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The Effectiveness of Vocational High School Student Practicum Skills in Mixture Separation Materials on Problem-Solving Ability

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Abstract

This study aims to analyze the effectiveness of chemistry practicum skills on students' problem-solving abilities. The method used is descriptive research with a survey approach. The sample was determined using a simple random sampling probability technique, which included chemistry teachers from three different schools and 107 students from three schools. Indicators of practicum skills to problem-solving abilities ie students complete learning. Survey data were analyzed using quantitative descriptive techniques. The results showed that 74 people (69%) were in the good category and 33 people (39%) were in the very good category, and there were no students in the average, poor, and failed categories. So, it can be concluded that students' practicum skills on the separation of mixture material are effective in problem-solving skills.

Keywords: *students practicum skills; separation of mixture; problem-solving ability.*

1. Introduction

Vocational High School (VHS) an educational unit that prepares students to be able to work, either independently or filling job vacancies in the business world and industry as a middle level workforce, according to the fields and programs of interest and enables students to be able to choose career, tenacious and persistent in competing in the world of work (Febriyanti et al., 2015; Sutrisno & Siswanto, 2016). Education curriculum in schools has a strategic position and can determine the achievement of educational goals. The 2013 curriculum focuses on student activities so that students' knowledge, skills, and attitudes are better so that students are active in learning to find concepts through analysis and problem solving (Husna & Nurhayati, 2018; Sucipto, 2017; Suherman, 2014). Therefore, one of the abilities that need to be developed in students is the ability to solve problems.

Chemistry is a combination of theories, calculations, and concepts that must be understood (Langitasari, 2016; Tukiran et al., 2017). In essence, chemistry subjects consist of two aspects, namely chemistry as a product and as a process. The knowledge that consists of facts, principles, and concepts is part of chemistry as a product, while the skills and attitudes possessed by students are part of chemistry as a process. So, in studying chemistry it is not only pressured to master the product but to find out how the process of finding chemical products, students also really need to learn it (Rizkiana et al., 2016; Wu & Zhao, 2020).

Chemistry materials in tenth grade Industrial Mechanical Engineering competence, one of which is to analyze changes in material and the separation of mixtures with Basic Competency (BC). The indicators through practicum, students can show differences in material changes and mixture separation. Based on the competencies that must be achieved in the material, it is expected that in the learning process students can design and carry out practicum, describe, analyze, and be able to infer the results of the practicum. Competencies that will be achieved by these students include the science process skills. Learning on the subject of mixture separation is more likely students receive knowledge information, students tend to memorize knowledge instead of understanding concepts, as a result, the knowledge obtained will be easily forgotten. So that it requires practical activities in learning skills that can practice problem-solving for students. The process of discovering product knowledge can be carried out through practicum activities (Aydin et al., 2015; Dharma & Prasetyo, 2012).

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From experience, while carrying out learning activities about chemistry, it is found facts that show students have difficulty in learning. That fact is, in the learning process, students only receive knowledge from the teacher but are not actively involved. The statement was supported by an initial survey of the ability to solve problems that showed students were still having difficulty understanding chemical concepts, even to understand a problem in chemistry. Thus, there is the potential for real problems to occur in the learning process that must be solved. Activities in the learning process are relationships that are conscious of the goal. Improving critical thinking, logical responses, and developing problem-solving abilities is one of the goals of education (Padmi, 2018; Wirdaningsih et al., 2017). In the learning process, students must always be trained so that students can solve the problems encountered. Problem-solving abilities can be developed at school through knowledge, skills, and practicum learning process.

Practicum is a way of learning by presenting through experiments, proving yourself something learned, applying knowledge and skills to the situation at hand. Through practical activities, students will become more confident about one thing, enrich experiences, develop scientific attitudes, and learning outcomes will last longer in students' memories than students only receive from teachers and books (Kurniawati et al., 2015; Suryaningsih, 2017). Practicum activities are learning that can provide opportunities for students to gain knowledge through activities working in groups, acting and thinking, and actualizing themselves through communicating the results of experiments (Aydin et al., 2015; Listyarini et al., 2019; Maknun et al., 2012). Thus, it is important to know whether practical activities can have a good impact on students' skills, especially on problem-solving skills.

