The analysis of students' practicum skills achievement in acid-base material

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Abstract. This research aims to analyze the achievement of students’ practical skills in learning chemistry on acid-base material. The subjects in this research were students of grade 11 senior high school. The research method used was an experimental design. The process of data collection was used the practical skills observation sheet. The sample was determined using cluster random sampling technique, namely XI MIPA 4 as the experimental class and XI MIPA 1 as the control class. The data analysis results showed that the average percentage of achievement of practical skills in the experimental class was 84.89%, while for the control class was 78.76%. Assessment of the achievement of students’ practicum skills includes 16 aspects that fall into three dimensions, namely preparation of practicum, implementation of practicum, and final implementation after practicum. Based on these data, it was concluded that students’ practical skills grade 11 senior high school on acid-base material were classified as good criteria.

1. Introduction
In the 21st century, science and technology in various countries have experienced a rapid increase [1]. One of the 21st-century skills that must be mastered is practicum skills [2]. Practicum provides opportunities for students to be able to find, prove, and clarify theories [3]. This is supported by previous studies’ results, which show that the improvement of learning outcomes and problem-solving abilities of students can be achieved through practicum activities [4]. Chemistry, one of the compulsory subjects in Mathematics and Science specialization at the high school level, requires students to carry out practicum activities. Some material on chemistry subjects needs to be put into practice so that students better understand these materials. Acid-base, one of the materials in chemistry subjects that can be conveyed through the lecture method [5,6,7] and practicum [8]. Practical activities can give learning experience for the students. More than that, after carrying out practicum, students are expected to be able to carry out mini research using available tools and materials to prove an existing hypothesis or theory.

Practical activities can also connect knowledge between theory, problem solving, and scientific processes [9]. Practical activities in the laboratory can develop the students’ attitudes to undertake exploratory studies (exploring) about science and technology as well as scientific thinking skills. Practical activities can generate motivation to learn chemistry or science for students and allow learning a scientific approach [10]. For this reason, the competence of students in chemistry subjects requires learning activities through practicum in the laboratory [11].
The laboratory is a place for students to carry out practical activities that can support the improvement of cognitive, psychomotor, and affective skills [12]. Based on the important role of the laboratory, especially chemistry at the high school level, its existence is very necessary for the implementation of modern science education [13]. Better mental agility students can be trained through experimental activities and active role in the laboratory [14]. More than that, the laboratory provides positive, fun, and valuable experiences for students [15].

The observations at several state high schools in Batang Regency, Central Java Province, Indonesia show that practicum activities, especially in chemistry subjects, are frequent. The practicum activity carried out in mini research, one of which is practicum on acid-base indicator material. However, the practical implementation still encountered several obstacles such as limited tools and materials in school laboratories. For this reason, teachers and students are required to be creative in carrying out practicum activities even though they are limited. Acid-base indicator practicum activities can still be carried out by adjusting the tools and materials in the school laboratory. In addition, chemicals that are hard to find can also be replaced with natural ingredients that are easily found in everyday life.

Based on the background that has been described, the formulation of the problem in this research is how the achievement of practical skills of class XI students in acid-base learning. This research aims to analyze the achievement of practical skills of class XI students in acid-base learning.

2. Methods
The research was conducted at SMA Negeri 2 Batang regency, Central Java Indonesia during the even semester 2019. The research method uses an experimental method with the chosen research design True Experimental Design. The population in this study were all students of class XI MIPA. The research sample was taken using cluster random sampling technique, namely class XI MIPA 4 as the experimental class and class XI MIPA 1 as the control class. This research consists three variables: the learning model as the independent variable, practical skills, the curriculum used, the teacher who taught and the subject matter of students of class XI MIPA as the dependent variable. Meanwhile, the number of hours of study as a control variable.

The research data were collected using the observation method as an assessment instrument during the acid-base material practicum. The assessment was carried out by three observers. All data collected was analyzed based on population data and research data.

