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Identification of Students Basic Science Process Skills Assisted of Practical Worksheet Based on Multiple Representations

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Abstract

Skills in the learning process are needed by students to be able to shape and develop the character possessed. This study aims to identify basic science process skills of students assisted practical worksheet based on multiple representations as media. This research was conducted by observation method that was done at the time of practicum activity by using an observation sheet and test method with response test. Students did practicum with practical worksheet media equipped with basic science process skills indicator and multiple representation level. Then the students worked the question with the basic science process skill indicators in it. Based on the analysis of the observation result, the basic science process skills profile of students in SMAN 11 Semarang was included in the high criteria with a range of 68 to 84. The criteria for each basic science process skills indicator were also analyzed from practicum 1 and practicum 2 which is high for indicators to observation, classifying, measuring, inferencing, predicting and knowing the relation of numbers and very high for indicators communicating and knowing relation between space and time. It can be concluded that students have demonstrated proficiency profile of basic science process. This research can be used as a reference for teachers and other researchers to improve student's basic science process skills on different subjects.

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INTRODUCTION

The implementation of the 2013 curriculum was one of the government's efforts to improve the quality of education in Indonesia which emphasizes character education through the development of student's attitudes, knowledge, and skills. Basic science process skills are a teaching-learning approach that leads to the growth and development of certain skills in the students themselves in order to be able to process information or new things useful both in the form of facts, concepts, and the development of attitudes and values (Dwiyanti & Siswaningsih, 2005). The most effective way of improving basic science process skills was by the practicum. Practicum can provide students with experience in terms of conceptual materials. Practicum becomes a means for students to get familiar with the equipment, materials, and chemical reactions. Practical work in the laboratory can make the original concept of abstract more concrete and easier to learn (Altun et al., 2009).

Practicum methods were also effectively used in improving student's science process skills consisting of four aspects: observing, classifying, predicting and communicating (Nasrullah et al., 2015). Practicum activities in the learning process have been done in schools, but still limited to observation and proof of concept or principle that has been studied. The general practicum does not allow students to actively participate in the experiment. Students have not been able to understand the purpose of their practicum. This is less suitable with the characteristics of chemistry as a process, especially students become less motivated to do practical activities. Laboratory activities should assist students in developing practical skills, students must also have direct experience with the concepts of knowledge and gain scientific skills by planning, designing, determining hypotheses, implementing and interpreting their own experiments, one of them through inquiry (Chairam & Nutsuda, 2015).

This study aims to identify the basic science process skills of students at practicum activities with practical worksheet based on multiple representations. It is intended that students are more motivated in practicum activities so that students have sufficient basic science process skills. Basic science process skills are very important for students as a provision to use scientific methods in developing science and is expected to acquire new knowledge or develop the knowledge that has been owned. Thus, students can apply knowledge and skills that have been owned in the life of society.

Identification of science process skills in practicum activities can be done using test and nontest assessment. Assessment with non-tests was performed with an observation sheet with the help of a practicum worksheet. Yildirim's et al. (2011) research shows that the using worksheets can help students understanding chemistry equilibrium materials. Mastery of solubility concept and solubility product increased with the use of inquiry-based worksheet (Manik et al., 2015). So with practical worksheet is expected the students can better understand the practicum performed.

Identification with this written test cannot be used to measure performance but can be used to measure the mastery of knowledge base, including the knowledge base for learners to perform their performance (Ebel & Frisbie, 1986). This is in accordance with research conducted by Arifin et al. (2015) that students who have the skills of the process of science will be able to answer the problem correctly because it is able to use the concept that has been studied previously.

METHODS

The research was conducted in SMA N 11 Semarang with the subjects of the study were the students of eleven science class 1, 2 and 3 semester 2 of the academic year 2017/2018. Data collection methods used in this study are the method of observation and test methods. Observational methods are used to identify student's basic science process skills during practicum activities. The test method is used to

identify the basic science process skills of students after the practicum (response).

The instruments used are multiple representation workbooks representation and basic science skill observation sheets. Multiple representation work-sheet worksheets are used as a medium for practicum activities, while observation sheets are used to identify basic student process skills. Students perform practicum activities according to the guidance that is on the practical worksheet while the observer observes and assesses on the observation sheet in accordance with the assessment rubric. After completion of the practicum, students work on a questioning problem that contains an indicator of basic science process skills. So the identification of basic science process skills can be seen from the student's answer. Identification of basic science process skill of students on solubility and solubility product practicum seen from observation sheet analysis. Assessment of the observation result is analyzed by calculating the average of each observer then calculated the average as a whole. The attainment value of each observed aspect is calculated based on the following formula:

$$\text{Value} = \frac{\text{obtained scores}}{\text{maksimum score}} \text{ x } 100$$

Interpretation of the observation sheet is presented in Table 1.

Table 1. Interpretation of the observation sheet

Interval	Category
$84 < V \leq 100$	Very High
$68 < V \leq 84$	High
$52 < V \leq 68$	Medium
$36 < N \leq 52$	Low
$20 < V \leq 36$	Very Low

RESULTS AND DISCUSSION

Student's basic science process skills were observed using observation sheets and response test results. The observation sheets and test results were analyzed so that the basic student's skill profile was obtained. Students with high basic science process skill criteria have the ability to answer questions correctly. This is because students use previously learned concepts to answer questions.

