Science Education and Application Journal (SEAJ) *September, 2023. Vol. 5, No, 2*
Program Studi Pendidikan IPA *p-ISSN: 2656-6672*
Universitas Islam Lamongan *e-ISSN: 2656-8365*
http://jurnalpendidikan.unisla.ac.id/index.php/SEAJ *pp.99-108*

Application of Student Worksheets Based on Ethnoscience of Tempe Making on Biotechnology Material to Improve Science Process Skills

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Article Info
Article History
Received: 05 July 2023
Revised: 26 August 2023
Published: 25 September 2023
Keywords
Student Worksheets, Science Process Skills, Ethnoscience.

Abstract (10pt italic)
The writing of this study aims to describe the improvement of students' science process skills, and the implementation of student worksheets. This research is a Pre-Experimental Design study using the One Group Pretest Posttest Design experiment. The target of this research was students of class IX A and IX B at UPT SMP Negeri 14 Gresik. The results showed that the results of the analysis of the pretest and posttest scores for class IX A experienced an increase in science process skills with an N-Gain of 0.89 with high criteria and in class IX B of 0.83 with high criteria. Based on the results of the implementation of student worksheets based on ethnoscience in class IX A and IX B got an average mode score of 4 with a very good category. It is concluded that ethnoscience-based student worksheets on biotechnology material can improve the science process skills of grade IX students.

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Citations: *Pamudiah, M. K., Setiawan, B. (2023). Application of Student Worksheets Based on Ethnoscience of Tempe Making on Biotechnology Material to Improve Science Process Skills. Science Education and Application Journal. 5(2). 99-108*

INTRODUCTION

The 4.0 revolution era is a change in the 21st century with rapid and extensive advances in the field of science and technology (Yulianda et al., 2021). The era of the 4.0 revolution will provide jobs with a wider scope, and build work faster, easier, and with satisfying results. The quality of human resources (HR) in the 21st century has increased in all efforts and work results (Mardhiyah et al., 2021). The area of education saw a tremendous development in the twenty-first century. Education is the basis for the formation of human resources who are intelligent, innovative, creative, and able to collaborate and solve problems (Andrian, 2019). Therefore, innovative learning can help develop the skills needed in the 21st century, namely science process skills. Due to the necessity of science process skills in learning, students are expected to actively participate in independently locating facts based on laws or postulates (Mardianti et al., 2020). The ability to solve problems using modified scientific procedures from experts to reach a conclusion is known as science process skills (Ningsih, 2018). Students get instruction on how to use scientific procedures to understand, create, and acquire knowledge. Students who regularly practice science process skills can develop knowledge derived from theory and experimentation (Mardianti et al., 2020). This allows students to independently understand and build concepts to overcome a problem and draw conclusions (Siahaan et al., 2020).

In fact, based on data on the science process skills of students at UPT SMP Negeri 14 Gresik through giving tests in accordance with the indicators of science process skills, it shows that the test results in class IX A students obtained details of the percentage value of each

indicator of science process skills, namely formulating problems by 40%, formulating hypotheses by 47%, identifying variables by 43%, interpreting data by 30%, and concluding by 30%. The test results on class IX B students obtained details of the percentage value of each indicator of science process skills, namely formulating problems by 42%, formulating hypotheses by 46%, identifying variables by 48%, interpreting data by 39%, and concluding by 37%. Students are deemed capable in science process abilities if the proportion of students' skills is more than 41%, in accordance with Riduwan's (2013) percentage criteria. According to the findings, learners have not yet acquired the science process skills since the teaching and learning methods are still traditional and teacher-centered.

In order to increase students' science process skills, efforts must be made to transform the learning process to be student-centered (Yulianda et al., 2021). Efforts to help teachers train students' science process skills require teaching materials. Student worksheets are important teaching materials for teachers and students (Suryaningsih et al., 2021). Student worksheets are often used as instructions to facilitate students in conducting experimental activities or making observations (Dewi & Utami, 2019). Students can be helped in understanding the learning content because the learner worksheets are related to daily activities. Student worksheets that are contextual or real and related to local culture are called student worksheets based on ethnoscience (Sholikhah & Sudibyo, 2021). Learning by integrating local culture can raise students' awareness of the importance of local culture. One of the indigenous cultures in Indonesia that we often encounter is the product of tempe food. The tempe production process in Indonesia is still mostly on a household scale with traditional equipment (Rizal et al., 2021). The learning process with a local culture approach will be carried out in accordance with the social conditions and cultural context in the community, so that students must have concern for the culture they have.