3. Results and Discussion
Acid-base learning is not only delivered in the classroom but also by doing practicum in the laboratory. This activity aims to train students' practical skills and so that the concepts conveyed by the teacher can be understood properly. In addition, through practicum, learning is expected to be more meaningful.

Assessment of the achievement of practicum skills is carried out starting from the preparation to the final implementation of the practicum. This activity is divided into 16 aspects. Based on Table 1, the control class received a higher percentage than the experimental class, namely in the aspects of practicum preparation and final implementation after practicum. Meanwhile, in the practical implementation, the experimental class received a higher percentage than the control class. These results indicate that classically, students in the experimental class are better at doing practicum. During the practicum activities, students in the experimental class looked more active, nimble, thorough, and orderly. Students in the experimental class thought that they had already sought information about the observations to be made, so that they did not experience difficulties.

For the preparation and final implementation aspects after practicum, the control class obtained a higher percentage result than the experimental class. Practical preparation in the work safety section, students in the control class look more ready because they have equipped themselves with practicum suits and gloves. During the practicum, students from the experimental and control classes looked enthusiastic and had high curiosity. This is shown by the active students to test the indicator extract with the sample solution.
Table 1. Percentage of Practicum Assessment Based on Work Dimensions

| No | Work Dimensions | Assessment Aspects | Percentage |
|----|-----------------|--------------------|------------|
| 1  | Practicum       |                    |            |
|    | preparation     | 1. Work safety     | 83.71%     |
|    |                  | 2. Preparation of tools | 84.00%   |
|    |                  | 3. Preparation of ingredients |   |
|    |                  | 4. Preparation of work steps |   |
| 2  | Practicum       | 1. Take out the solution | 88.82% |
|    | implementation  | 2. Using tools     | 76.04%     |
|    |                  | 3. Pour the natural indicator extract |   |
|    |                  | 4. Using litmus paper |   |
|    |                  | 5. Test the solution with natural indicators |   |
|    |                  | 6. Observing the change in the color of the solution |   |
|    |                  | 7. Carry out practicum in accordance with the sequence |   |
|    |                  | 8. Able to work together in groups |   |
| 3  | Final           |                    | 78.21%     |
|    | Implementation  |                    |            |
|    | After Practicum| 1. Handling of practicum waste | 78.96% |
|    |                  | 2. Cleaning practicum tools |   |
|    |                  | 3. Arranging practicum tools |   |
|    |                  | 4. Cleaning the practicum table |   |

Information:
1. Work safety
2. Preparation of practicum tools
3. Preparation of practicum materials
4. Preparation of practicum work steps
5. Take out the solution
6. Using tools
7. Pour the natural indicator extract
8. Using litmus paper
9. Test the solution with natural indicators
10. Observing the change in the color of the solution
11. Carry out practicum in sequence
12. Able to work together in groups
13. Handling of practicum waste
14. Cleaning practicum tools
15. Organizing practicum tools
16. Cleaning the practicum table

Figure 1. Percentage of Practicum Skills Achievement Diagram for (a) Class XI MIPA 4 and (b) Class XI MIPA 1
In the final implementation after practicum, students in the experimental and control classes cleaned and tidied the tools they had used for practicum. They also cleaned the tables and put the benches back in order. This assessment also shows their attitude of responsibility after carrying out the practicum. Students leave the laboratory after they make sure that there is no trash or practicum waste on their work tables.

The results of the data analysis showed that the average percentage of achievement of practical skills for class XI MIPA 4 students was 84.89%. The average percentage of attainment of practical skills of students in class XI MIPA 1 was 78.76%. The percentage of achievement of each aspect is stated in the diagram presented in Figure 1.

Figure 1 show that there are differences between students' practical skills in the experimental and the control class. In the first aspect is safety work, the percentage of achievement in the experimental class is 75.00% lower than the control class, which is 91.67%. The low percentage in the experimental class indicates a lack of individual preparation to prepare the practicum. Students in the experimental class have not used laboratory coats when they are doing practicum.

