

Student's Perception in Virtual Experiment using PheT Simulation

Naila Fauza
Department of Physics
Education
Universitas Riau
Pekanbaru, Indonesia
nailafauza@lecturer.unri.ac.id

Diah Anugrah Dipuja
Department of Biology
Education
Universitas Riau
Pekanbaru, Indonesia
diahanugrah@lecturer.unri.ac.id

Neni Hermita
Department of Elementary
Education
Universitas Riau
Pekanbaru, Indonesia
neni.hermita@lecturer.unri.ac.id

Jesi Alexander Alim
Depart of Elementary
Education
Universitas Riau
Pekanbaru, Indonesia
jesi.alexander@lecturer.unri.ac.id

M Yogi Riyantama Isjoni
Department of economic
Education
Universitas Riau
Pekanbaru, Indonesia
m.yogi@lecturer.unri.ac.id

Fanny Rahmatina Rahim
Department of Physics
Education
Universitas Negeri Padang
Padang, Indonesia
fannyrahmatina@fmipa.unp.ac.id

Abstract—Covid-19 pandemic changed the procedures for implementing various aspects of life such as education. virtual experiments is the best solution in overcoming imperfections in physics learning. Virtual simulation media known as Virtual Laboratory Model (VLM) using PheT simulation is a program consisting of a collection of interactive virtual simulations, so that everyone can carry out experimental activities without the need for an actual environment. So we need analyze Student's Perception about Virtual Experiment using phet simulation. The research was carried out at SMAN 4 Pekanbaru. The sampling technique with purposive sampling. This type of research is descriptive research with mixed method such as quantitative and qualitative methods. it can be concluded that virtual laboratory learning is effective in learning. Students feel safe, fast, and easy in doing Virtual laboratory helps students in understanding physics concepts. Phet simulation has several drawbacks, namely the interaction of discussions among students is not effective.

Keywords—student's perception, virtual experiment, PheT simulation

I. INTRODUCTION

Currently, multimedia in learning activities is one of the real evidences in the 21st century [1][2][3][4][5][6]. the flow of globalization which has a major impact on the adaptation of the use of ICT, the covid-19 pandemic has also indirectly changed the procedures for implementing various aspects of life such as education. The learning process, which is usually carried out in schools, now requires a temporary closure to break the chain of the spread of COVID-19. School closures have affected more than 1.5 billion children and youth. This is because 188 countries have implemented school closures across the country[7][8]. As a result of school closures, the government issued a policy that teaching and learning activities must be carried out online or distance learning in accordance with the Circular Letter of the Minister of Education and Culture Number 36962/MPK.A/HK/2020. The policy is made so that the desired learning objectives can still be achieved [9]. Distance learning, which is now used as an alternative, makes each user need time to adapt. Indirectly, these new habits have an impact on the level of learning absorption of each student [10].

Physics is not just a formula but also an understanding of concepts by relating it to everyday life [11]. As a result of learning methods that seem monotonous, each student becomes less familiar with concepts and even finds it difficult to relate fundamental relationships during the teaching and learning process [12]. Many studies have shown that there are problems with online learning and materials related to physics. First, online learning requires learning media or those that are considered effective so that the learning process runs smoothly [13]. Second, there is an assumption that physics is difficult, resulting in the low attractiveness of students in participating in physics learning [14]. Third, learning methods that are considered less attractive (such as lectures and blackboard media), so that students' absorption of sentences that educators convey is relatively small. Fourth, physics material which is generally abstract and its mathematical concepts require high logic and concentration (such as dynamic fluids), so that it has an impact on students' low understanding of concepts. Fifth, many students still experience misconceptions so that solutions are needed to reduce and improve students' misconceptions towards scientific concepts [15].

The use of ICT in education such as virtual experiments is the best solution in overcoming imperfections in physics learning, especially in the midst of the current pandemic. Through the application of virtual experiments, it is expected to reduce verbalism, so that each student can take a role during learning [16]. Virtual experiments such as VLM (Virtual Laboratory Model) is one of the uses of educational technology that can be used to modify and display the complete experiment. One example of a VLM that is widely used is PhET. PhET Simulation Interactive is a VLM. Through PhET (Physics Education Technology) Simulation Interactive, each user is given the freedom to take on a role. Users will become more active, think critically, and be creative, because they can synchronize between virtual laboratories and real labs [12].