Learning activities and achieve the three domains of educational goals that are cognitive, affective and psychomotor through the implementation of practicum at school, actively involving students by working independently, following processes, observing objects, proving and analyzing and making own conclusions. Applying theory in the form of practical activities in learning can improve students' interests and attitudes towards learning, find their knowledge, improve their ability to solve problems, and improve process skills. Practicum activities in schools can increase students' high-level thinking skills, one of which is the ability to solve problems that will be very beneficial for students in the future (A. Hastuti et al., 2016; Misbah et al., 2018).

Practicing science process skills that are taught through a practicum in chemistry learning, it is hoped that it can develop students' potential towards solving problems encountered (Irwansyah et al., 2018; Misbah et al., 2018; Nurhudayah et al., 2016). Science process skills with the method of "learning by doing" are learning which are assumed to be very effective, because students not only gain an understanding of concepts but experience experiences "discovering" which makes the understanding of concepts more comprehensive. The purpose of science in the laboratory is to help students towards the development of conceptual understanding, provide experience to engineer various laboratory materials and equipment (Darmaji et al., 2018; Misbah et al., 2018; Muspiroh, 2012).

Some research on the development of students' science process skills through learning with practical methods in solving problems has been carried out, including by (Naj'iyah et al., 2020) stated that the application of the photoelectric effect interactive module is able increase the value of students' science process skills is 82.6 with a high category. Research conducted by (Darmaji et al., 2018) stated that science process skill can be mastered by students is measuring and experimenting. Research conducted by (Misbah et al., 2018) stated that practical instructions developed fulfilling the content requirements with a very valid category and can be used at a later stage to test students' science process skill.

Based on the problems above, the main problem with the effectiveness of chemistry practicum skills is the ability to solve students' problems. The research aims to identify the practicum skills of vocational students on the separation of mixture material on the ability to solve problems. Practicum skills revealed are measured by analyzing motivation and practicality in practicum. The motivation referred to is the encouragement of students towards

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involvement and activeness in practicum activities on the separation of mixture material. While the implementation of practicum in chemistry lessons refers to the constraints and looks for alternative solutions based on the study of literature and the analysis of the constraints of practicum implementation.

2. Method

The research method used is descriptive survey type that refers to (S Arikunto, 2010). Descriptive research is research conducted to analyze a condition or other things that have been mentioned and the results are presented in a report. Descriptive type survey research is research that only really describes what is happening in a particular area. The collected and complete data are then classified based on the type, nature, and condition, then concluded (S Arikunto, 2010).

The targets of this research are chemistry teachers and students of SMK Negeri 1 Puloampel, SMK Negeri 1 Kramatwatu, and SMK Negeri 1 Waringinkurung, Serang Regency. The research sample used was determined using probability sampling techniques, a type of simple random sampling, including chemistry teachers from 3 different schools, and 107 students who were focused on the three schools. Data collection techniques are done through interviews with teachers and students and direct observation. Data collection procedures performed are direct observation in the chemistry laboratory, collecting data obtained from the results of practicum activities, as well as interviewing students and teachers of chemistry subjects. Research data were analyzed through quantitative descriptive techniques in the form of simple percentages and using tables. Before the instrument is used in research, content validation is done firstly by experts that are two competent lecturers and two chemistry teachers who have a minimum of 5 years of teaching experience.

The steps in the problem-solving ability test include: (1) understanding the problem, i.e. formulating the context of the problem, (2) explaining the problem i.e. looking for information to use in problem-solving. In the form of theory, variables and application of problems, as well as establishing hypotheses, (3) designing solutions to problems, that is arranging stages to solve problems, (4) implementing problem solutions, that is taking and processing data, (5) evaluating problem solutions, that is making conclusions.

Students are said to be able to solve problems if students complete the Minimum Mastery Criteria, then categorize the criteria can be seen in Table 1.

Table 1. Criteria for Problem Solving Skill

Classification (%)	Activity Results
81 – 100	Very Good
66 – 80	Good
56 – 65	Average
41 – 55	Poor
0 – 40	Failed

(Suharsimi Arikunto, 2015)

3. Results and Discussion

Based on surveys and data obtained from several schools, data on the effectiveness of chemistry practicum skills on the ability to solve problems is obtained. Data are presented in Table 2.

