

Students and teachers' necessity toward virtual laboratory as an instructional media of 21st century science learning

D P Lestari¹ and Supahar²

¹Science Education, Universitas Negeri Yogyakarta, Sleman, Indonesia

²Physics Education, Universitas Negeri Yogyakarta, Sleman, Indonesia

Corresponding author: diahpuji.2018@student.uny.ac.id

Abstract. This research aims to determine the needs a virtual laboratory. The research used survey method. Instrument used were questionnaires for both teacher and students. The research used 2 class grade VII total 67 students which choosen by purposive sampling and 2 science teachers in Junior High School 6 Yogyakarta. The questionnaires were analyzed by percentage and interview analyzed by descriptively. The questionnaires contains about science learning in school, science practicum in school, the use of technology in learning, and media virtual laboratory needed in learning. The interview consist of student learning outcomes, media that are commonly used in learning, implementation of science practicum, and the needs of the virtual laboratory. The result show that 94,3% students need virtual laboratory media should be developed to supporting media for the science practicum activities. This condition was supported by interview, teachers assume that with a virtual laboratory in which there are material, videos, pictures, and simulations make students not only understand the theory but students can do practicum virtually. The teacher states that it is necessary to develop a virtual laboratory media to overcome the constraints of science practicum in schools because of that students and teachers need virtual laboratory in science learning.

Keywords: *virtual laboratory, science learning*

1. Introduction

The development of increasingly sophisticated technology in the 21st century has an impact on changing the paradigm of learning in the curriculum and media used. The 2013 curriculum, which based on the 21st century learning paradigm states that in the structure of a junior high school curriculum, the computer will be a media for all subjects. Based on this, the integration of ICT in computer-aided learning is significant. The combination of ICT in computer-assisted education can improve creative thinking skills, effective communication, high productivity, and spirituality [1]. Students who used IT-based media that do not directly develop their abilities in the field and can develop the quality of supported human resources [2]. Therefore, the use of IT-based learning media in the teaching and learning process is highly recommended to improve the quality of learning; one of them is in science learning.

Science is one of the essential subjects in secondary schools and as a basic science that underlies the development of technology. A virtual laboratory is one of the developments of computer technology as a form of interactive multimedia objects to simulate laboratory experiments into a computer to provide a meaningful virtual experience for students and present essential concepts, principles and processes. Through a virtual laboratory, students have the opportunity to repeat the



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wrong experiment or to deepen the intended experience [3],[4]. Virtual laboratories are more effective than traditional hands-on methods for acquiring scientific skills. Besides, virtual laboratories can present realistic visualizations, images, and create constructive learning environments that can improve student learning outcomes [5], [6]. But it also cannot be separated from the role of the teacher in the learning process.

The role of a teacher in good science learning as a learning resource, facilitator, guide and control of the science concepts that are understood by students. The teacher not only provides material ideas for memorised by students but prepares a learning environment that allows students to build knowledge actively [7]. Science teachers in junior high school must always follow the development of ICT in conducting learning methods that use computers and often surf the internet to find the latest science experiments. The experimental method in learning science is inseparable from the scientific method in learning science and the science process skills. This is because science obtained through a scientific approach [8]. But the fact that there are still many problems found in science learning.

The problem in science learning today is not only the low learning outcomes but also the low quality of learning that takes place. At present science learning in Junior High Schools only emphasizes content and not process [9]. In addition, science learning does not only include concepts, principles, or theories, but there are also scientific processes taught through practicum. Based on the results of observations in schools, the supporting components of science laboratory are still inadequate due to: nothing specific time for practicum, inadequate tools, and practical materials, and some do not master how to work in the laboratory. Through practicum plays an important role in learning science [10]. Practicum problems can be overcome one of them by learning media as a result of technological development.

Practicum problems can be done using virtual laboratory media. The use of instructional media in the science learning process is highly recommended to enhance the quality of learning, including virtual laboratory media. The simulation method using a virtual laboratory is one of the effective methods in applying the 2013 curriculum in the science learning process of Junior High School [11]. Virtual laboratory experience allows students to interact with scientific concepts that are difficult to observe directly [12]. The contents of virtual laboratory providing theoretical material equipped with images, animations, and videos make students to learn independently [13]. This is due to the tendency of students to now prefer things related to computers.

This study aims to conduct an analysis of the needs of the science laboratory virtual media for junior high school students and teachers. Needs analysis is a study of aspects needed by students of teachers, what components and facilities are required so that they can achieve the objectives as expected [9]. The needs analysis is the first step in the instructional design process and guides the teacher and students to choose assignments and content that is appropriate and the definition of teacher and student goals [14]. in addition to providing a better understanding of agreed goals for students [15]. Based on this, it hoped that the virtual science laboratory prepared will meet the expectations and needs of students and teachers. The results of this study will further serve as a basis for the development of a virtual science laboratory Another section of your paper.

