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UTILIZATION OF THE LABORATORY AND APPLICATION OF SCIENCE PROCESS SKILLS TO INCREASE STUDENT LEARNING OUTCOMES ON THE CONCEPTS OF ELECTROLYTE AND NON-ELECTROLYTE SOLUTIONS CLASS X SMA NEGERI 26 MALUKU TENGAH

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ABSTRACT

The purpose of this study was to determine the application of science process skills to improving student learning outcomes on the concept of electrolyte and nonelectrolyte solutions for class X SMA Negeri 26 Maluku Tengah and to determine student responses to learning by using the laboratory. The type of research used is descriptive quantitative research design with one group pretest-posttest design. The research sample was 25 students of class X MIA-1 SMA Negeri 26 Maluku Tengah. Data was collected using test instruments and non-test instruments. The results showed that all students (100%) had reached the KKM. To find out the increase in student learning outcomes, it is calculated using the normalized gain formula (n-gain) where 8 students (32%) are in high qualification and 17 students (68%) are in medium qualification, with an average value of n-gain of 0.7 with a percentage of 70%. For student responses to learning by utilizing laboratories in the form of practicum activities, 17 students (68%) were in the strongly agree qualification, 8 students (32%) were in the agree qualification. Thus the application of science process skills and the use of laboratories has a positive effect on improving learning outcomes.

Keywords: *Science Process Skills, Laboratory, learning outcomes, electrolyte and nonelectrolyte solutions*

INTRODUCTION

One important factor that influences and supports education is infrastructure. Infrastructure facilities affect the process to the results of education. Manlea (2017) explains that the quality of education is influenced by 2 important factors, including the availability of adequate educational infrastructure and competent human resources. These two factors are very important input components in supporting learning activities. One of the educational facilities that functions as a support in the implementation of the learning process in schools, especially in practicum activities, is the science laboratory, including a laboratory for chemistry learning.

The existence of a laboratory is very important in learning in science or science, especially in chemical materials, because activities in the laboratory can make it easy for students to understand chemical material with a scientific work approach, for prove chemical theories through experiments (practicum). According to Emda, (2017) students can carry out practical activities to prove the scientific theories they have obtained in learning and it is possible for students to discover new concepts based on previous concepts.

Practical activities carried out in the laboratory can also be used to train and develop students' science process skills. These science process skills will give students direct experience of the

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practicum material being worked on (Simanjuntak, et al., 2017: 103). According to Lepiyanto (2017) science process skills must be grown in students according to the level of development of their thinking which creates high curiosity. These skills will become the driving wheels of discovery and development of attitudes, insights and values. Science Process Skills (SPS) which combined with practicum activities, requires students to be able to study chemistry by direct observation of symptoms or scientific processes, train scientific thinking skills, be able to instill and develop scientific attitudes, and find and solve new problems. In addition, science process skills are also can help students' understanding of the lesson, so that it becomes more meaningful and in-depth, namely through practicum activities by utilizing laboratories and the application of science process skills in chemistry learning. The concept of electrolyte and non-electrolyte solutions was chosen in this study because the material is abstract, it is hoped that learning by utilizing laboratories and the application of science process skills can motivate and improve student learning outcomes.

The results of Putri et al's research (2015) stated that the experimental group in learning applied science process skills had higher learning outcomes compared to the control group in which the teacher explained material orally in learning. Furthermore, Yuliana et al (2017) stated that the motivation and learning outcomes of students by utilizing the science laboratory were in the high category.

Based on the background that has been described, the researcher believes that it is necessary to conduct research to find out the Utilization of Laboratory and Science Process Skills in Improving Student Learning Outcomes on the Concept of Electrolyte and Non-electrolyte Solutions Class X SMA Negeri 26 Maluku Tengah. With the formulation of the problem, how is the application of science process skills to improving student learning outcomes in the concept of electrolyte and non-electrolyte solutions and how are students' responses to learning by utilizing the laboratory?

