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APPLICATION OF GUIDED INQUIRY STUDENT WORKSHEET ON ADDITIVE MATERIALS TO IMPROVE THE SCIENCE PROCESS SKILLS OF JUNIOR HIGH SCHOOL STUDENTS

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Abstract: This study aims to describe the effectiveness of guided inquiry-based worksheets on additive material to improve students' science process skills. This type of research is a pre-experimental design with a one-group pretest-posttest design. The techniques of data collection a written tests and questionnaires. The research instrument was pretest-posttest sheets and student response questionnaires. The subjects in this study are 20 students of SMP Negeri 60 Surabaya class VIII-B in the odd semester of the 2021/2022 academic year. The data obtained were analyzed using quantitative descriptive methods. The students' science process skills increased significantly with the analysis of the N-gain average pretest-posttest score of 0.82 with the high category. It is 15% in the medium category and 85% in the high category. The analysis of the average N-gain indicators of science process skills also shows an increase in the high category of 0.82, which shows a percentage of 33% with the acquisition of categories, including aspects of presenting data and communication, and 67% with the acquisition of high categories formulate hypotheses, variables, and conclusions. Student responses to learning by applying guided inquiry-based worksheets showed a good response, with 96.75% in the very good category. In conclusion, guided inquiry-based worksheets can improve students' science process skills.

Keywords: *Student Worksheets, Guided Inquiry, Science Process Skills*

INTRODUCTION

The quality of education is a very important thing in the development of education. Quality education will create qualified graduates. The government's effort, in this case, is always to optimize the development of references or guidelines for the implementation of education following existing demands and developments, namely by implementing the 2013 curriculum. The story of the curriculum based on Law No. 20 of 2003 Chapter X is carried out to realize the purpose of national education that refers to national standards [1].

Education by applying the 2013 Curriculum prioritizes the process of knowledge, attitude building, and skills, in contrast to before the implementation of the 2013 Curriculum, which only emphasizes knowledge [2]. Knowledge development is emphasized through a learning process that requires students to have a productive, innovative, affective, and creative attitude.

The learning process in schools, especially sciences, must be adjusted using policies that apply to subjects contained in schools. The attachment of Permendikbud Number 22 of 2016, Science subjects are not limited to a collection of knowledge in the form of concepts, facts, and principles. SCIENCE also includes systematic procedures to find information about nature so that there is a process of discovery or inquiry. [3] stated that through the process, students can obtain the concepts they learn independently so that the student learning process becomes meaningful. Process standards can form students to have scientific skills that make it easier for students to acquire facts and concepts. Thus it is necessary to provide a learning experience to students through the development of scientific skills and skills of science processes. Process skills applied in learning activities can build an active learning environment so students' involvement in learning increases. In this case, students become triggered to discover and develop facts and concepts that they learn independently (constructivism) [4].

The interview results of teachers at SMP Negeri 60 Surabaya stated that the Covid-19 pandemic over the past two years directly changed the learning system in schools into distance learning. This situation requires teachers to apply online learning with the help of video conferences as a communication medium to deliver learning materials. In its implementation, the teacher thoroughly explains the material, and the student only listens to what is conveyed (teacher-centered learning) so that the student's involvement in learning is less, which causes the student to become passive.

Based on observations, when learning, students rarely ask questions, which shows the low ability of students to formulate problems. The interview results stated that students rarely do activities that apply the scientific method. Besides, students also said that they have never carried out experimental activities during distance learning because of space and time constraints, so scientific skills such as data interpretation and making conclusions based on an experiment have not been trained. Teaching materials and tasks used during learning are only a summary of materials and questions taken from the SCIENCE book. In this

case, the teaching materials provided have not supported students in developing their process skills.

The results of the student response questionnaire regarding the science learning process at SMP Negeri 60 Surabaya showed that after learning with the inquiry model, 95% of students stated that they could better understand the scientific method. 100% of students also said that they have never been given learning with an inquiry model, so the learning carried out is new for students. It can be concluded that the learning that took place has not implemented innovative learning models and applied supportive teaching materials to accommodate students' science process skills.

Based on the problems and facts that occur in the field, it can be identified that there is a need to provide teaching materials that can improve the skills of student science processes. An alternative that can be used is to implement a guided inquiry-based student worksheet. Learning using an inquiry-based student's worksheet, which contains practicum activities that make students' involvement in conducting investigations increase, and students can acquire their concepts through a process skills approach [5]. Using guided inquiry-oriented student worksheets can support learning and improve students' science process skills. In his research, students experienced increased science process skills after being given a student worksheet with medium and high categories [6]. Guided inquiry, students can actively partic sciencete in learning to improve their process skills, which include solving problems, compiling hypotheses, identifying variables, collecting data, drawing conclusions, and communicating [7].