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Table 2. Interpretation of Practicum Skills on Problem Solving.

Scale (%)	Category	Frequency	Percentage (%)
86 – 100	Very good	33	31
66 – 80	Good	74	69
56 – 65	Average	0	0
41 – 55	Poor	0	0
0 – 40	Failed	0	0
Total		**107**	**100**

Based on Table 1, students' practicum skills on the separation of mixture material on the ability to solve problems are in good category. This is based on evidence of students' completeness of the ability to solve problems in terms of the value of the practicum report which can be seen in Figure 1.

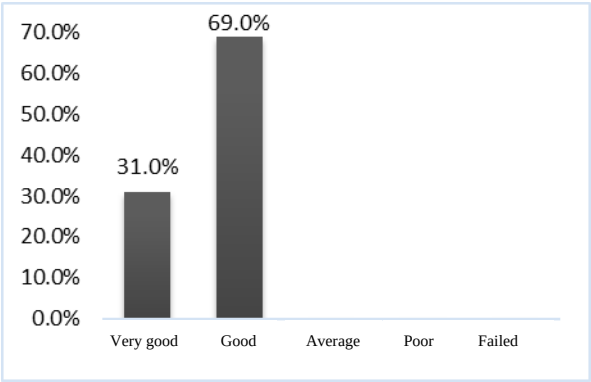

Figure 1. Comparison diagram of the level of students' practicum skills in problem solving skills.

Students' practicum skills on the problem-solving skills are in the good category with 74 students (69%), and 33 students (31%) are in the very good category. There are no students in the category of average, poor, and failed. This proves that practical skills are effective in problem-solving skills. The evidence in this study was found in the steps of formulating the problem and describing the problem by writing down the variables and hypotheses following the problem formulation. Students also have new skills in the steps of designing and testing the solution by utilizing materials and designing tools properly. The effectiveness of this research is found based on the results of data analysis using theory and being able to evaluate solutions that are answers to the formulation of the problem and can draw conclusions from the results of the practicum. When students can make the results of practicum reports properly following indicators of problem-solving, then the way students think can be trained and develop. The ability of the problem has been owned by students because they have been able to understand the problem so that they can solve correctly every step of problem-solving through a practicum. Through practical activities can make an increase in students' interest in subject matter and improve student learning outcomes, so students can solve problems (Bahriah & Abadi, 2016; Rizkiana et al., 2016).

Important skills for students to have are science process skills (Dewi et al., 2019; P. W. Hastuti et al., 2018; Wulandari, 2016). Learning that emphasizes science process skills through practical activities means giving opportunities to students to become more active, and providing opportunities so that they can solve their problems with learning material. Research conducted by (Royani et al., 2018) stated that the practicum-based direct learning model was affect toward students' science process skills and critical thinking ability. The other research

conducted by (Bahriah & Abadi, 2016) stated that the students' motivation in chemical bonding material through practical methods including the high criteria.

The implementation of chemistry practicum in secondary schools has several obstacles. From interviews with teachers from all three schools, it was found that not all material taught to students could be done with practical activities. That is because there are some obstacles to the implementation of practicum. These obstacles include (1) the factor of the state of facilities and infrastructure which support practicum, (2) the level of motivation and the ability of teachers to do the practicum, (3) limited learning time that does not support the implementation of practicum. So, these obstacles affect the implementation of practical activities that are rarely done.

Lack of facilities in some schools, including tools and materials, can be overcome by using tools and materials from the surrounding environment or materials that are easily obtained. This can improve students' understanding of the chemistry of natural products. This problem can also be overcome by applying the demonstration method. Research conducted by (Rizkiana et al., 2016) stated that there was differences in students' motivation that learned with hands-on and demonstration in guided inquiry learning. The other research conducted by (Arisman, 2015) stated that cooperative learning using labwork methode increased students science literacy, better than cooperative learning with interactive multimedia demonstration.

The level of motivation and ability possessed by teachers to carry out practicum activities, still need to be evaluated. The solution to address these obstacles is providing training on laboratory management of chemistry and laboratory subject teachers, training, and briefing on understanding basic applications of practicum activities. The next obstacle is the lack of learning time as a support in the implementation of practicum can be overcome through the application of virtual lab learning, so that it can reduce practicum time, also does not require real equipment and materials. The results of some research conducted by (Makransky et al., 2019; van der Graaf et al., 2020) explained that to improve understanding of concepts and learning achievement students can use the application of virtual labs in the learning process.

