Proceeding International Conference on Religion, Science and Education (2023) **2**, 17-20

Perceptions and Responses of Prospective Biology Teachers on The Use of Virtual Laboratories in Learning Plant Tissue Biology Material

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Abstract: This study aims to examine the perceptions and responses of prospective biology teachers towards the use of virtual laboratories in teaching plant tissue material. This research involved prospective biology teachers, namely biology education students from universities in Indonesia. Students answered 15 questionnaire questions which were distributed online. Questionnaire result data will be analyzed quantitatively and qualitatively. This study shows the results that prospective biology teacher students have positive perceptions and responses to the use of plant tissue virtual laboratories in biology learning. Biology teacher candidate students strongly agree that the plant tissue virtual laboratory is easier to use in terms of accessing and displaying microscopic visual images of plant tissue. Responses from biology teacher candidate students indicate that they agree to use the plant tissue virtual laboratory as a biology learning medium. The use of a plant tissue virtual laboratory also has the potential to increase student motivation and learning outcomes in learning plant tissue biology material.

Keywords: Virtual laboratory, biology Learning, perceptions, prospective biology teachers.

Introduction

In the 21st Century, the world is constantly changing with technological advances. Technology facilitates various sectors of life, including the world of education. Technology in the world of education has become a necessity in every learning activity. In Indonesia itself, the world of education was assisted by technology when massive online learning began to be implemented suddenly in early 2020 due to the COVID-19 pandemic. The COVID-19 pandemic has changed the way of face-to-face learning in class to virtual face-to-face from home. Based on the Circular Letter of the Ministry of Education and Culture of the Republic of Indonesia Number 4 of 2020, teaching and learning activities are carried out from home to prevent the spread of COVID-19.

Learning plant tissue requires careful study, discussion, and laboratory procedures for various microscopic visualizations of plant tissue. For this reason, learning facilities are needed that support student activities in studying the material. However, there are still constraints on limited laboratory facilities in several educational units. An alternative solution is to develop a virtual laboratory (virlab) application which is expected to overcome the limitations of laboratory facilities and give students the experience of 'working' in the laboratory.

Virlab is an application and web interactive simulation of experiments where all the manipulations are done inside the computer. Virtual laboratory is a software that simulates experiments in real laboratories. Virlab has been popularly used in most science lessons, especially because it is supported by increased computer capabilities in information processing. Various virlab applications related to biological content as well as virtual biology equipment have been developed and used in learning, for example

ISSN 2829-3355 | EISSN 2828-8467

biotechnology virtual labs, virtual microscope, virtual transgenic, virtual immunology, virtual morphology laboratory and in the fields of microbiology and pharmaceutical toxicology (penjak & Šorgo, 2017). Most of Virlab's software features 3D graphics that enhance the user experience, but the level of detail of the Virlab environment varies. Virlab's software products are available on multiple platforms, including desktop and web-based. Desktop versions generally have better graphics and higher quality content (Raineri, 2001).

Virtual laboratories have several advantages, namely being flexible in setting practicum times and locations, practicum results are immediately available and reliable, practicums can be repeated immediately, no need to buy laboratory equipment and materials frequently, experiments are safe and economical because they allow 'work' with hazardous or expensive materials, and the shorter the duration of the experiment regardless of the availability of actual experimental facilities, minimal work procedure errors and experimental handling errors, and also minimal use of reagents increases work safety in the laboratory and is a more effective way to focus students in understanding difficult concepts. On the other hand, there are limitations or weaknesses in using virlab in learning, namely the loss of acquiring hands-on skills in working in real laboratories, the lack of connections between designs and experimental results, and the level of socialization or collaboration among students becomes lower (Špernjak & Šorgo, 2009); limited possible actions, poor manual responses, and possible lack of proper experience when dealing with real laboratory facilities (Potkonjak, et al., 2016).

Based on existing research, there has been no research on the perceptions and attitudes of prospective Biology Education teachers regarding the potential use of virtual laboratories as learning media in plant tissue material in Biology Learning. Many studies focus on the use of virtual laboratories in teaching biology to students. Therefore, this study aims to explore the potential use of virtual laboratories as a medium in Biology Learning based on the perceptions and attitudes of prospective biology teachers. The findings of this study contribute to providing basic information for lecturers, students, and teachers regarding the perceptions and attitudes of prospective biology teachers towards virtual laboratories as learning media in plant tissue material. This will be a consideration for policy makers to issue relevant policies and improve educational facilities and services in the field of quality learning media.

Materials and Methods

This research uses mixed-method research by combining quantitative and qualitative research methods. Data collection is done by using a questionnaire. the questionnaire was distributed in the form of a google form contains 15 questions. Questions were answered using a 5-point Likert scale. The questionnaire was filled out by prospective biology teachers who are active students from various semesters.

