

The Development of Contextual Inquiry-Based Student's Worksheet to Enhance Science Process Skill for the Topic of Water Microbiology

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ABSTRACT

The aim of this study was to find out science process skills after the implementation of a contextual inquiry-based student's worksheet occurred. This study was conducted by quasi-experimental method for the students of Biology Education, Universitas Negeri Medan. Samples were taken by simple random sampling technique. The experimental group was taught by a contextual inquiry-based student's worksheet, while the control group was taught by a conventional (traditional) student's worksheet. The data collection was employed by pretest-posttest, using an essay test of science process skill for the topic of water microbiology. The results of data analysis were using a student t-test for the post-test score of both groups, in which the results gave a value ($t_{\text{value}} = 3.175$; $p = 0.002$) was $0.002 < 0.05$. It showed that there was a significant difference between experimental group and control group as well.

Keywords: Student's Worksheet, Contextual Inquiry, Science Process Skill

1. INTRODUCTION

Education is one of the dynamic and developmental manifestation of human's culture. Hence, change or development of the education itself should merely happen in accordance with the change of life culture. Act No. 20 (2003) on National Educational System mentioned, that national education functioned to develop skills and to shape the character as well as prestigious civilization of nation in term of educating national life. An education aimed to develop students' potentials in order to be a faithful and piety person to the Almighty, well-behaved, healthy, knowledgeable, capable, independent, creative and become a democratic and responsible citizen (Trianto, 2009).

For the sixth semester of Biology Education, Universitas Negeri Medan, there is the course of water microbiology. Microbiology was one of a practice courses. Nowadays, we all know that many students

have difficulties in understanding materials, particularly science materials, besides they should be able to understand materials, they also have to conduct the experimental activities. In the learning of Biology, each student must have skills to conduct the experiments to enhance science process skills in those learning activities.

From the questionnaire (analysis of needs) which was obtained from students of Biology Education, Universitas Negeri Medan who joined the course of microbiology, the results of the questionnaire randomly spread, it was obviously known that students required a contextual inquiry-based worksheet for the topic of water microbiology. The availability of contextual inquiry-based worksheet was still rarely found and it would be one of the reasons that students did not conduct the experimental activities or investigation more directly in developing a lot of students' skills. The interviews from

one of the microbiology lecturers showed that student's worksheet which was produced these past years just contained the material contents, working procedures and exercises, so it did not completely train student's science process skill more specifically. It would be the bad effects for the quality of exploration activities to build student's knowledge via direct instruction in developing science process skill through scientific method in discovering concepts or principles.

Experimental activity was a learning which involves students in the practice activity through experiment with the aid of student's worksheet, so it could activate them in the learning process. Student's worksheet could be a learning source or learning media depends on how the design of the learning activity was made, a contextual inquiry referred to the student's activity in which they could develop their science knowledge and comprehension about how scientists learned a nature. Students' science process skills were required to be increasing as well. A science process skill was a leading movement of discovery and the development of facts or concepts (Semiawan, 1992). It could also enhance students' cognitive and affective skills. A science process skill could be obtained by applying the learning based inquiry, so students were expected to obtain more meaningful comprehension and deep insight about themselves and their surroundings (BSNP, 2006).

The use of a contextual inquiry-based worksheet was addressed to enhance students' science process skills. It was in line with the study of Naibaho (2014) stated that the inquiry learning had the influences on the learning outcomes of biology, critical thinking abilities and science process skills as well. An inquiry was the series of learning activities that emphasized on critically and analytically thinking process to figure out and find out their own answer of the questionable issues. It was the part of a contextual learning. It was also the third main component in the contextual learning.

The learning steps of a contextual inquiry approach were an orientation, problem formulation, hypotheses formulation, data collection, hypotheses testing and conclusion (Sanjaya, 2009).

According to Sagala (2008), a science process skill was a learning approach that gave students an opportunity in taking part of feeling the process of discovery or concept as a process skill. Gagne (Dahar, 1985) has mentioned that by developing the science process skill, students would be more creative and they would be able to learn science on the highest level in a short period. A science process skill could make students discover and develop their own facts and experiments as well as their own attitude and value. All the rhythms, movements or actions in the learning process such a way would be creating the learning condition that involve more active students and they were capable to relate them in the daily life.

2. RESEARCH METHOD

This study was conducted in the Laboratory of Biology, Universitas Negeri Medan in Jln. William Iskandar Pasar V Medan Estate - Postal Code 20221. It was conducted from April to June 2017.

The study was a quasi-experimental method with the population of all the sixth semester students at Universitas Negeri Medan, Indonesia. The samples consisted of two classes, Class A was classified into the experimental group as much as 48 students, meanwhile Class C was classified into the control group, as much as 57 students, taken by simple random sampling. The learning instruction for the experimental group used a contextual inquiry-based worksheet for the topic of water microbiology, meanwhile the control group used a conventional worksheet.

