

Need Assessment for Designing Mobile Virtual Laboratory of Water Pollution

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ABSTRACT

The aim of this research is as a basis for designing a virtual lab application for water pollution material. Needs assessment is carried out by giving questionnaires to college students so that they can collect information related to their responses to virtual lab implementation on environmental pollution material as an alternative to the real practicum activities in the field. This research is conducted in August 2020 in the biology education program of The Faculty of Teacher and Training Education, Sriwijaya University. The correspondences of this research are 76 college students of the fifth semester. The result of need assessment based on the questionnaire showed that 81.58% of students thought that it was necessary to create a virtual lab as an alternative to practicum activities. 89.48% of students agree that water pollution material can be one of the materials that can be made in the form of a virtual lab. 90.79% of students thought that practicum activities in the virtual lab could be made in the form of games accompanied by pictures to better understanding the topics that are being practiced. Based on the result of the research, it can be concluded that the development of virtual laboratory applications can be an alternative to help improve concept mastery and overcome the limitations of laboratory facilities.

Keywords: *Need assessment, Virtual lab, Water pollution, Biology education*

1. INTRODUCTION

The laboratory is a supporting facility that can support students' skills, especially in investigative and experimental activities on a problem that occurs in our daily lives. However, there are some learning materials that require laboratories with tools and materials that must meet predetermined standards so that it is impossible to carry out practicum activities on these materials. Based on the research of Seifan et al. [1] the combination of a real laboratory and a virtual laboratory is effective in increasing student activity in different learning styles while supporting them to carry out experiments that are cost-effective, affordable and timely.

One of the learning materials that require a laboratory with costs, equipment, materials and

anticipation of work risks that must meet standards is material related to pollution, especially water pollution. So far, these practicum activities have been limited to the impact of pollution compared to the causes and environmental quality being measured. Thus, students are less able to formulate problem-solving ideas due to a lack of knowledge in analyzing changes in data related to environmental pollution problems

The limitations of laboratory facilities can be overcome by using virtual labs as an alternative learning strategy that can support in practicum activities [2]. This is also supported by research which states that virtual labs are an alternative solution to the limited learning resources in Higher Education, especially practicum [3]. The use of virtual labs in the learning process can help students in the process of investigations and experiments without thinking about the limitations of

time, tools and materials that have become obstacles to practicum activities. This is in line with the results of that the use of virtual laboratory oratory has a positive effect in providing experiences to gain skills in biology learning [4].

The implementation of virtual labs on water pollution material can provide opportunities for students to connect the fact findings with concepts in learning. In one of research stated that students' science process skills in ecosystem material increased by using problem-based virtual labs compared to classes without using virtual lab [5]. This can support students to innovate and analyze the relationship between the community structure of aquatic organisms and the response of organisms to environmental changes. Data are presented on the activities of virtual lab also be directed at the ability of higher-order thinking and critical thinking. Also, the result of Amber et al. [6] research showed that he innovative virtual laboratory design is successful in facilitating practicum activities and students gain positive experiences of the constraints of limited laboratory facilities in learning activities. These things are the basis for developing virtual laboratory applications as an alternative to create interesting learning, help improve conceptual mastery and overcome the limitations of laboratory facilities on water pollution material.

The purpose of this research is as a basis for designing a virtual lab application for water pollution material. The needs analysis was carried out with a preliminary study including field observations and giving questionnaires to students in order to collect information related to student responses to the implementation of virtual labs on environmental pollution material as an alternative to direct practical activities in the field.

2. METHOD

This research was conducted in August 2020 in the biology education program of The Faculty of Teacher and Training Education, Sriwijaya University. Respondents of this study were all fifth semester students, totaling 76 students.

This research is preliminary data for virtual lab product development research. This type of research is descriptive quantitative. The needs assessment is based on the results of a questionnaire filled out by correspondents. Questionnaire data is used to get a response about the need to use virtual laboratories in learning water pollution as an alternative to laboratory work. The data from the questionnaire were analyzed using the calculation of the number of respondents'

answers in one item divided by the number of respondents then presented

The method used in this research is descriptive qualitative research method. The purpose of descriptive research is to describe the phenomenon and its characteristics and to collect data using survey tools. Qualitative research collects data qualitatively, involves data to identify recurring themes, patterns, or concepts and then describing and interpreting them according to their categories. The results of this study are used as an initial assessment of the need for virtual lab development products on water pollution material.

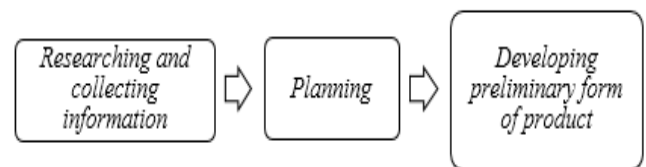


Figure 1. Steps of designing virtual lab product

3. RESULT AND DISCUSSION

3.1. Result

The questionnaire was used to obtain data on student needs for the development of virtual lab. The questionnaire was distributed online using Google Form. This was chosen as an effort to accelerate the spread over a wide range. In addition, the condition of the Covid-19 Pandemic requires researchers to maintain distance and maintain health protocols. Following are the results of the analysis of the needs for the development of a mobile virtual lab on water pollution material which are presented in Table 1.

