPS Score in Pretest and Posttest**

| Paired Samples Test | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest - Posttest | -11.9760 | 15.8543 | 3.1709 | -18.5203 | -5.4317 | -3.777 | 24 | .001 |

Table 3 presents that the results of paired sample t-test obtained the value of Sig. (2-tailed) of 0.001, which is smaller than 0.05. This means that the application of the guided inquiry model assisted by a simple science media kit on temperature and heat material significantly affected the science process skills of prospective MI/SD teacher students. These results are also supported by results of observations conducted towards the students' response during the learning process. The most crucial finding from the observations was that learning took place more interestingly and actively through experimental activities carried out by students in their respective groups. Additionally, it was found that some group members performed an interactive discussion during the experimental activities. The results of the experiment that had been discussed in the group were presented by each group representative in front of the class, and other groups responded to the presentation. During the activity, there was a discourse among the groups because some groups had different opinions from the presentation group, and they proposed logical arguments based on the results of the experimental findings they had carried

out. At the end of the learning session, the researcher as the lecturer completed the results of the group discussions and conveyed the conclusions of the learning process.

In general, the application of guided inquiry model assisted by the simple science KIT media had a significant and positive impact during the learning activities. One of the impacts of this model was that it could improve the science process skills of prospective MI/SD teacher students both qualitatively, through the results of observations during learning activities, and quantitatively, through the score obtained from the test on the science process skills. This is supported by the data of students' response during the learning process, which were obtained through observation sheets, as well as the results of KPS test, which increased from the pretest to the posttest. Based on qualitative data results from observation sheets regarding student responses during learning, it was revealed that the majority of students were known to be highly motivated and actively participate in experimental activities throughout learning. In this experimental activity, students completed the activity stages created following the guided inquiry model assisted by simple science KIT media. The students indirectly practiced a variety of scientific process skills when they conducted experiments in their respective groups. These skills included the ability to observe objects or phenomena presented, to measure temperature with a thermometer to gather the necessary experimental data, as well as to process and analyze data from experimental results, which later were presented in the forms of tables and graphs. Students' abilities to classify experimental data results that they acquired while conducting the experiment were additionally honed by this. Furthermore, students encountered no problems or barriers when using the instruments included in the simple science kit, making it straightforward for them to comprehend and apply them during experimental activities to gather the necessary experimental data. Students also learned intriguing lessons and found relevant experimental data during the experimental activities. This happened because students genuinely enjoyed these learning activities, even if they were not often given the chance to conduct these experimental activities during lectures. This indicated that, in order to make learning more meaningful for them, this experimental activity was definitely one of the new techniques the students learned when attending lectures.

The findings of this research are also in line with several studies about the guided inquiry model in learning activities to create joyful learning for students. First, Fitri & Fatisa (2019) conducted a study entitled "An Application of Guided Inquiry Learning Model to Support Students' Scientific Literacy Abilities in Colloidal Systems Material. In this study, they found that the average pretest score of students' scientific literacy abilities was 23.93%, and it increased to 72.32%, which was categorized as Good. Moreover, they also found that inquiry learning was in line with constructivism-based learning which also had the potential to encourage the emergence of various skills needed to master scientific literacy abilities. Second, Hakim et al. (2023), in their research entitled Improving Student's Self-Efficacy through Inquiry Learning Model and Modeling in Physical Education, revealed that there was a significant increase on students' self-efficacy after implementing the inquiry learning model with single-mastery model and inquiry learning model with multiple-coping modeling. This means that both inquiry-based learning models gave a positive impact on learning activities, but the inquiry learning model with multiple-coping modeling was more effective in improving self-efficacy students compared to the inquiry learning model with single-mastery modeling. Meanwhile, another study found that the guided inquiry model using virtual laboratories had a significant effect on science process skills, especially in the aspects of formulating hypotheses, practicing and communicating. These findings provided a significant contribution to current knowledge about the effectiveness of guided inquiry models using virtual laboratories to improve students' science process skills in learning physics (Gunawan et al., 2019). After that, research by Siswanto et al. (2023) also provided enrichment on the positive impacts generated by guided inquiry model when it was implemented in learning activities at school. In this research, they concluded that online inquiry

learning activities combined with scientific argumentation activities were able to increase students' mastery of conceptual knowledge in the high category. Overall, the learning process received a positive response from students.

## CONCLUSION

Findings of this research confirmed that there was a difference in the score of students' science process skills during the pre-test and posttest, which was caused by the influence of the implementation of guided inquiry model assisted by simple science KIT media in learning science, especially on the materials of temperature and heat. This was proved by the result of paired sample t-test, which was carried out with the SPSS 22.0 application. The significance value of the paired sample t-test was 0.168, which was greater than 0.05. Thus, this research concluded that the implementation of guided inquiry model assisted by simple science KIT media had a significant effect on students' science process skill scores in learning science. In addition, it was observed that during the learning process, the majority of students gave positive feedback when they participated during learning using a guided inquiry model assisted by a simple science KIT media.

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