2. Research method

This type of research is a survey. The study conducted in September 2019. Samples taken by purposive sampling of 2 class from grade VII total 67 students and two teachers in Junior High School 6 Yogyakarta. Data collection techniques used in the form of questionnaires need analysis for students and interview for teachers. Technique of data analysis used a descriptive quantitative analysis for questionnaires and descriptive qualitative analysis for interview. The questionnaires contain about science learning in school, science practicum in school, the use of technology in learning, and media virtual laboratory needed in learning. The interview comprises student learning outcomes, media that commonly used in learning, implementation of science practicum, and the needs of the virtual laboratory. Through the blueprint below, we can investigate the needs of students can be known.

Table 1. Blueprint of students' need.

Num.	Aspects	Indicators	Item questionnaire
1	Science learning in school	Interest in science material	1
		The level of difficulty of science learning	2
2	Science practicum in school	The importance of practicum in science learning	3
		The intensity of practicum implementation in schools	4
		Practicum makes it easy to understand the concept of science	5
		Problems science practicum in schools	6
3	The use of technology in learning	Student using technology in science learning	7
		An interest in learning with the help of technology media	8
		Technology media helps students to improve cognitive abilities	9
		Media most widely used by teachers	10
		Interest using power point media	11
4	Virtual laboratory media needed in science learning	Experient student using virtual laboratory media	12
		Interest using science virtual laboratory media	13
		The important of science virtual laboratory	14
		Science virtual laboratory make it easy to understand the concept of science	15

3. Results

Analysis of the needs of virtual laboratories in this study was divided into two, namely the need for students and for science teachers. The results of the needs analysis carried out by each are discussed as follows.

3.1. Analysis of Needs for Students

The result of the needs of student for virtual laboratory that show in table 2-5 below.

Table 2. Student opinion about science learning in school.

Num.	Questionnaire	Answer (%)			
		Yes		No	
		f	%	f	%
1	Are you interested in science materials?	49	73.1	18	26.9
2	Do you think that science learning is difficult to understand?	45	67.1	22	32.9

Table 2 shows that science learning in school isn't interesting and student thinks that science learning is difficult to understand. Table 3 shows students' opinions about science practicum in school.

Table 3. Student opinion about science practicum in school.

Num.	Questionnaire	Answer				Explanation
		Yes		No		
		F	%	f	%	
3	Do you think should there be practicum activities in science learning?	56	83.5	11	16.4	
4	Does the teacher always invite you to do a practicum	29	43.2	38	56.7	

Num.	Questionnaire	Answer				Explanation
		Yes		No		
		F	%	f	%	
	in every science learning?					
5	Do you think that practicum makes science learning more easily?	53	79.1	14	20.9	
6	Are there any problems in carrying out the practicum? (If you Choose Yes, mention the example in the remarks column)	58	86.5	9	13.4	Limited times, tools and material

Table 3 shows 83,5% student think that should be there practicum activities in science learning. It also reinforces the fifth questionnaire shows 79,1% student believe that with the practicum makes science learning more efficiently. But, in fact, with the questionnaire number 4 shows that 43,2 % teacher does not always invite student to do a practicum in every science learning. And it is reinforced make student difficult to an understanding of science learning. This is in accordance with the sixth questionnaire; there is any problem in carrying out the practicum like limited times, tools and material

Table 4. Student opinion about using technology in learning.

Num.	Questionnaire	Answer				Explanation
		Yes		No		
		f	%	F	%	
7	Do you study science material using technology like computers/laptops?	58	86.5	9	13.4	
8	Do you interested in learning with the help of technology like computers/laptops?	58	86.5	9	13.4	
9	Can use a computer as an instructional media increase your value?	54	80.6	13	19.4	
10	Do teachers often use computer media in science learning? What media is that? <i>(If you Choose Yes, mention the example in the remarks column)</i>	63	94	4	5.9	Powerpoint, videos
11	Is learning media in the form of powerpoints very interesting?	10	14.9	57	85	

Table 4 shows from seventh questionnaire that most student (86.5%) use technology like computer/laptop. This is consistent with questionnaire 10 (94%) that teacher often use computer media in science learning like powerpoint and videos. But from the questionnaire 11 shows 85% student not too interesting with powerpoint media.

Table 5. Student opinion about needed of virtual laboratory.