Inquiry is a model of stroked learning that can build knowledge or concepts. The inquiry learning model can improve the scientific process skills because the science process skill indicator corresponds to the Inquisition syntax. Through the application of the inquiry learning model, concept mastery skills will increase, and students will be active during learning so that students discover their concepts during the learning process [8]. The guided inquiry approach needs to be used in developing student worksheets because learners can learn actively with the help of material tools and explanations of scientific methods. Some questions have been prepared so learners can find later answers through investigating [9]. Guided inquiry learning limits the role of teachers as a source of information, so learners are required to be more active in independently building an understanding of concepts [10].

Science subjects are divided into several branches of science, learning materials contained at the junior high school level, one of which is additives. Additive material is closely related to daily life. Its relationship with staples that are often consumed, namely food and drinks. This material aims to classify the types of additives and identify the content of additives in foodstuffs that are often consumed. The results of the interview stated that conventional methods or teacher still teaches additive materials, in addition to teaching materials used that do not facilitate students to be active during learning activities. Innovative teaching materials can be given to students as a tool to facilitate learning activities so that learning will be more meaningful, make the atmosphere active learning, and develop their knowledge-building skills through involvement in discovery-based learning or inquiry. Based on the description above, The current study focus on the effectiveness of application of guided inquiry worksheet on additive materials to improve the science process skills of junior high school students.

RESEARCH METHODS

This study is a study with a type of Pre-Experimental Design without a control class (comparison) that uses one group pretest-postest design. Data collection method with write test that uses pretest-posttest questions. Pretest questions are given at the beginning of learning to measure students' initial abilities before being treated and posttests to see improvements in process skills after being treated. The form of the problem applied is a description problem that includes questions under the indicators of science process skills. The subjects in this study were the students of SMP Negeri 60 Surabaya class VIII-B odd semester, which amounted to 20 heterogeneous students.

An analysis of the N-gain score was carried out to see the scale of the increase in grades on the skills of the student's science process after being given the student's worksheet. The obtained value is further converted by the acquisition category in the following table:

Table 1. N-gain Score Criteria

N-gain score	Category
$g < 0.3$	Low
$0.7 > g \geq 0.3$	Medium
$g \geq 0.7$	High

[11]

The aspect of the scientific process is also measured to be able to find out the percentage of its achievement. The values obtained are categorized according to the following table:

Table 2. Percentage category of science process skill indicators

Range values percentage (%)	Category
% science process skill < 54%	Low
54% ≤ % science process skill < 74%	Medium
% science process skill ≥ 74%	High

[12]

Data collection methods in the form of questionnaires were also given in this study—

schedule responses with statements using the "Yes" and "No" answer options. The answer "Yes" gets a score of 1, instead of the answer "No" getting a score of 0 according to the Guttman Score Criteria [13]. Questionnaires are given to measure students' responses to the application of guided inquiry-based student worksheets in learning. The following mathematical formula is used to calculate the percentage of student responses and their categories:

Table 3. Categories of Interpretation of Student Responses

Percentage (%)	Category
1 - 20	Very Less
21 - 40	Less
41 - 60	Enough
61 - 80	Good
81 - 100	Very good

If the average student response score is ≥ 61, then all are considered to agree or have a positive response to the questions in the questionnaire given.

RESULTS AND DISCUSSIONS

Based on the research carried out, several data are obtained, including data on the results of science process skills and data on student response questionnaires to the implementation of guided inquiry-based student worksheets during learning. The science process skills exercises include formulating problems, compiling hypotheses, identifying variables, presenting data, inferring, and communicating. The skills that have been mentioned through guided inquiry-based student worksheets are applied in learning activities. Based on the results of pretests and posttests, the improvement in students' science process skills can be seen.

The results obtained from the study showed an increase in grades from the student's pretest and posttest results. With the average acquisition of student pretest scores of 37 and the average student posttest score of 89, the average of the two grades has increased. The results of the N-gain calculation also support the score increase. It is shown to be 15% in the medium category and 85% in the high category. In absorbing information, there is a difference in students' abilities with each other. It causes differences in the gain score obtained. There is a difference in the ability of each individual to absorb information that causes differences in the improvement of science process skills so that each needs time, guidance, and direction to master his skills further [4].

The average gain score obtained by the high category indicates that after learning by applying guided inquiry-based student worksheets, students' process skills have improved significantly. The increase in science process skills occurred after implementing guided inquiry-oriented student worksheets in learning [14]. The use of guided inquiry-oriented worksheets for students can support learning and be able to improve students' science process skills. Science process skills owned by students increased after being given student worksheets with medium and high categories [6].

