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The Role of Laboratory Activities on Laundry Industry Waste Pollution to Improve Problem Solving skills: Teacher's Perception

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Abstract: This study aims to describe the teacher's perception of problem-solving-based laboratory activities to improve the problem-solving skills of junior high school. This study involved 30 science teachers in Lampung. Collecting data in this study using a questionnaire, then analyzed using descriptive analysis. The survey results show that 65% of science teachers have not carried out problem-solving-based laboratory activities in their learning activities. This is due to several factors including teachers not being able to manage time in learning activities and limited tools and materials in school laboratories. Whereas on environmental pollution material for class VII of Junior High School, students can be invited to carry out laboratory activities based on solving real problems such as water pollution by laundry industrial waste. Based on the survey results, it can be said that the laboratory activity program is needed by teachers and students to improve students' problem solving skills.

Keywords: laboratory activities, problem-based learning, problem solving skills.

Abstrak: *Penelitian ini bertujuan untuk mendeskripsikan persepsi guru tentang aktivitas laboratorium berbasis pemecahan masalah untuk meningkatkan keterampilan pemecahan masalah siswa SMP. Penelitian ini melibatkan 30 guru IPA di Lampung. Pengumpulan data dalam penelitian ini menggunakan kuesioner, kemudian dianalisis menggunakan analisis deskriptif. Hasil survei menunjukkan bahwa 65% guru IPA belum melaksanakan aktivitas laboratorium berbasis pemecahan masalah dalam kegiatan pembelajarannya. Hal ini disebabkan beberapa faktor diantaranya guru tidak mampu mengatur waktu dalam kegiatan pembelajaran dan keterbatasan alat dan bahan di laboratorium sekolah. Sedangkan pada materi pencemaran lingkungan untuk kelas VII SMP, siswa dapat diajak untuk melakukan kegiatan laboratorium berdasarkan pemecahan masalah nyata seperti pencemaran air oleh limbah industri laundry. Berdasarkan hasil survei dapat dikatakan bahwa program kegiatan laboratorium sangat dibutuhkan oleh guru dan siswa untuk meningkatkan kemampuan pemecahan masalah siswa.*

Kata kunci: *aktivitas laboratorium, pembelajaran berbasis masalah, keterampilan pemecahan masalah.*

▪ INTRODUCTION

The improvement of human resources in Indonesia has been carried out in various ways, one of which is through education. In the 21st century, the Indonesian people, especially students, face many global challenges. These challenges include students being expected to have thoughts, verbal and written communication, teamwork, creativity, research skills, and problem solving to compete and grow well in the future. Facing these problems, it is necessary to prepare superior human resources who have 21st century competencies (Mukminan, 2014).

One of the 21st century competencies that must be mastered by students today is the ability to think critically and solve problems (Robinson and Kay, 2010). Problem solving skills train students to find various concepts in a holistic, meaningful, authentic

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and applicable manner (Hariawan et al, 2014). In addition, problem solving skills are seen as very fundamental in science learning (Gok and Silay, 2010). The steps for solving problems according to Beyer (1995) are (1) formulating problems, (2) developing answers (hypotheses), (3) testing hypotheses, (4) developing and drawing conclusions, (5) and applying conclusions to the data or new experience.

To support the achievement of learning that is able to train students' problem solving skills, educators need appropriate learning models, one of which is through laboratory activities. Through laboratory activities, the learning process will be student-centered because students are given the opportunity to conduct experiments and do not depend on the teacher as a source of information in learning. In addition, laboratory activities allow the application of various science process skills as well as the development of scientific attitudes that support the process of acquiring knowledge in students. This is where it can be seen that laboratory activities have a very important position in science learning (Subiantoro, 2010).

Facilitating learning with laboratory activities also has strategic values including: 1) linking theory & practice; 2) make learning more interesting; correcting misconceptions, and empowering higher order thinking skills (Ottander and Grelesson, 2006); improve laboratory skills & learning outcomes (Moore, 2007); improve students' scientific abilities such as: observing, measuring, using tools, and materials and being able to follow the correct work steps (Balanay and Roa, 2013); provide direct experience so as to change students' perceptions of important things (Watson, et al., 1995).