RESEARCH METHODS

This type of research is a quantitative descriptive research, which describes the phenomenon of how the laboratory is used and the application of science process skills in improving student learning outcomes in the concept of electrolyte solution Class X SMA Negeri 26 Central Maluku. With a one group pretest-posttest design (Creswell, 2014). Sampling in this study used a purposive sampling technique (purposive sample), which is a sampling technique used by researchers if the researcher has certain considerations or goals in taking the sample (Arikunto, 2010: 97). With a sample population of class X students at SMA Negeri 26 Maluku Tengah for the 2020/2021 academic year, a total of 25 students.

Data collection techniques using test and non-test instruments. The test instrument consists of pre-test and post questions. Non-test instruments consist of observation sheets, namely observation sheets to measure science process skills, and student response questionnaires. The research data obtained were analyzed using the following percentage formula.

$$A = \frac{n}{N} \text{x } 100\%$$

Furthermore, the score obtained (in percent) with a descriptive analysis of the percentage correlated with the criteria (very good, good, good enough, not good can be seen in **Table 1.**

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Table 1. Percentage Criteria

No	Interval Persentase	Criteria
1	81,25% < P ≤ 100 %	Very good
2	62,50% < P ≤ 81,25%	Good
3	43,75% < P ≤ 62,50%	Less Good
4	25% < P ≤ 43,75%	Not good

Furthermore, data analysis was also carried out using the normalized gain test (n-Gain), which was used to determine the category of increasing student learning outcomes in the sample class before and after learning. The normalized gain score is calculated by the following formula:

$$g = \frac{S_{post-test} - S_{pre-test}}{S_{maks} - S_{pre-test}}$$

The calculation results are then compared with the n-gain criteria which can be seen in **Table 2.**

Table 2. Criteria for Normalized Gain (n-Gain)

n-Gain Earnings	Criteria
n-Gain > 0,70	High
0,30 ≤ *n-Gain* ≤ 0,70	Medium
n-Gain < 0,30	Low

RESULTS AND DISCUSSION

This study used one class, namely class X MIA-1 with 25 students. To obtain data on improving student learning outcomes, research instruments were used in the form of pre-tests, assessing Science Process Skills (SPS) abilities, and final tests (post-test). closed.

A. Description of Initial Test Results (pre-test)

The initial test was carried out to find out to what extent the material to be taught had been mastered by students before learning was carried out (Sudijono, 2011: 69). Data on achieving the level of understanding of students on the material of electrolyte and non-electrolyte solutions is shown in **Table 3.**

Table 3. Student Achievements in the Initial Test (Pre test)

Intervals	Frequency	Relative Frequency (%)	Qualification
86 - 100	-	-	Very good
75 - 85	-	-	Good
66 - 74	-	-	Less Good
< 66	25	100	Not good
Quantity	**25**	**100**	

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Based on **Table 3**, it can be seen that the ability of students to answer the initial test questions is at a low level of qualification or has not reached the KKM, totaling 25 students (100%). This is due to the lack of prior knowledge of students about the concept of electrolyte and non-lectrolyte solutions and the lack of readiness of students before the material is taught, so that all indicators on electrolyte and non-electrolyte solutions become an important focus during the learning process.

B. Description of the Application of Science Process Skills (KPS) During the Learning Process

One of the successes of students in learning, namely the learning process by utilizing the laboratory during practicum and the application of science process skills. This is because during the learning process, students are actively involved directly. Learning by utilizing laboratory and science process skills makes students trained to work scientifically. In line with what Sari, et al. (2017) that in science process skills, students are trained to think using the stages of the scientific method and develop their knowledge so that these stages can help students develop their cognitive characteristics.

The same thing was expressed by Arnyana (2006) that science process skills are an approach that can be used to improve learning outcomes (cognitive, affective, psychomotor) and students higher-order thinking abilities. To measure the implementation of students science process skills and their activeness in the learning process, it was observed using the science process skills observation sheet that there were indicators of science process skills.