In addition to employing student worksheets to supplement students' learning activities, teachers also require a learning model to make sure that students are actively engaged in the learning process (Sholikhah & Sudibyo, 2021). The guided inquiry can help students find solutions to problems independently (Khoiri, 2021). The search and discovery process will be the main emphasis of this model. This will motivate students to take a more active role in problem solving which will help develop science process skills. Guided inquiry learning seeks to teach students how to investigate problems and questions according to the truth through observation activities. This learning model is suitable for materials related to daily life (Ningsih, 2018). One of the learning materials is biotechnology material. Students will play an active role in identifying biotechnology problems in food related to everyday life. Students may get more engaged in their education, practice conducting research, and acquire directed topics by incorporating local culture and guided inquiry into their worksheets. As a result, they will learn more (Sholikhah & Sudibyo, 2021).

Based on the description above, it encourages researchers to apply student worksheets based on ethnoscience in learning which are expected to improve students' science process skills through biotechnology material involving local culture, namely the traditional process of making tempeh with a guided inquiry learning model.

METHODS

This type of research is a pre-experimental design that is carried out to describe the improvement of students' science process skills without a control class. The trial design used One Group Pretest Posttest Design with research subjects of class IX-A with a total of 29 students and class IX-B with a total of 29 students of UPT SMP Negeri 14 Gresik. The research subjects were taken using purposing sampling technique. The research instruments was a test

sheet in description form and observation sheets for the implementation of student worksheets based on ethnoscience. The following are data analysis techniques:

Analysis of test sheet results

In this study there were tests in the form of pre-test questions and post-test questions in the form of descriptions. The indicators of science process skills assessed are formulating problems, formulating hypotheses, identifying variables, interpreting data, and making conclusions. The pre-test was conducted before the application of ethnoscience-based student worksheets to determine the results of students' science process skills before treatment. Post-test was conducted after the application of ethnoscience-based student worksheets. The knowledge value obtained from the pre-test and post-test results is used to determine whether or not there is an increase in students' science process skills. The category of improvement in students' science process skills and science process skills in each indicator can be analyzed from the results of the N-gain test which is expressed by the following formula:

$$< g > = \frac{\% \text{ (Sf)} - \% \text{ (Si)}}{\% \text{ (Smaks)} - \% \text{ (Si)}}$$

Source: Hake (1999)

Description:
g = normalized gain score
Si = initial score (pre-test)
Sf = final score (post-test)
Smax = possible score

The normalized gain is interpreted according to Hake's categories as in the following table:

Table 1. Normalized N-gain Criteria

Normalized N-gain Range	Gain Category
(<g>) ≥ 0,7	High
0,7 < (<g>) ≥ 0,3	Medium
(<g>) < 0,3	Low

Source: Hake (1999)

Analysis of the applicability of the learner worksheet

The results of the assessment carried out by the observer will be analyzed using the mode in each aspect with the provisions in the rubric as follows:

Table 2. Criteria for Assessment of Implementation of student worksheets based on ethnoscience

Score	Interpretation
4	Very good
3	Good
2	Fair
1	Insufficient

Source: Sugiyono (2013)

RESULTS AND DISCUSSION

The data on the results of science process skills in this study contain five indicators, those are: 1) the skills to formulate problems, students identify a problem from a phenomenon (Rosdiana, 2020); 2) the skills to formulate hypotheses, students propose temporary answers

or conjectures in answering a problem (Sund & Trowbridge, 1973); 3) the skills to identify variables, students determine the manipulation variable, response variable, and control variable in the research; 4) the skills to interpret data, students record and relate the observations made (Sudibyo et al., 2018); and 5) the skills to draw conclusions, students determine an event or phenomenon based on facts, principles, and concepts found through experimental activities (Sudibyo et al., 2018). Pre-test and post-test scores with five fill-in questions were used to determine the students' scientific process skills. Students in classes IX A and IX B received a pre-test and a post-test with a processing time of 1×40 minutes. The following recapitulation results of the pre-test and post-test of classes IX A and IX B can be seen in Figure 1 and Figure 2.