Some research on the development of students' science process skills through learning with practical methods in solving problems has been carried out, including by (Naj'iyah et al., 2020) stated that the application of the photoelectric effect interactive module is able increase the value of students' science process skills is 82.6 with a high category. Research conducted by (Darmaji et al., 2018) stated that science process skill can be mastered by students is measuring and experimenting. Research conducted by (Misbah et al., 2018) stated that practical instructions developed fulfilling the content requirements with a very valid category and can be used at a later stage to test students' science process skill

4. Conclusion and suggestions

The findings from the results of this study are practical skills proven effective in solving problems because students can understand problems and can take steps to solve problems appropriately reviewed based on the results of practicum reports, where students have been able to write practicum reports under indicators of problem-solving. When students can make the results of practicum reports properly, the way of thinking of students will be trained and developed. The ability to solve students' problems is proven based on the data obtained by 74 students in the good category and 33 students in the very good category.

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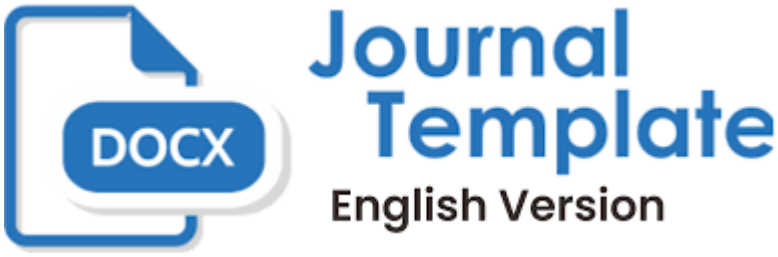

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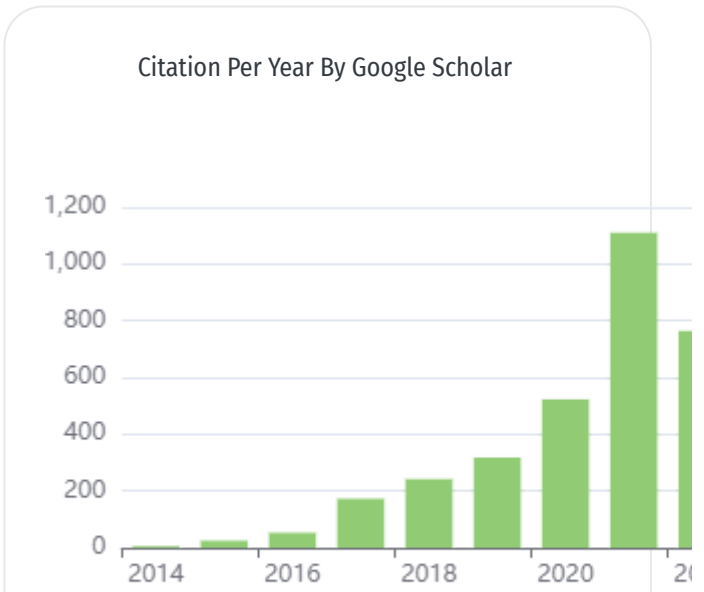

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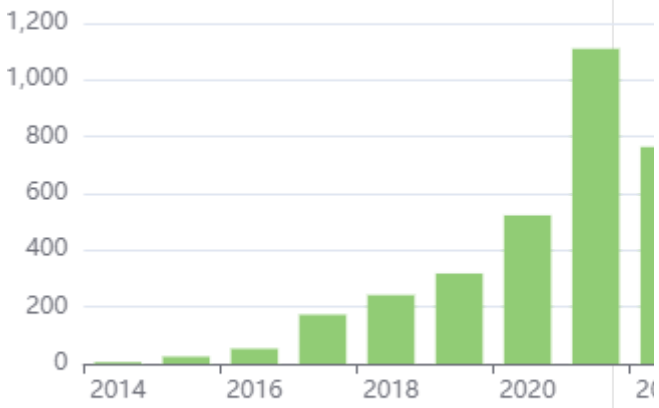

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