Results and Discussion

The results of the analysis of data filling out the questionnaire conducted by 67 respondents stated that prospective biology teachers were familiar with virtual laboratories. They have often used Virtual laboratories in Microteaching. The biggest percentage is 70% in using the Virtual laboratory. Thus, technical problems in using virtual laboratories can be reduced because respondents are familiar with using virtual laboratories.

Table 1. Perceptions of Prospective biology teachers on the use of plant tissue virtual laboratories in biology learning

Peceptions	Mean	Result
I am well acquainted with the "virtual laboratory" of Plant tissue	52 %	Agree
I once used a Plant tissue "virtual lab".	52.2 %	Agree
I can understand very well the plant tissue material in the plant tissue "virtual laboratory".	39.1 %	Agree
Virtual plant tissue laboratory is easy to access	47.8 %	Agree
It is very easy to operate the plant tissue Virtual Laboratory	47.8 %	Doubtful

Table 1 shows the responses of prospective biology teachers to perceptions about using the Virtual

Laboratory in biology learning. Prospective biology teachers respond 'agree' on the use of the Virtual Laboratory in class. These results indicate that prospective biology teachers respond positively to the use of the Virtual Laboratory in biology learning. Prospective biology teachers assess that Virtual Laboratory is easy to access as a learning platform. Many teachers also use Virtual Laboratory media as online learning media because of its easy operation. The convenience of Virtual Laboratory features is also a distinct advantage. This is in line with research conducted by Evy Suryanti et al. (2019) on Students regarding perceptions of using Virtual Laboratories in learning Molecular Biology

Table 2. perceptions of prospective biology teachers on the potential of plant tissue virtual laboratories as media in the learning process

Peceptions	Mean	Result
Material features of the Virtual Laboratory of plant tissue can be used in biology learning of plant tissue material	60.9 %	Agree
The use of plant tissue virtual laboratories in biology learning has the potential to increase student motivation	52.2 %	Agree
The use of plant tissue virtual laboratories in biology learning has the potential to increase interaction between students	52.2 %	Agree
The use of plant tissue virtual laboratories in biology learning has the potential to increase student creativity	43.5 %	Agree
The use of plant tissue virtual laboratories in biology learning has the potential to create fun learning for students	65.2 %	Agree

Table 2 shows perceptions of prospective biology teachers on the potential of plant tissue virtual laboratories as media in the learning process From the results it can be seen that prospective biology teachers gave responses ranging between 'agree' . Prospective biology teachers agree with the use of the Virtual Laboratory which can increase student learning motivation. the use of Virtual Laboratory in learning can increase student motivation. Various Virtual Laboratory features can be used to increase student learning motivation. Furthermore, prospective biology teachers responded 'strongly agreed' on the use of Virtual Laboratory to increase interaction, creativity and fun learning for students. In case of interaction, Virtual Laboratories can bring students closer even though they are far apart because social media can 'bring closer' those who are far away so that they can 'easier' the communication process (Sari, 2017). Utilization of the Virtual Laboratory in learning that contains descriptive text can be fun learning for students

Table 3. Responses of prospective biology teachers to the use of plant tissue virtual laboratories in the learning process

Peceptions	Mean	Result
I agree to tell other biology teacher candidates that it is very effective to use a plant tissue Virtual Laboratory	39.1 %	Agree
I prefer to use Virtual Laboratory media on plant tissue material in biology learning	39.1 %	Agree
Interesting plant tissue virtual laboratory is used for biology learning	56.5 %	Agree
I agree that the Virtual Laboratory of plant tissue can increase students' interest in learning plant tissue material	60.9 %	Agree
Overall I like the use of the Virtual Laboratory in learning plant tissue biology material	56.5 %	Agree

Table 3 shows the attitude responses of prospective biology teachers to the use of the Virtual Laboratory in biology learning. Prospective biology teachers responded with a range of 'agree'. Prospective biology teachers agree that the Virtual Laboratory is inherent in their daily lives. Prospective biology teachers also agree that they are proud to use the Virtual Laboratory. In addition, prospective biology teachers like the use of the Virtual Laboratory application in teaching biology. Even so, prospective biology teachers do not agree if there is a feeling of being left behind when they do not open a Virtual Laboratory in learning plant tissue material. This shows that prospective biology teachers are not dependent on always opening the Virtual Laboratory application. Prospective biology teachers also disagree if they prefer to use the Virtual Laboratory in online teaching rather than face-to-face. Basically, the integration of social media technology is not to replace traditional methods, but only to improve the teaching and learning process. Virtual Laboratory can be an alternative online learning platform and overcome the problem of lack of laboratory facilities in schools.

Conclusions

Based on data analysis and discussion, it can be concluded that evenly most students have a positive perception of the use of virtual laboratory applications in learning plant tissue biology

material, although a small number of students are still unsure. The results of this study can be used as a basis for further developing virtual laboratory applications as an alternative to create more interesting learning, help improve mastery of concepts, and overcome the limitations of laboratory facilities.

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