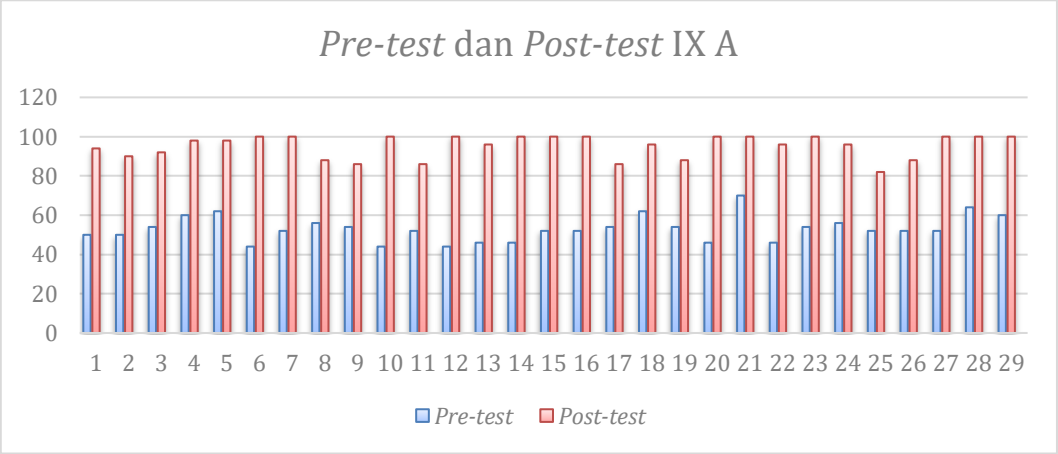

Figure 1. Recapitulation of Pre-test and Post-test Results of Class IX A

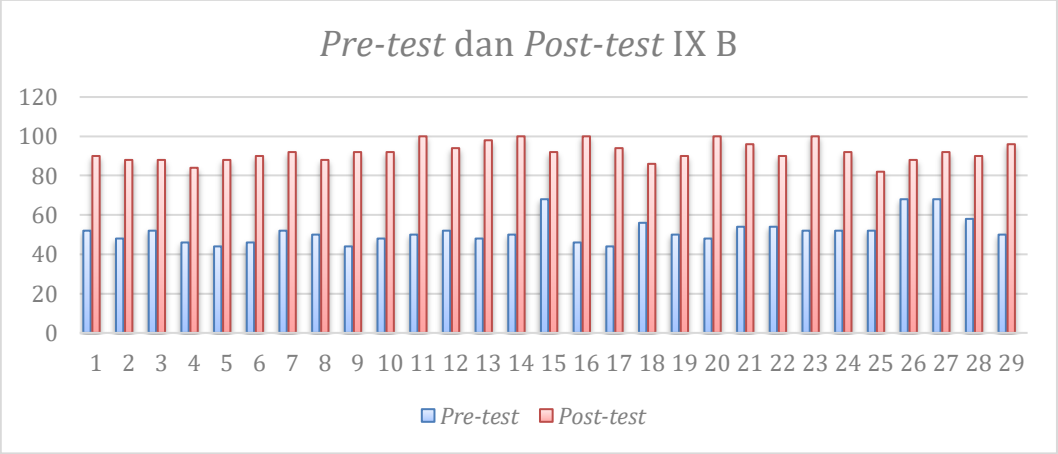

Figure 2. Recapitulation of Pre-test and Post-test Results of Class IX B

Xts

Class	N-Gain	Criteria
IX A	0.89	High
IX B	0.83	High

Class IX A's pre-test and post-test N-Gain test results revealed an average N-Gain score of 0.89 with a high category. Class IX B's pre- and post-test N-Gain test results revealed an average N-Gain score of 0.83 with a high category. Tables 2 and 3 show the average N-Gain

scores for the pre-test and post-test questions overall as well as the average N-Gain scores for each indication of science process abilities.