Student's Basic Science Process Skills of Psychomotor Aspects

Assessment of basic science process skill of psychomotor aspect seen from the result of observation during practice activity. The average acquisition of basic science process skills in one class is calculated based on observational data from three observers and grouped according to established criteria. The basic skills profile of the student's basic science processes on practicum 1 and 2 based on basic science process skill criteria can be seen in Figure 1. An analysis of the mean value of the basic science process skills of each indicator is also performed. The results of the basic science process skill criteria for each indicator in Practicum 1 and Practicum 2 are listed in Table 2 and Table 3.

Based on Figure 1, the profile of basic science process skill students in practicum 1 and 2 can be said to have high and very high criteria. This indicates that students have the basic science process skills at practicum activity. Afiyanti et al. (2014) state that students with the provision of science process skills will be able to carry out practicum according to a standardized scientific method and not experience significant barriers in the implementation of the lab. Nevertheless, there are still students who have basic and low basic science process skills. This may be due to students not taking into account the direction given by the teacher and not reading the instructions in the practical worksheet carefully.

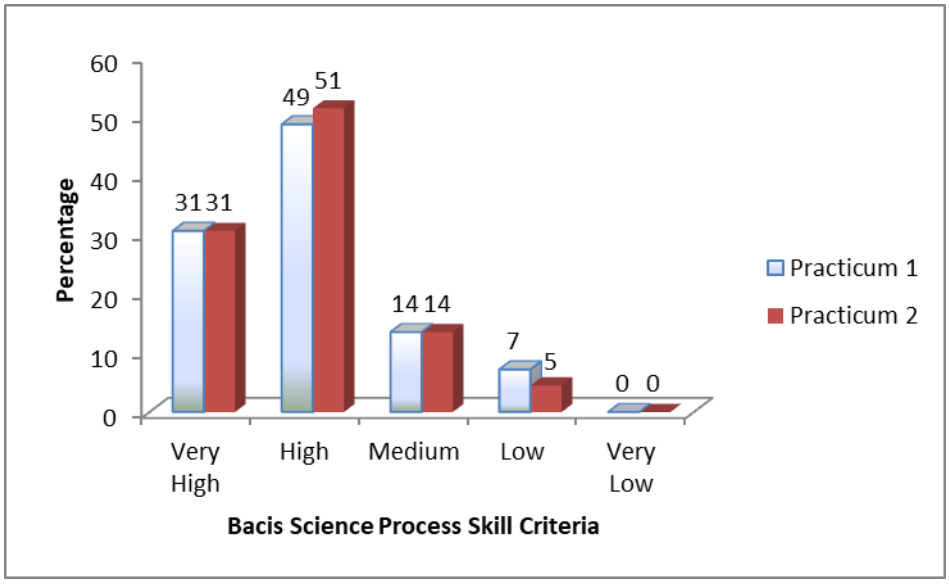

Figure 1. The Profile of Student's Basic Science Process Skills

Table 2. Basic Science Process Skills Criteria for Each Indicator Practicum 1

Basic Science Process Skills Indicator	Criteria
Observation	High
Classifying	High
Measuring	High
Communicating	Very High
Inferencing	High
Predicting	High
Knowing relation between space and time	Very High
Knowing the relation of numbers	High

Table 3. Basic Science Process Skills Criteria for Each Indicator Practicum 2

Basic Science Process Skills Indicator	Criteria
Observation	High
Classifying	Medium
Measuring	High
Communicating	Very High
Inferencing	High
Predicting	Medium
Knowing relation between space and time	Very High
Knowing the relation of numbers	High

There are 8 indicators observed in this research are observation, classifying, measuring, communicating, inferencing, predicting, knowing relation between space and time and knowing the relation of numbers. Table 2 and Table 3 shows the criteria for each basic science process skill indicator from the observations included in the high and very high criteria. So it can be said that most students have demonstrated basic science process skills that are consistent with the observed indicators. This is because learning chemistry with practicum activities can develop student's science process skills (Winarti & Nurhayati, 2014). The student's science process skills will continue to

grow in line with student activeness during the learning process (Ariyati, 2010).

The highest scores of basic science process skill indicators are in communicating indicators. Students can deliver accurate and clear observations according to the guidance provided in the practicum worksheet. This certainly allows students to communicate the results of observations made. The lowest basic science skill indicator score is in the predictor indicator. Students are still difficulty in predicting compounds that precipitate from the calculation. Students still do not understand the concept of predicting precipitation by calculation. Although there are still indicators of skills with a low value, basically practicum activities provide flexibility to students to conduct experiments, observations, and discussions. Students not only listen to the teacher's lecture on a material course, but students can experience the process to get the concept so that student's understanding of a concept or principle more stable (Wardani et al., 2009).