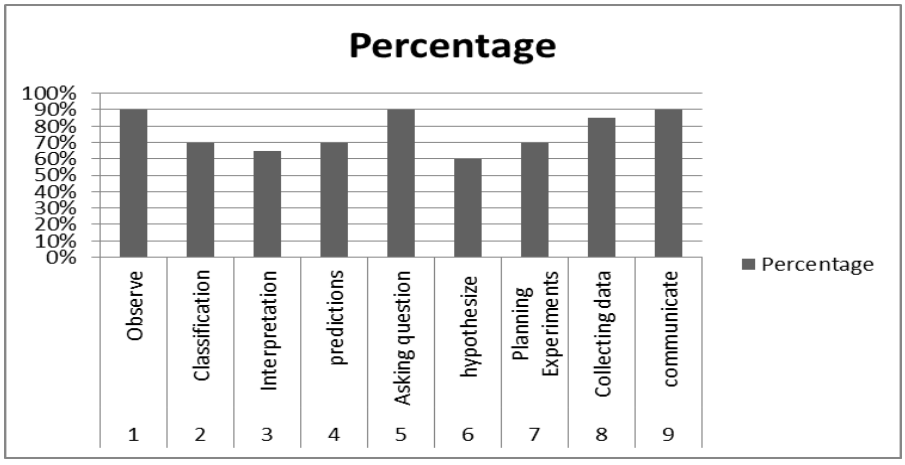

Figure 1. Observation Results of Science Process Skills Indicators

Figure 1 shows the results of observations of the learning process on electrolyte and non-electrolyte material, that the observed and highest indicators of science process skills, namely the process of observing, asking questions, collecting data, and communicating. These results result in the concepts being learned meaningful, because in addition to high curiosity, data that are directly observed and obtained during the learning process become real concepts for students. Curiosity led to the emergence of indicators of science process skills in the form of asking questions. This activity can be seen when students ask questions while making observations, students ask each other about what is found during observation activities, or when students experience difficulties related to understanding the material.

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Data obtained from observations of students science process skill indicators can be seen in **Table 4.**

Table 4. Data on Students' Science Process Skills at Each Meeting

Intervals	Meeting I		Meeting II		Qualification
	Frequency	Relative Frequency (%)	Frequency	Relative Frequency (%)	
81% < P ≤ 100 %	-	-	5	20	Very good
62% < P ≤ 80%	25	100	20	80	Good
43% < P ≤ 61%	-	-	-	-	Less Good
25% < P ≤ 42%	-	-	-	-	Not good
Quantity	**25**	**100**	**25**	**100**	

Table 4 can be seen that the results of observing the indicators of students science process skills at the first meeting 25 students (100%) obtained results with good qualifications where most of the indicators of science process skills that were applied were carried out well. Hamdiyati and Kusnadi (2007) explained that improving the quality of experimental design skills can be trained by conducting continuous and experimental practicum.

The results obtained are strengthened by Selfi et al. (2020) argued that learning by utilizing laboratories and applying science process skills to electrolyte and non-electrolyte solution materials gave better results, namely with a 100% learning completeness percentage in the first meeting and the second meeting when compared to using the application of a problem-based learning model in which students only obtained a completeness percentage of 28.57% at the first meeting and a completeness percentage of 89.28% at the second meeting.

Learning activities by applying science process skills make students directly involved in the learning process because students are required to be independent, become more active and responsible in completing the stages of existing science process skills. In the learning process by applying these science process skills, students learn material by observing objects directly then students build their own knowledge so that the knowledge (concepts) obtained by students becomes more meaningful and students will easily remember the concepts of the material being studied and will have an impact on student learning outcomes later.

According to Anisa, et al. (2014) the process skills approach can train students in the process of carrying out scientific activities in the form of direct practice and observation as well as developing science process skills and abilities in psychomotor aspects.

C. Final Test Results (Post-Test)

The final test is often known as the post-test. The final test is carried out with the aim of knowing how far students have mastered all the subject matter that is classified as important as well as possible (Sudijono, 2011: 70). The final test is given to students after participating in learning activities. In this study, the final test consisted of 5 essay questions which were the same as the initial test questions. The data on the achievement of the level of mastery of the students' material at the final test (post-test) are shown in **Table 5**.