Table 1. Using virtual laboratory in learning

Aspect	Answers	Percentage (%)
Virtual laboratory for practicum activities	Yes	81,58
	No	18,42
Virtual laboratory on water pollution material	Yes	89,48
	No	18,42
Virtual laboratory into game	Yes	90,79
	No	9,21

In addition, an analysis of the dominant color choices was carried out both of them at the beginning of the virtual lab display and the inside of the virtual lab in Figure 2 and Figure 3. Then it is also analyzed the need for a typeface or font that will be used at the beginning of the virtual lab display and the inside of the virtual lab in Figure 4 and Figure 5.

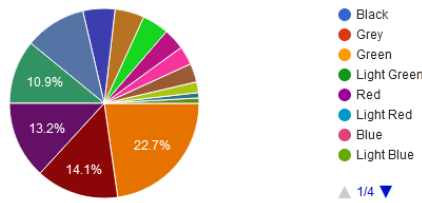


Figure 2. Color options for *virtual lab* initial

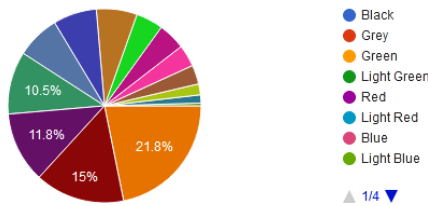


Figure 3. Color options for display in *virtual lab*



Figure 4. Font options for *virtual lab* initial display

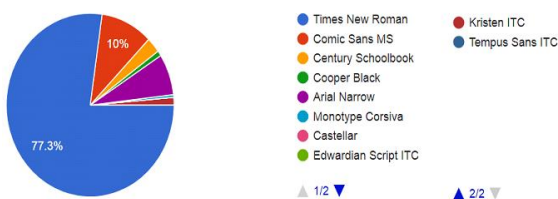


Figure 5. Font options for display in the *virtual lab*

Figure 2 shows the percentage of colors selected at the start of the virtual lab display. Figure 3 shows the percentage of color selected in the virtual lab. Figure 4 shows the percentage of fonts that will be used at the start of the virtual lab display. Then Figure 5 shows the percentage of fonts that will be used in the virtual lab view.

3.2. Discussion

The results of the analysis of student needs for the development of the Mobile virtual lab were carried out by distributing questionnaires online via Google Form to 76 students. Based on the results obtained, 81.58% of students gave “Yes” answer to practicum activities made in the form of virtual labs. This shows that students agree that practicum activities are made in virtual form. According to Suryati et al. [7] that students mostly tend to give positive perceptions of the use of virtual laboratory. Besides that, according to Dominguez et al [8] that practicum activities have virtually motivated students to equip students with knowledge other than hands-on .

If analyzed from the material. Lecture material such as water pollution is material that students assess 89.48% agree to be made into virtual practicum activities. According to Tatly & Ayas, the material carried out with virtual lab activities can be related to limited laboratory facilities [2]. The limitations of this laboratory facility can be overcome with a virtual lab as an alternative learning environment that can assist in practicum activities to replace face-to-face practicum activities. Research of Hanson et al. [9] concluded that visualization using access mobile devices can make it easier for students to get learning information and increase student satisfaction in accessing information in conditions of limited access.

Then, it is explored whether the development of virtual labs into games is a development that is approved or interested by students or not. Based on the results of the analysis also needs data showed that 90.79% of the students agree that practicum in the virtual lab can be created a game that is accompanied by images for understanding the practicum topic more. In addition, the creating game in this virtual lab was developed using a mobile phone. Its advantages include learning that it can be done anywhere and anytime because it can adjust the mobility of its users. Based on Dewi [10], games are one of the features that are in great demand by both children and adults so that the development of education-based games can be an alternative in learning innovation so that it can attract students in the learning process. Also, the application of virtual labs in games has potential in supporting learning process in science [11].

This is in line with that expressed by Monikowati & Iskandar [12] that a virtual lab which is developed into mobile phone will be easier for student to learn because it can be used by users everywhere. According to Basak, Wotto, and Belanger [13] that mobile learning is one of information and communication technologies that can

be used in learning and is regarded as one of the tools of learning. It's also supported with the research by Mayer [14] that Learning using mobile technology (mobile) such as tablets, cell phones can help students learn academic content. This shows that cellular technology (mobile) also plays an important role in the advancement of education.

In addition, the analyzing process of the needs have been described in before. Researchers also analyzed both the dominant color choices at the beginning of the virtual lab display and the inside of the virtual lab as well as the need for a typeface or font that will be used at the beginning of the virtual lab display. According to Tendero et al. [15] mobile Virtual Lab used for learning must offer the visuals needed by users. In addition, a mobile virtual lab must consider the appearance of a small screen on a mobile device.