According to Blaine (2003), laboratory activities consist of five activities, namely: setting up and maintaining equipment (set-up and equipment care), following procedures (following procedures), data collection (data collection), security (safety), and cleaning (clean-up). The application of science laboratory activities can develop students' scientific skills in observing and measuring. Students are more experienced in using measuring tools or equipment and are personally involved in data collection directly. In this case, the researcher will develop a laboratory activity program in junior high schools with real problems that occur in the surrounding environment in the form of laundry industry waste pollution. The example of a solution that can be applied in the laundry industry waste pollution is to use coffee grounds through a filtration process. Learning activities like this can train students' thinking. Therefore, learning innovations are needed that are able to integrate effective laboratory activities in improving students' problem solving skills, so it is necessary to develop a laundry industry waste pollution laboratory activity program to improve problem solving skills.

▪ METHOD

Participants

The participants of this research consisted of 30 teachers in academic year of 2021/2022 with science teachers in Lampung.

Research Design and Procedures

The research was conducted on August 1-15, 2021. First, the researcher conducted a literature study by analyzing the results of the latest studies on laboratory activities and problem-solving skills. Furthermore, the researchers developed an instrument to analyze the needs of science learning educators, then the instrument was distributed to

30 schools through the google form. The analysis of the questionnaire made has two aspects, namely laboratory activities, and student problem solving.

Instrument

The data collection instrument was in the form of a questionnaire made through google form. In the preliminary study, the instrument used was in the form of a teacher's needs questionnaire to find out the activities carried out by students during learning, student learning resources and problem-solving-based laboratory activities.

Data analysis

To analyze the data collected in the study, the data collection combined and analyzed qualitatively and quantitatively by analyzing the responses of 30 teachers. Furthermore, an analysis of the results of the questionnaire analysis of teacher and student needs is carried out which is described in the form of percentages, then interpreted qualitatively.

▪ RESULT AND DISSCUSSION

The results and discussion of the data obtained in the form of a questionnaire. The results of the analysis of the needs of teachers and students on the activities of the laundry industry waste pollution laboratory to improve students' problem solving skills are in Table 1.

Table 1. Teacher's Questionnaire Results (n= 30)

No	Question	Persentase (%)	
		Yes	No
1	Do you often hold laboratory activities in science learning activities?	35	65
2	Are the laboratory activities that you have designed in accordance with the KI and KD in the applicable curriculum?	50	50
3	Have you designed lesson plan for environmental pollution with laboratory activities?	20	80
4	Are laboratory activities on environmental pollution materials that you apply accompanied by student worksheets for practicum?	30	70
5	Do you make your own practical worksheets (laboratory activities) on environmental pollution materials?	15	85
6	Do the laboratory activities on environmental pollution materials that you apply use a certain learning model?	35	65
7	Do you already know about problem solving based learning?	45	55
8	Can the environmental pollution laboratory activities that you implement help students solve problems?	50	50
9	Are the environmental pollution laboratory activities that you implement accompanied by phenomena/facts in everyday life?	45	55

10	Do the environmental pollution laboratory activities that you implement lead students to seek information about related materials?	50	50
11	Do you do the skill aspect in your learning, namely writing about solving environmental pollution problems?	55	45
12	Is the environmental pollution laboratory activity that you designed able to train students to develop concepts/skills/ideas in new situations?	40	60
13	Is the environmental pollution laboratory activity that you designed able to provide opportunities for students to show the ideas developed?	40	60
14	Are the environmental pollution laboratory activities that you designed accompanied by evaluations related to these practicum activities?	40	60
15	Do you know how to practice problem solving skills?	45	55
16	In your opinion, is it necessary to develop a laboratory activity program on environmental pollution materials to improve students' problem solving skills?	95	5

Based on the results of a survey conducted on 30 teachers in Lampung Province, 65% of teachers have not conducted laboratory activities in science learning and as many as 80% have not designed environmental pollution lesson plans accompanied by laboratory activities. As many as 70% of teachers are also in laboratory activities that are not accompanied by student worksheets for practicum. As many as 20% of teachers have designed lesson plans on environmental pollution materials, for example in water pollution, such as overcoming the problem of laundry waste. And only 30% of teachers perform the skill aspect in environmental pollution lesson plans, namely writing about ideas for solving pollution problems in their environment based on observations. In fact, the lesson plan must be achieved by students in learning about environmental pollution.