Inquiry-based worksheets can be used as a vehicle to assist students in practicing science process skills. Student's worksheet serves as teaching material that minimizes the role of teachers and educates learners. The innovative application student worksheet combined with guided inquiry can help learners find their concepts [15]. With an inquiry approach, during the learning process, students are always required to be actively involved [16]. At the junior high school level, the path to inquiry that is suitable to be applied is guided inquiry because students can build concepts through their construction, and the process skills can develop through learning with guided inquiries [17]. Following the opinions of previous studies, the results of the gain test in the study showed an improvement from the results of the student's pretest and posttest scores.

Table 4. Descriptive analysis results

	N	Min	Max	Mean	Std. Deviation
Pretest	20	25	54	37.05	7.229
Posttest	20	79	100	89.15	6.002

Tabel 5. Normality Test of student pretest and posttest scores
Shapiro-Wilk

	Kelas	Statistic	df	Sig.
Science Process Skill	Pretest	.936	20	.205
	Posttest	.933	20	.174

Researchers have also conducted normality tests and paired t-tests (paired sample t-tests). The normality test is first carried out as a condition of the tester to see the distribution of data generated by normally distributed pretest and posttest values or not before the t-test. Descriptive analysis is used to present research data and describes the amount of research data, minimum value, maximum value, average value, and standard deviations produced. The data that has been tested is presented in table 4.

In Table 5, The normality test was analyzed using SPSS 26 using the Shapiro-Wilk method with a significance value (Sig.) of 0.205 in the pretest and 0.174 in the posttest results. When the significance value expresses a value greater than 0.05 or Sign. > 0.05 indicates that the processed data is distributed normally [18], then it can be concluded that the data obtained is distributed normally. The data is then analyzed to determine whether there is an improvement in the skills of the student's science process after giving the student's worksheet using a paired t-test (paired sample t-test). The results of the

calculation of the t-test can be seen in Table 6. below:

Table 6. Paired Sample t-test Results

		Mean	t	df	Sig. (2-tailed)
Pair 1	Pretest-Posttest	-52.100	-21.114	19	.000

Paired sample t-tests are performed on two samples that are related to each other to find out the difference in average values. Descriptively, there was a significant difference in students' average pretest and posttest scores, where the average pretest was less than the posttest average. To prove the difference is substantial, one can look at Sig. (2-tailed) in the table showing a value of 0.000. The value can be expressed as smaller than 0.05, meaning that Ha is accepted and H0 is rejected. When H0 is rejected, there is a difference between the average pretest and posttest result values. The conclusion was obtained that the implementation of a guided inquiry-oriented worksheet increased science process skills.

Analysis of the acquisition of students' pretest and posttest scores is also carried out based on the achievement of each aspect of science process skills. Here is the percentage of achievement of science process skills and the results of calculating the gain test of each aspect in Table 7.

Table 7. N-gain Science Process Skills Indicator

Science Process Skill Indicator	Percentage (%)		N-gain	Category
	Pretest	Posttest		
Asking Question	41	94	0.90	High
Formulating Hypothesis	45	89	0.80	High
Variable Identification	25	94	0.92	High
Interpret Data	39	82	0.70	Medium
Summed	45	97	0.95	High
Communicate	30	78	0.69	Medium
Average N-Gain per aspect			0.82	High

Table 7 shows that the percentage of each science process skill indicator in the pretest results shows the low value obtained compared to the percentage of the value of the posttest result. The data shows that the average aspect of science process skills owned by students is still low before being given guided inquiry-based worksheets. It is influenced by teaching methods that are commonly applied less involving students because they still use conventional methods in learning activities and have not been trained in process skills. After being given a guided inquiry-based student's worksheet, overall aspects of science process skills experienced an increase that can be seen in the percentage of posttest values. To find out the magnitude of the increase, again test was conducted and obtained an average gain of each aspect of science process skill of 0.82 with a high category. The results of the gain analysis obtained science process skill indicators with high categories, namely on the aspect of formulating problems, making hypotheses, identifying variables, and concluding. In contrast, two other science process skill indicators are in the medium category, namely presenting data and communicating.

In observations, students can quickly formulate problems because problem orientation activities in student worksheets present the phenomenon of additives that are often found in foodstuffs consumed daily. Students can more easily understand issues, solve problems, and improve their process skills when presented with phenomena that are common in everyday life [19].