Based on Figure 1, it is obtained data that 22.7% of the desired and dominant color chosen for the initial appearance of virtual lab activities is light blue. She was then followed by other color choices with a lower percentage, such as green, light green, black, blue color. This shows that students prefer to use light blue in the initial virtual lab appearance. Then Figure 2 shows that 21.8% of the desired and dominant color chosen for the part in the virtual lab activity view is light blue. Then followed by other color choices, it has a lower percentage such as light green, black, blue and so on.

This shows that students prefer to use the light blue color in the interior of the virtual lab. In Line with it, Huang et al. [16] stated that The effect of virtual color affects a person's visual in cyberspace which affects his actual perception which affects multi-sensory integration.

Figure 3 shows the percentage of the desired and dominant types of writing at the beginning of the virtual practicum activity. As much as 77.7% of students chose Times New Roman typeface at the beginning of the virtual lab display. Then followed by other selected fonts with a lower percentage such as Comic san MS, Arial Narrow and so on. This shows that students prefer to use the Times New Roman font at the beginning of the virtual lab display. Figure 4 shows the percentage of the desired and dominant types of writing in the virtual practicum activity. As much as 77.3% of students chose Times New Roman fonts in the inner virtual lab display. Then followed by other selected fonts with a lower percentage such as Comic san MS, Arial Narrow, Century Schoolbook and so on. This shows that students prefer to use Times New Roman fonts in the virtual lab interface. This was revealed by Jaya that the need to develop a virtual lab is not limited to the medium. Another thing that can be analyzed is the need for color and writing users to support virtual LAN according to the wishes of users who study and understand the material [17].

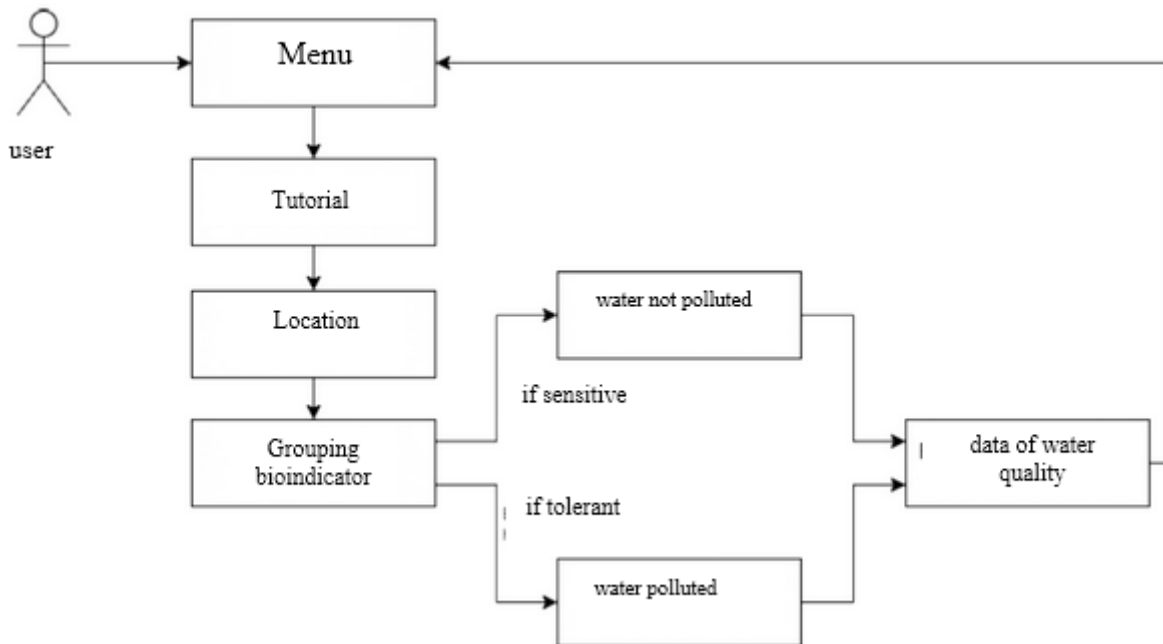


Figure 6 Flowchart of designing mobile virtual lab

The use of virtual laboratories has great educational potential because it can involve students in exploring, constructing and manipulating objects. Most of the students recommend virtual laboratory as a form of distance learning [18]. The design and implementation of virtual laboratories can be used to solve specific interdisciplinary problems. Teachers and students use the mobile virtual lab without the need to install any additional devices on the computer [19]. Also, Well-designed and correct experiments in a virtual lab can provide increased knowledge of students [20].

4. CONCLUSION

Based on the results and discussion above, it can be concluded that. In the early stages of virtual lab product development, it can be started by conducting a needs assessment. Based on the needs assessment is known that 81.58% of the students agreed that if the practicum is made into the form of a virtual lab, then 89.48% of students agreed that if the virtual lab was carried out on the material water pollution, and 90.79% of the students agreed that practicum activity in the virtual lab can be made into a game. Furthermore, for the initial display color choices and the inside of the virtual lab is a light blue color and the type of writing chosen for the initial display and the inside of the virtual lab is Times New Roman. It was created by the wishes of student in order to facilitate student for creating interest learning, so they can easily understand the material.

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