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Table 5. Student Achievements in the Final Test (Post-test)

Intervals	Frequency	Relative Frequency %	Qualification
86 – 100	2	8	Very good
75 – 85	13	52	Good
66 - 74	10	40	Less Good
< 66	-	-	Not good
Quantity	**25**	**100**	

The data obtained after participating in the learning process by utilizing the laboratory through practicum activities and applying science process skills, it can be concluded that all students can achieve the minimum completeness criteria (KKM) which shows that the final test results are much better than the initial test. According to Sudijono (2011: 70) if the results of the final test are better than the results of the initial test, it means that the teaching program has been running and succeeding as well as possible.

D. Improving Student Learning Outcomes Using N-gain Scores

Normalized gain (N-gain) is used to determine the increase in students' understanding or mastery of concepts before and after learning activities are carried out. From the results of the pre-test and post-test of students, there was an increase in learning outcomes. N-gain achievement data can be shown in **Table 6.**

Table 6. Results of Analysis of Improved Learning Outcomes N-gain

Intervals	The number of students	Percentage	Category
N-Gain > 0,70	8	32	High
0,30 ≤ *N-Gain* ≤ 0,70	17	68	Medium
N-Gain < 0,30	-	-	Low
Quantity	**25**	**100**	

The results obtained can be seen that all students (100%) have obtained increased learning outcomes, even though they are in different categories. This shows that learning activities by utilizing laboratories through practicum activities and the application of science process skills provide significant results in improving student learning outcomes. This is in line with the research results of Yuliana, et al. (2017) that learning activities by utilizing laboratories in the form of practicum activities can improve student learning outcomes. Besides that, the application of science process skills also influences the improvement of student learning outcomes, as research conducted by Puri, et al. (2015) that the application of science process skills has an effect on improving students' chemistry learning outcomes.

E. Student Responses to Laboratory Utilization and Science Process Skills

Student response questionnaires to learning by utilizing laboratories in the form of practicum activities used in this study, namely closed questionnaires where all answers have been provided so that students only have to choose answers according to what students want. Student response questionnaires before being used in research, were first validated by lecturers and subject teachers.

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The indicators assessed in the closed questionnaire validation. The data obtained from distributing the questionnaire to students can be seen in **Table 7.**

Table 7. Student Response Questionnaire Data on Utilizing Laboratory and Science Process Skills

Intervals	Frequency	Relative Frequency %	Qualification
81,25% < P ≤ 100 %	17	68	Very good
62,50% < P ≤ 81,25%	8	32	Good
43,75% < P ≤ 62,50%	-	-	Less Good
25% < P ≤ 43,75%	-	-	Not good
Quantity	**25**	**100**	

Table 7 can be seen that the students' responses to learning by utilizing the laboratory in the form of practicum activities, 17 students (68%) are in very good qualifications/agree, 8 students (32%) are in good qualifications/agree. this shows that most students are very happy/agree with learning by utilizing laboratories in the form of practicum activities and some are happy/agree, it can be seen that in the learning process by utilizing laboratories students are so enthusiastic, active and have great curiosity.

The involvement of students directly in the learning process by utilizing the laboratory in practicum activities directs learning that is more meaningful for students, so that the knowledge gained by students can last longer. In line with Emda (2017: 90) argued that the use of laboratories in the form of practicum activities is able to arouse students motivation in learning chemistry, besides that students are also given the opportunity to satisfy their curiosity and are trained to develop basic skills in conducting experiments. Utilization of laboratories in practicum activities plays an important role in the process of learning science process skills and improving student learning outcomes.

CONCLUSION

1. The application of science process skills can improve student learning outcomes, namely 14 students (56%) are in high qualifications and 11 students (44%) are in moderate qualifications and all students (100%) have achieved KKM.
2. Student responses to learning by utilizing laboratories in the form of practicum activities, namely 17 students (68%) are in very good qualifications/agree, 8 students (32%) are in good qualifications.

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