Table 4. N-Gain Results of Each Science Process Skill of Class IX A

Science Process Skills Indicator	Pre-test Score	Post-test Score	N-Gain	Category
Formulating the Problem	42.24	96.51	0.93	High
Formulate Hypothesis	36.20	92.24	0.87	High
Identifying Variables	54.46	99.56	0.99	High
Interpreting Data	52.15	96.51	0.92	High
Drawing Conclusions	55.60	96.51	0.92	High

Table 5. N-Gain Results of Each Science Process Skill of Class IX B

Science Process Skills Indicator	Pre-test Score	Post-test Score	N-Gain	Category
Formulating the Problem	37.93	91.81	0.86	High
Formulate Hypothesis	32.75	90.51	0.85	High
Identifying Variables	55.60	98.27	0.96	High
Interpreting Data	58.62	94.82	0.87	High
Drawing Conclusions	52.15	91.37	0.81	High

Students of class IX A obtained an N-Gain score of 0.93 for the indicator of formulating problems, an N-Gain score of 0.87 for the indicator of formulating hypotheses, an N-Gain score of 0.99 for the indicator of identifying variables, an N-Gain score of 0.92 for the indicator of interpreting data, and an N-Gain score of 0.92 for the indicator of drawing conclusions. Students in class IX B obtained an N-Gain score of 0.86 for the indicator formulating the problem, an N-Gain score of 0.85 for the indicator formulating the hypothesis, an N-Gain score of 0.96 for the indicator identifying variables, an N-Gain score of 0.87 for the indicator interpreting data, and an N-Gain score of 0.81 for the indicator drawing conclusions. All indicators of science process skills in classes IX A and IX B increased with a high category.

Based on the students' post-test results, it is clear that their science process skills have improved. This finding is also corroborated by the N-Gain average scores on the pre-test and post-test results, which demonstrate an increase in the high category. Each science process skills indicator showed an improvement in science process skills. This could happen when guided inquiry learning approaches are used in the classroom together with student workbooks based on ethnoscience. The statement above is supported by Andriani & Widodo, that student worksheets are used in education to increase student involvement, guide learning activities, and accelerate the teaching and learning process (Andriani, R.P., & Widodo, 2018). Students are given the opportunity to find and investigate a problem procedurally by formulating problems, formulating hypotheses, and conducting experiments (Margaretta & Erman, 2017). The right learning process is a learning process that encourages students to understand knowledge instead of remembering it as information only (Af'idayani et al., 2018). The use of ethnoscience-based student worksheets in the learning process can train students to become more adept at linking a problem with existing concepts. This is supported by Piaget's statement which explains that the level of children's intellectual development is differentiated based on

age stages, so that junior high school students are included in the formal operational level at the age of >11 years (Indrawati & Qosyim, 2017). Students are able to think abstractly, able to find alternative solutions to problems, develop applicable legal bases, and think scientifically (Sudibyo et al., 2018).

Ethnoscience-based learning can have a positive influence on students, namely learning activities can run effectively centered on students, increase students' curiosity, and increase students' knowledge of the culture and local potential of a region (Supriyadi et al., 2016). In this study, the theme of ethnoscience of making tempeh is familiar to students. Tempe is one of the traditional foods consumed by most Indonesians and tempe production has spread in various regions. This enables students to relate what they are learning to real-world situations, ensuring that learning activities are not just reliant on textbooks (Puspasari et al., 2019).

Application of ethnoscience-based student worksheets can help students' science process abilities develop, thus observational activities are done to demonstrate how learning is implemented as a result of application of ethnoscience-based student worksheets. The adoption of student worksheet applications is a gauge of how well research on the use of ethnoscience-based student worksheet applications in the learning process has worked. The stages of the guided inquiry syntax that have been synchronized with the indicators of the science process abilities that are taught to students may be found in the learner worksheet. Each component of the observation data was computed in mode. The outcomes of implementing the learner worksheet's application were as follows.

Table 6. Implementation of Class IX A Students' Worksheet

Guided Inquiry Syntax	Component observed	Mode score	Category
Phase 1: Asking questions about a phenomenon	Observe an illustration of a phenomenon	4	Very good
Phase 2: Formulating the problem	Formulate the problem to be investigated	4	Very good
Phase 3: Formulate a hypothesis	Formulate the hypothesis of an experiment	4	Very good
Phase 4: Designing the investigation	Identifying variables	3	Good
Phase 4: Designing an investigation	Designing the experimental procedure	3	Good
Phase 5: Conducting the investigation	Conducting the experiment	4	Very good
Phase 6: Synthesizing knowledge	Interpreting data	4	Very good
Phase 6: Synthesizing knowledge	Drawing conclusions	4	Very good
Phase 6: Synthesizing knowledge	Presenting the results of the experiment	4	Very good
Average		4	Very good