The teacher also begins learning by explaining a certain concept, then continues with practice questions taken from the student's textbook, so that the learning chosen by the teacher makes students passive because students only accept and remember what the teacher gives. As a result, students only tend to memorize the concepts that have been taught without understanding them. In fact, the ability to solve problems is an indispensable ability in everyday life or at work. Therefore, learning should provide access to students to have learning experiences that provide opportunities for the problem solving process. According to Dogru (2008), problem solving steps include understanding the problem, gathering information about problem solving, solutions, and interpreting information about the problem, determining how to solve it, determining effective solutions, preparing reports and evaluating.

Students must be able to solve problems through laboratory activities if viewed from environmental pollution lesson plans integrated science subjects, namely "analyzing the occurrence of environmental pollution and its impact on the ecosystem" with environmental pollution lesson plans, namely "writing writing about ideas for solving pollution problems in the environment based on observations. Based on the lesson plan, students are faced with many real problems in everyday life, for example, water pollution

by laundry industry waste. The example of a solution that can be applied in the laundry industry waste pollution is to use coffee grounds through a filtration process. Learning activities like this can train students' thinking.

Table 2. Teacher's Questions and Responses

No	Question	Teacher's Respons
1	What learning methods do you use in teaching environmental pollution materials?	• Lectures and discussions • Lectures • Experiment • Discussions
2	Why don't you do laboratory activities in science learning, especially environmental pollution material?	Due to limited tools and materials in schools, schools are still online, limited time and conditions, environmental pollution materials are sufficient with examples without practicum, confused about what experiments to do
3	Write down the learning model that you apply to the environmental pollution material	• Lectures • Discussion • Problem based learning (PBL) • Lectures and practice questions
4	In your opinion, how do you train students to improve problem solving skills?	• With phenomena that occur in the environment • Provide problems related to daily life • Applying more learning methods and models that train critical thinking • Engage in various projects, change mindset and focus on solutions • Giving problems to students
5	What learning resources/learning media do you use when teaching environmental pollution materials?	• Textbook • E-books • Module • Power point
	If necessary, what do you expect from laboratory activities on environmental pollution materials to improve students' problem solving skills?	• Loading events in daily life • Loading pictures and steps in solving problems • The language used is communicative

The obstacles faced by some teachers were unable to carry out laboratory activities, namely due to the limited tools and inadequate laboratory conditions, time constraints where teachers felt they could not manage time if laboratory activities were carried out. In fact, laboratory activities do not have to be carried out in the laboratory and can be done with simple tools. According to Blaine (2003), laboratory activities consist of five activities, namely: setting up and maintaining equipment (set-up and equipment care), following procedures (following procedures), data collection (data collection), security (safety), and cleaning. The application of science laboratory activities can develop students' scientific skills in observing and measuring. Students are more experienced in using measuring tools or equipment and are personally involved in data collection directly. Laboratory activities for students also increase self-development and encourage students to take advantage of self-regulation such as following instructions or procedures from the teacher (Balanay & Roa, 2013).

To be able to carry out a series of learning activities that are able to train students in solving problems, we need a learning that involves students, namely laboratory activities. This is supported by research conducted (Domin et al., 2007) where laboratory activities can assist students in improving science process skills, understanding the nature of science, cognitive aspects and student attitudes. Hofstein & Lunetta (2003) also suggest that student learning outcomes will be more meaningful if the learning is linked to laboratory activities. Therefore, learning innovations are needed that are able to integrate effective laboratory activities in improving students' problem solving skills.

▪ CONCLUSION

The conclusions obtained based on the results and discussion are that teachers have a positive perception of problem solving skills which are implemented through laboratory activity programs. Based on the teacher's perception of the analysis of laboratory activities based on problem solving, most of the teachers have not carried out laboratory activities in the learning process. This is due to various factors, one of which is the limited time in learning, although not all practicums or laboratory activities must be carried out in schools. Therefore, this is a challenge for teachers in the world of education with improvised tools and materials at school, teachers can design and arrange learning activities that are able to improve student problem solving with contextual problems in everyday life. Teachers need learning activities that involve laboratory activities so that they can improve student problem solving.

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