The instrument of science process skill was the essay test consisting of 8 items. It was validated by 3 experts, furthermore the test could be used as a research instrument.

The data testing of the students' pretests and post-tests was applied the normality test and hypotheses test by using SPSS Version 22.0.

3. RESULTS AND DISCUSSION

3.1 Results of Instrument Testing

The instrument could be used if it was initially validated by professional experts. The content and construct validity were validated by 3 expertise lecturers. The results of validation showed that the essay test could be used as the research instrument.

Pretest

A pretest was given to students before the treatment occurred, to find out the initial score of science process skill from both groups. The average score of science process skills could be seen in Table 1.

Table 1. The Average Score of Pretest

Class/Group	Average Score of Pretest	Min Score	Max Score	SD
Experimental	48.12	37.50	57.50	4.74
Control	46.18	35.00	60.00	5.55

From Table 1, it was obviously known that experimental group had an average score of 48.12, minimum score of 37.50, maximum score of 57.50, and standard deviation of 4.74. The average score of control group was 46.18, minimum score of 35.00, maximum score of 60.00, and standard deviation of 5.55. Subsequently, the data was tested by a normality test. Normality test could be seen in Table 2.

Table 2. Normality Test of the Pretest Scores

Group	Normality Test of Kolmogorov-Smirnov		Desc.
	Statistic	Significant	
Experimental	0.114	0.157	Normal
Control	0.115	0.058	Normal

Table 2 showed that the data of two groups was normally distributed on the significance level > 0.05 . Subsequently, the student t-test was applied for the pretest score of two groups. The result of a student t-test could be seen in Table 3.

Table 3. Student t-test of Pretest Scores

Group	Mean	SD	Sig.	α	Desc.
Experimental	48.12	4.74	0.059	0.05	There was no significant difference
Control	46.18	5.55			

Table 3 showed that both groups had the same/homogenous average scores, from the result gave the value of 0.059, it could be concluded that there was no a significant difference.

Post-test

A post-test was conducted after the experimental group used a contextual inquiry-based worksheet and control group used a conventional worksheet. The average score for the science process skill could be seen in table 4.

Table 4. The Average Score of Post-test

Group	Average Score of Post-test	Min Score	Max Score	SD
Experimental	75.26	65.00	92.50	6.68
Control	71.05	55.00	85.00	6.82

Table 4 showed that experimental group had an average score of 75.26, minimum score of 65.00, maximum score of 92.50, and standard deviation of 6.68. The average score of control group was 71.05, minimum score of 55.00, maximum score of 85.00, and standard deviation of 6.82. Subsequently the data was tested by a normality test. Normality test could be seen in Table 5.

Table 5. Normality test of the Posttest Scores

Group	Normality Test of Kolmogorov-Smirnov		Desc.
	Statistic	Significant	
Experimental	0.119	0.087	Normal
Control	0.104	0.189	Normal

Table 5 showed that the data of both groups was normally distributed on the significance level > 0.05 . Subsequently, the student t-test was applied for the post-test score of both groups. The result of student t-test could be seen in Table 6.

Table 6. Student t-test of Post-test Scores

Group	Average Score of Post-test	SD	Sig.	α	Desc.
Experimental	75.26	6.68	0.002	0.05	There was a significant difference
Control	71.05	6.82			

Table 6 showed that a student t-test for the post-test score of both groups, the results gave the value of 0.002, it could be concluded that there was a significant difference.

The difference of students' science process skills using a contextual inquiry-based worksheet and a conventional worksheet was presented in Figure 3.1.

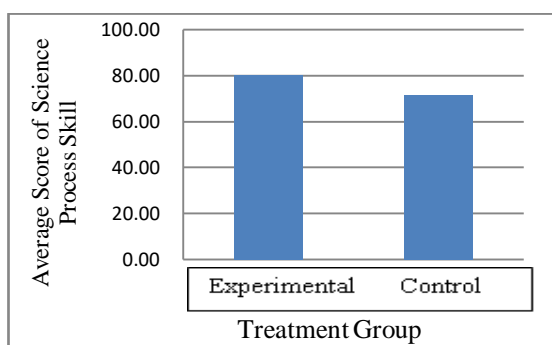


Figure 3.1. The Comparison of Average Score of Science Process Skill for the Experimental and Control Group

3.2 DISCUSSION

Based on the results of hypothetical testing from all the data of pretest and post-test for students' science process skills by applying a t-test. From the results of hypothetical testing for the science process skill on pretest was clearly known that there was a significant difference of students' science process skills which was taught by a contextual inquiry-based worksheet and without the use of a contextual inquiry-based worksheet (conventional) for students of Biology Education, Universitas Negeri Medan ($t_{\text{value}} = 1.906$; $p = 0.059$). The average score of students' science process skills using a contextual inquiry-based worksheet was (48.12 ± 4.74) significantly higher than taught without the use of a contextual inquiry-based worksheet (conventional) (45.18 ± 5.55).