Table 7. Implementation of Class IX B Students' Worksheet

Guided Inquiry Syntax	Component observed	Mode score	Category
Phase 1: Asking questions about a phenomenon	Observe an illustration of a phenomenon	3	Very good
Phase 2: Formulating the problem	Formulate the problem to be investigated	4	Very good
Phase 3: Formulate a hypothesis	Formulate the hypothesis of an experiment	4	Very good
Phase 4: Designing the investigation	Identifying variables	3	Good
Phase 4: Designing an investigation	Designing the experimental procedure	3	Good
Phase 5: Conducting the investigation	Conducting the experiment	4	Very good
Phase 6: Synthesizing knowledge	Interpreting data	4	Very good
Phase 6: Synthesizing knowledge	Drawing conclusions	3	Very good
Phase 6: Synthesizing knowledge	Presenting the results of the experiment	4	Very good
Average		4	Very good

Based on table 4.4 above, the results of observations of the implementation of the application of student worksheets in class IX A show that phase 1 on the component of observing illustrations of a phenomenon, phase 2 on the component of formulating problems to be investigated, phase 3 on the component of formulating hypotheses from an experiment, phase 5 on the component of conducting experiments, and phase 6 on the component of interpreting data, drawing conclusions, and presenting experimental results get a mode score of 4 which is included in the very good category. Phase 4 on the components of identifying variables and designing experiments received a mode score of 3 which is included in the good category. The results of observing the implementation of the application of the worksheet for class IX B students showed that phase 2 on the component of formulating the problem to be investigated, phase 3 on the component of formulating the hypothesis of an experiment, phase 5 on the component of conducting an experiment, and phase 6 on the component of interpreting data and presenting the results of the experiment received a mode score of 4 which is included in the very good category. Phase 1 on the component of observing illustrations of a phenomenon, phase 4 on the component of identifying variables and designing experimental procedures, and phase 6 on the component of drawing conclusions received a mode score of 3 which is included in the good category. The total average mode score of the implementation of the worksheet for students in class IX A and IX B is 4 with a very good category.

The implementation of ethnoscience-based student worksheets in each phase of the guided inquiry and in line with the indicators of science process skills largely received 4 marks in the area of very excellent. This demonstrates how the use of student worksheets based on ethnoscience has helped students develop their science process abilities (Ningsih, 2018). Students can understand how to process data and relate experimental data to existing concepts

(Sudibyo et al., 2018). Learning activities contained in the stages of ethnoscience-based student worksheets can involve students in the scientific process, so will help them develop their science process skills (Lestari et al., 2015). Based on tables 4.4 and 4.5, there are still phases of the guided inquiry that are aligned with the indicators of science process skills that score 3 implementation with a good category. This can happen because in that phase, students are less careful in reading the filling instructions. This viewpoint is consistent with that of Indrawati & Qosyim (2017), who claim that during group activities, there are some students who read the instructions correctly and there are also students who only follow the discussion activities without looking at the instructions or information on the ethnoscience-based student worksheet.

Ethnoscience-based student worksheets are applied using the guided inquiry which makes students the center of learning who are required to be able to take responsibility for the knowledge gained, so they do not depend on the teacher (Khoiri, 2021). The guided inquiry used in the application of ethnoscience-based student worksheets can provide benefits for student learning, namely students' interest in the surrounding environment increases, students' scientific attitudes develop, students' science process skills improve (Andriani, R.P., & Widodo, 2018).

CONCLUSION

The implementation of ethnoscience-based student worksheets can enhance the science process abilities of UPT SMP Negeri 14 Gresik students, according to the research findings and discussion. The increase is in accordance with the results of the N-Gain pre-test and post-test in class IX A which scored 0.89 with high criteria and class IX B scored 0.83 with high criteria. The implementation of ethnoscience-based student worksheets in class IX A and IX B was very good. The implementation of the student worksheet in class IX A and class IX B received an average mode score of 4 with a very good category.

SUGGESTION

Based on the research that has been conducted, the following suggestions can be made:

1. Teachers should consider managing learning time more so that practicum activities can run well and on time.
2. Teachers create more conducive learning conditions, so that students can focus on doing pre-test and post-test, as well as group activities.

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