Num.	Questionnaire	Answer			
		Yes		No	
		F	%	f	%
	A Virtual laboratory is a science learning media application using a computer that contains lab simulations. The virtual laboratory is also equipped with text, images, animations, and videos. So when using virtual laboratory media, students seem to do real practicum.				
12	Have you ever practiced science using a virtual laboratory media?			3	4.5
				64	95.5

Num.	Questionnaire	Answer			
		Yes		No	
		F	%	f	%
13	Based on the explanation above, is science virtual laboratory media an interesting media?	61	91,4	6	8.6
14	Should the virtual laboratory media be developed to as a supporting media for the science practicum activities?	63	94.3	4	5.7
15	Do you agree if the practicum uses virtual laboratory media so that it can help make it easier to understand the science concept?	65	97.2	2	2.8

Table 5 shows from questionnaire 12 that most student (95.5%) never practiced science using virtual laboratory, and they are think that virtual laboratory is interesting. Then student (97,2%) agree if the practicum uses virtual laboratory media so that it can help make it easier to understand the science concept. 94,3% student shows that it is necessary to develop a virtual laboratory media that can overcome the problem of practical activities.

3.2. Analysis of Needs for Students

Analysis of the needs of the virtual laboratory given to science teachers contains student learning outcomes, media that commonly used in learning, implementation of science practicum, and the needs of the virtual laboratory media. The results of student learning outcomes show that it is known the main problem faced by science teachers is the learning outcomes of students are still low. Assessment of science material, especially students of class VII, many have not yet reached the Minimum Score Criteria (MSC), where students who achieve the MSC are usually around 24%. The needs analysis conducted are the most frequently used media by teachers in science learning, consisting of powerpoints and videos.

Not all science practicum in schools is done on every material, this is due to inadequate tools and materials, limited time, and also need laboratory assistants to help carry out the practicum. The demand for teachers to complete the material is also an obstacle to carrying out the practicum, so the learning process is not ideal. It makes students less understanding of science learning and makes learning boring because monotonous is only learning material in the classroom. Besides the achievement of student learning outcomes is limited only to aspects of knowledge (cognitive) only. So that the affective and psychomotor aspects have not yet developed. One of the media that needs to be developed to facilitate students is a virtual laboratory in which there are material, videos, pictures and simulations to make students not only discuss theory, but students can do practicum virtually. The teacher states that it is necessary to develop a virtual laboratory media to overcome practicum obstacles in schools.

4. Discussion

Science is a difficult subject for student. Based in result questionnaire is known that it's because the less interesting student of science learning. this is supported by the results of the teacher interview of student learning outcomes shows that it is known the main problem faced by science teachers is that the learning outcomes of students are still low. Every daily assessment of natural science, especially students of class VII, many have not yet reached the MSC, where students who reach the MSC are usually around 24%. Apart from science practicum aspect, in the student questionnaire result that with practicum activities make science practicum more easily. This is supported by Ismail, et all [10] science learning does not only include concepts, principles, or theories, but there are also scientific processes that are taught through practicum. But in fact practicum is rarely done by teachers for several reasons, including no specific time for practicum, inadequate tools and practicum materials, and do not have laboratory assistants.

Tecnological skill is one of part from 21st century learning framework and in education technology used as source information [16]. Based on result form questionnaire student and interview with teacher show that commonly used technology in learning is powerpoint. But from the quetionnaire 11 shows 85% student not too interesting with powepoint media. The use of this powerpoint only provides information from one perspective only [17]. The development of the 21st century, known as technological development, requires everything that utilizes technology.

One of kind tecnological skill is virtual laboratory. Virtual laboratories are interactive products that help students to carry out their trial procedures in stages, by providing appropriate learning and to expand limitations [18]. Virtual lab can support students to explore and visualize abstract concepts especially in describing the application of knowledge [19]. According to research Koretsky, et al [20] stated that students' perceptions about the use of virtual laboratory media can help them lead to the potential of experiential learning experiences. This is supported by Sari's research [21] virtual laboratory applications have a positive effect on students' attitudes and motivations. But based on the results of the questionnaire for students show that students have never used virtual laboratory media and this is supported by interviews with science teachers that science teachers have never used virtual laboratories as learning media. In addition, 94% of students stated that virtual laboratory media is an interesting learning media, and they believe that learning to use virtual laboratory media can make learning science easier. In addition, according to the results of interviews with teachers, teachers assume that with a virtual laboratory in which there are material, videos, pictures and simulations make students not only understand the theory but students can do practicum virtually. That is why virtual laboratory suits the needs of teachers and learners as instructional media of 21st century science learning.

5. Conclusion

Based on the needs analysis of students and teachers can be concluded that 94.3% student need virtual laboratory media should be developed to replace or as a supporting media for the science practicum activities. Based on result interview teachers that teachers support this condition and assume that with a virtual laboratory that contain material, videos, pictures, and simulations make students not only understand the theory but students can do practicum virtually. The teacher states that it is necessary to develop a virtual laboratory media to overcome the constraints of science practice in schools. It means that students and teachers need a virtual laboratory in science learning.

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