Based on the results of hypothetical testing for science process skill on post-test was clearly known that there was a difference of students' science process skills taught by a contextual inquiry-based worksheet and without the use of a contextual inquiry-based worksheet (conventional) for the students of Biology Education, Universitas Negeri Medan ($t_{\text{value}} = 3.175$; $p = 0.002$). The average score of students' science process skills using a contextual inquiry-based worksheet was (75.26 ± 6.68) significantly higher than taught without the use of a contextual inquiry-based worksheet (conventional) (71.05 ± 6.82).

In this case, it could be concluded that there was a difference of science process skills for the students who were taught by a contextual inquiry-based worksheet for the topic of water microbiology than students who were not taught by a contextual inquiry-based worksheet (conventional) for the students of Biology Education, Universitas Negeri Medan. A science process skill was very important for every student as a foundation to apply a scientific method in developing science and obtaining a new knowledge or developing their own knowledge as well.

It would be due to the contextual inquiry was closely related with the classroom activity for a certain learning purpose that would be achieved, involving the original data analysis, encouraging students' communication and collaborating with constructive learning process, involving the use of materials' skills and cooperating in the application of science concepts for the context of direct instruction.

This was in line with the study of Ambarsari (2013) who stated that the application of guided inquiry instruction could enhance basic science process skills of Biology for the eight grade students of SMP Negeri 7 Surakarta. Afrida, et al. (2015) mentioned that the development of guided inquiry-based worksheet could enhance students' science process skills and

interests for the topic of static fluid at SMA Negeri 11 Banda Aceh. Wahyudi, *et al.* (2013) stated that the application of guided inquiry with the training of science process skills could enhance students' learning outcomes at SMAN 1 Sumenep. Andrini (2016) stated that inquiry learning model could help students solve their problems through investigation that would increase their skill and knowledge more independently. It also would give students a chance to build their own knowledge, to use concepts that was employed to solve problems and they had a chance to relate a new information with a cognitive, psychomotor and affective structures that could also be developed well. Suhada (2017) suggested that an inquiry learning model could enhance students' science process skills for the fifth grade students.

According to Lotter (2006), a contextual inquiry was a varied process and comprised of the activities to observe, to formulate relevant questions, to evaluate books and other information sources critically, to plan the investigation, to review what was figured out, to conduct experiments or practices with the aid of devices for obtaining, analyzing and interpreting the data, and also to make prediction and communicate its results. An inquiry focused on several ways where scientists learned a nature and proposed the scientific explanations based on their own evidence from their works. A contextual inquiry also focused on the students' activities where they developed the knowledge and comprehension of scientific idea and understanding about how scientists learned a nature. Rustaman (2009) stated that science process skill was very important for every student as a foundation to apply science and was expected to be able to develop their own knowledge and to obtain a new knowledge.

According to Harlen (1992), science process skill was a physical and mental skill which relate to fundamental skills that had been possessed, mastered and applied in a scientific activity, so the scientists were

succeeded to discover something brand new. Besides it was as the approach for the science instruction, a science process skill was also a skill that should be possessed by all the students as basic modality in understanding science. A process skill played a great role in understanding science as well. It involved a cognitive and intellectual skill, social norm in employing students' process skills through their own state of mind. A manual skill obviously involved the use of device and material, measurement, and arranging devices. A social skill was meant to be here was materials that were used to interact with process skills.

According to Mulyasa (2009), a science process skill was a learning approach that emphasized on students' learning process, activity and creativity in gaining knowledge, skill, value and attitude, and apply them in daily life as well.

A science process skill was a means to understand and master the knowledge, it was assumed to have main goals for knowledge, education and arrangement of laboratory. A practice in the laboratory was the most important thing to prepare students' abilities in understanding the concepts of knowledge and training. A science process skill was required for the advancement of science education. The use of contextual inquiry-based worksheet had many advantages for students, for instance it could enhance students' skills in understanding concepts and increase their skills in observing and making experiments directly or indirectly as well.

4. CONCLUSION

Based on the results of the study, it could be concluded that there was a difference of students' science process skills taught by a contextual inquiry-based worksheet than taught by a conventional worksheet for the topic of water microbiology.

From the tests and conclusion aforementioned above, it required several recommendation, as follows: (1) This

student's worksheet was arranged in line with a contextual inquiry learning approach. Hence, this worksheet could be used as additional practice manual to give students a better feedback; (2) For a more meaningful comprehension and perfection of this worksheet, it was ought to develop a contextual inquiry-based water microbiology worksheet in a wider and deeper scope, so that the results would be more maximum; and (3) The results of this research and developmental study was probably influenced by any uncontrollable factors, so it needs a much further research for more materials and samples and for more maximum results as well.

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