Rizkianawati et al. (2015) states that learning aimed at improving the skills of the science process is important to apply to the learning process as it may involve the active role of the students. Practical worksheet based on multiple representations are used in practicum activities to train basic science-process skills possessed by students so that students are easier in observing and communicating the results of discussions in written form. The application of problem-based student worksheets is a vehicle for students to involve their optimally-owned skills in mastering process skills (Susilo et al., 2012). Aminudin et al. (2015) state that worksheet based on multiple representations are very well used to train student's basic science process skills on material classification materials.

Student's Basic Science Process Skills of Cognitif Aspects

Assessment of basic science process skills of students of cognitive aspects is evident from the results of the response test. The Response is done by using test questions in the form of multiple-choice questions of open-ended (two-tier) solubility and solubility. Not all basic science process skill indicators can be included in test questions. Only 3 basic science process skill indicators assessed through the tests, ie classifying indicator, inferencing indicator and knowing the relation of numbers indicator. All three indicators are scattered in 10 questionable multiple choice questions. The distribution of basic science process skill indicators is presented inTable4.

Table 4. The distribution of basic science process skill indicators

Basic Science Process Skill Indicators	Question Number
Classifying	7
Inferencing	1, 3, 5, 6, 8 and 9
Knowing the relation of numbers	2, 4, 7 and 10

Based on the analysis of test results, it can be calculated as the percentage of students who have basic science process skills of the 3 indicators. Percentage of students who demonstrated basic science process skills of the test results are shown in Figure 2, which is 68.47%, 62.61% and 66.67%. This result was obtained from the number of students who answered correctly on each question and summed up for each of the same indicators. The results can be interpreted that some students have demonstrated basic science process skills of classifying, inferencing and recognizing the relationship of numbers. Students who have the skills of the science process will be able to answer the problem correctly. This suggests that students 'science process skills will have an impact on student's material understanding and cognitive domain (Susantini et al., 2012). This is also in accordance with research conducted by Odja & Rahandra (2010) that learning activities that are oriented to student's science process

skills will be able to actively involve students so that students are able to find a regular pattern to be interpreted according to the existing concept.

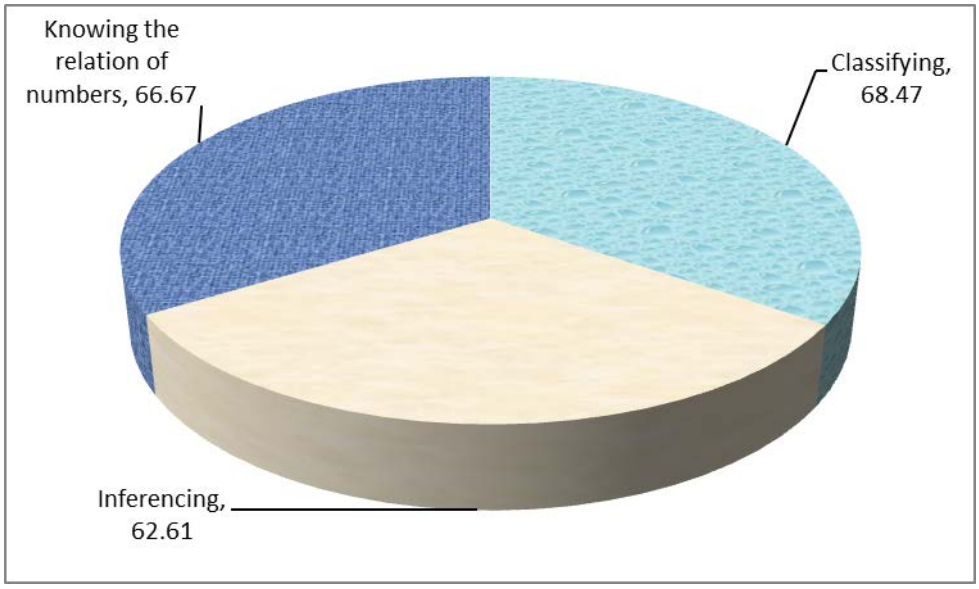

Figure 2. Percentage of Basic Science Process Skill from the Test Result

The identification of basic science process skills in this study focused on the use of practicum worksheets as media, so students have a clear picture of the practicum performed. In addition, the identification of basic science process skills is not only limited to psychomotor aspects of observation. Identification of basic science process skills was also done by providing two-tier tests that require students to understand the concept more deeply to be able to answer each question.

The result of the identification of basic science process skill, both from psychomotor aspect and cognitive aspect can be used as a reference for further research. Teachers and other researchers can modify the observation sheets as well as the practicum worksheets to be able to improve student's basic science process skills on different subjects and subjects. So the purpose of education to educate students who are characterized by developing knowledge, attitudes, and skills can be achieved.

CONCLUSION

Based on the results of research and discussion it can be concluded that the skill profile of basic science process of students on soluble material practicum activity and solubility product included in criteria high and very high. The results of the analysis of each indicator of basic science process skills were also included in the high and very high criteria. This suggests that most students already have basic science process skills demonstrated during practicum activities with the help of multiple representation practicum worksheets for psychomotor aspects as well as response tests for cognitive aspects.

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