Likewise, the aspect of making hypotheses and identifying variables that obtain a high percentage after the implementation of student's worksheet in learning, as evidenced by the results of high category gain scores. Students' skills in making hypotheses show 89% have increased. The hypothesis is a quick answer or conjecture of a problem formulation, said temporarily because the answer is put forward before it is proven true [2]. The application of worksheets in learning helps students create hypothesis sentences by formulating problems containing two variables, namely free variables and control variables. Variable identification skills also experienced significant improvements. This increase is due to the student's worksheet containing an explanation of the types and examples of experimental variables so that students can easily distinguish and classify experimental variables. Different when before the implementation of the worksheet in learning, students get a percentage gain of 25%. The low initial ability of students to identify variables is caused by having never gained learning by applying the scientific method, so students' knowledge of variable identification is low.

The skill of presenting data and communicating after analysis with a gain score indicates a medium category. The skill of presenting data is recording observations by sorting and categorizing data according to their group. In this aspect, students' abilities increase after learning using student worksheets, but the improvement is not more significant than other aspects of science process skills that obtain high categories. Because teachers have not provided an inquiry-based learning experience such as conducting experiments, students are less trained to collect experimental results data.

In the aspect of communicating is well. This aspect experienced the lowest increase compared to other aspects of science process skills, with a percentage of posttest results of 78%. The small

increase in communication is caused by the lecture method that teachers always apply to the learning process so that learning does not take place both ways involving students to develop their communication camps. Based on observations, students are also less able to communicate the results of data analysis using precise and complete sentences. It is because new students are familiar with the scientific method, so they are less accustomed and need further guidance to develop their process skills. The difference in improvement in each aspect of student science process skills is due to students' different abilities to absorb various information. So it takes time, guidance, and direction to master their skills further [4] but still affect the skills of the process, which can be proven by the improvement of the results of each aspect of science process skills with an average high category gain score.

Thus guided inquiry-oriented learning using student worksheets can familiarize students with learning through the scientific work process [20] and present experimental activities in learning. The experimental activities presented make students actively process learning activities and make it easier to find the concepts learned, thus improving their process skills [21].

After applying the guided inquiry-based worksheet in learning, a response questionnaire sheet is given to find out each student's response. The questionnaire contains 20 statements of student responses. The results of student responses to learning using the guided inquiry-based worksheet above, there are 20 questions related to the worksheet used, including the skills of the science process training and activities during the learning process. The average result obtained from the response of all students was 96.75%, with a very good category. It indicates that the worksheet used gets a positive response from students.

The student response questionnaire contains questions about the skills of the scientific process that is taught, including aspects of formulating problems, compiling hypotheses, identifying variables, concluding, and communicating. All students answered "Yes," which means that all aspects of science process skills have been taught through activities in the worksheet. According to the results of the student's responses, they also better understand the scientific method after learning is applied using a guided inquiry-based worksheet. After the guided inquiry approach is implemented, students' activeness increases in observing, classifying, predicting, measuring, concluding, and communicating learning materials [22].

It is known that students also feel happy about the learning applied. Students feel more active in learning and show enthusiasm for learning, and the response of students with a high percentage gain of 100%. All students responded positively and felt happy with the learning activities that implemented the guided inquiry-based student worksheet. Students can discover their concepts and develop their process skills during the learning process. In addition, students can also interact actively with other students in learning activities [14].

The percentage that shows the smallest results is 70%, which contains questions about students' ease in doing worksheets. As many as 6 out of 20 students find it difficult to do the questions given. Students still find it difficult because they are not used to guided inquiry-based questions containing scientific methods. Each student's ability is also different in absorbing new information [4].

The overall average percentage shows a score of 97.75%, with a very good category, meaning students respond positively to guided inquiry-based student worksheets in learning. Conclusions are obtained during learning activities using worksheets students are taught about the scientific method so that the skills of the process develop. The steps of learning activities in a guided inquiry-based worksheet can also involve active students in their learning activities so that the learned concepts can be obtained, which is characterized by improvements in students' science process skills.

CONCLUSION

Data analysis and discussion showed that the improvement in students' science process skills occurred significantly with the analysis of the average pretest-posttest average N-gain score of 0.82, which is high categorically. A total of 85% obtained a gain score with a high category and 15% with a medium category. The results of the analysis of N-gain science process skills indicators show 33% in the medium category, covering aspects of presenting data and communicating, and 67% in the high category covering aspects of formulating problems, making hypotheses, identifying variables, and concluding. Students' responses to learning by applying student worksheets showed a good response with a percentage of 96.75% in the category was very good. The study concluded that a guided inquiry-based worksheet was declared effective for improving the science process skills of junior high school students in class VIII on additive materials.

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