The second aspect is preparing practicum tools. The experimental class gets a percentage of 91.68% while the control class gets 93.52%. It’s indicate that students in both classes have prepared the necessary tools properly. It’s because the tools that students must carry are in their everyday life [16], meanwhile other tools such as mortar pestle, beaker, dropper pipette and drop plate have been provided. The practical material preparation aspect was the third aspect, the experimental class was 83.33% higher than the control class 78.33%. These both results show that students are able to prepare well the practical materials, because the materials that students must bring are natural materials that usually find in everyday life [17].

The preparation aspect of the work step as the fourth aspect, the experimental class was 84.85% higher than the control class, which achieved 72.50% achievement. The achievement of aspect 4 is higher in the experimental class because most of the students have made flowcharts for practicum. In the fifth aspect is taking the solution, the achievement of students in the experimental class was 93.18% while for the control class was 82.50%. The high achievement percentage of the two classes was caused some students have been able to take the solution with the right position and dose.

The sixth aspect is using tools, the achievement of skills for the experimental class is 87.88% while the control class gets achievement percentage of 76.67%. The high percentage of achievement from these two classes was caused students have been able to use practicum tools properly and appropriately. The aspect of pouring the extract of natural indicators as seventh aspect, the achievement for the experimental class was 92.43% higher than the control class which was 72.50%. Students in the experimental class were better at pouring the natural indicator extract they made into the drip plate, so the achievement percentage for seventh aspect is higher than the control class.

In the aspect of using litmus paper as eighth aspect, the experimental class achieved 83.33%, while the control class was 77.50%. Both classes have high achievement was caused students in both experimental and the control class able to use litmus paper well and observe the change color of the litmus paper that reacts with natural indicator extracts. Nineth aspect is testing the solution with natural indicators, the achievement for the experimental class was 90.15% while for the control class was 71.67%. The achievement percentage of experimental class higher than the control class was caused the students in the experimental class were better at adding extracts when tested with a sample solution. Students feels excited and have great curiosity when they react to practicum materials.

The tenth aspect is observing the change in color of the solution, the achievement obtained by the experimental class was 84.09%, while for the control class was 72.50%. The higher achievement in the experimental class shows that students are right in determining color changes. It’s also caused the students make good observations. The eleventh aspect is carry out practicum in accordance with the order, in the experimental class the achievement was 91.68% and for the control class was 72.50%. The achievement of the control was lower than experiment class. It’s caused the students have not carried out practicum according to work steps. Students streamline the time available during the practicum, however they do not pay attention to the order in doing the practicum.
The twelfth aspect is being able to work together in groups, the experimental class achieved 87.88% attainment, while the control class achieved 82.50%. Both of the experiment and control class are equally in high percentage achievement. That’s caused each group in the experimental class and control class can work together well and can use the time as effectively as possible. The division of tasks in each group was distributed so that each student gets assignments and able to carry out trials. The thirteenth aspect is handling practicum waste, the achievement for the experimental class was 75.00% lower than the achievement percentage of the control class which was 82.50%. These results indicate that students in the control class are good at handling practicum waste. Students in the control class do not throw the dregs of natural indicator extract into the sink but throw it in the trash.

The fourteenth and fifteenth aspects are cleaning the practicum tools and arranging the practicum tools. The achievement percentage for fourteenth and fifteenth aspects of the experiment class, respectively was 84.85 and 78.00%. The achievement percentage for fourteenth and fifteenth aspects of the control class, respectively was 70.00 and 85.00%. The results of both aspects of the experimental class and the control class show fairly high gains. These results show that students are able to be responsible for practicum tools. They cleaned and rearranged the tools they had used in to their original places.

The sixteenth aspect is cleaning the practicum table, the achievement percentage of the experimental class was 75.00% and the control class was 78.33%. The table that has been used for practicum was cleaned and no trash left on it. These results also show if students have a sense of responsibility after doing practicum. Based on the percentage results of practical achievement from the experimental class and the control class, it shows that students have good practicum skills.

4. Conclusion
The average achievement percentage of practical skills the experimental class was higher than the control class. The average attainment of practicum skills for the experimental class was 84.89% and the average attainment of practicum skills for the control class was 78.76%.

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