PhET has advantages in learning such as: 1) PhET simulation is able to properly visualize abstract material concepts when learning is presented with the lecture method [17]. 2) Learning outcomes using PhET simulation are more

effective than simple KIT; 3) Learning that utilizes PhET simulation obtains better learning outcomes [12][13]. Some of the benefits of using PhET include: 1) Reducing time constraints; 2) Reducing geographic barriers; 3) Economical; 4) Improve the quality of experiments because experiments can be carried out ideally ; 5) Increase security and safety because students do not come into direct contact with the actual tool [20]. In addition, the simulations contained in PhET are easy to use, interactive, and can be run both online and offline [21].

Media means an intermediary or delivery of messages from the sender to the recipient of the message [22]. Simulation can also be interpreted as a way of reproducing the conditions of an existence by using models in the context of introduction studies, testing, training and others [23]. Virtual simulation media or also known as Virtual Laboratory Model (VLM) is a program consisting of a collection of interactive virtual simulations, so that everyone can carry out experimental activities without the need for an actual environment [24]. PhET simulation interactive is one of the rapidly growing VLMs, especially in science learning such as physics [12]. PhET (Physics Education Technology) is a free licensed, research-based interactive simulation program. PhET was founded by Carl Wieman under the University of Colorado, USA [25]. Physics learning materials such as fluids which are classified as abstract and difficult to conduct experiments in the midst of the covid-19 pandemic, increasingly support the application of PhET as part of the learning media. Therefore, it is necessary to analyze Student's Perception about Virtual Experiment using phet simulation. The purpose is analyze Student's Perception about Virtual Experiment using phet simulation.

II. METODOLOGY

The research was carried out at SMAN 4 Pekanbaru. sampling technique with purposive sampling is a technique of determining and taking samples determined by researchers with certain considerations [26]. the population is all students of SMAN 4 Pekanbaru and the sample is class XI IPA 2 semester 1 students for the 2020/2021 academic year as many as 20 people. The physics material being tested is fluid. This type of research is descriptive research with mixed method such as quantitative and qualitative methods. The quantitative method is a questionnaire about students' perceptions of virtual media, while the qualitative method is a descriptive analysis explaining the questionnaire. The questionnaire consists of a closed questionnaire and an open questionnaire. Closed questionnaire has a choice of answers "yes" and "no" consisting of 14 question items. Yes has a value of 1 and does not have a value of 0. The open questionnaire consists of 3 question items. Open questionnaires aim to give students the freedom to provide answers or responses, usually in the form of questions and students can write their own answers in the form of descriptions [27]. The data analysis technique used in this study is qualitative analysis which consists of data collection, data reduction, data presentation, and conclusions [28].

$$\frac{\text{students answered yes/no}}{\text{total students answered}} \times 100\% \quad (1)$$

Categories of data analysis results are presented in Table I [29].

TABLE I. CATEGORIES OF STUDENTS' PERCEPTION ANALYSIS RESULT USING VIRTUAL LAB MEDIA

Percentage	Categories
86 – 100%	Very good
76 – 85%	Good
60 – 75%	enough
55-59 %	not enough
≤ 54%	not much

III. RESULT AND DISCUSION

The results of the student perception questionnaire in using virtual Phet simulation media are presented in the following Table II.

Based on the data stated that the virtual laboratory is beneficial for students. Result of this study showed that virtual laboratory applications made positive effects on students' achievements and attitudes when compared to traditional teaching methods [30]. PhET simulation can increase mastery of concepts because through a virtual laboratory physics concepts are presented in an applicative manner according to facts, making it easier for students to master physics concepts, both abstract and real [31]. PhET makes it easier for teachers and students in the learning process, so that it can foster motivation for students and improve students' understanding of concepts [32].

TABLE II. STUDENT PERCEPTION RESULTS USING VIRTUAL LABORATORY PHET SIMULATION

No	Statement	Yes	No	Category
1	I can use virtual lab program on fluid topic	100%	0	Very good
2	I learned a lot about fluid concepts by using the virtual laboratory	92%	8%	Very good
3	I understand doing practicum using virtual laboratory	92%	8%	Very good
4	I understand about fluid concepts by using a virtual l laboratory	92%	8%	Very good
5	I better understand the teacher's explanation by using the virtual laboratory	100%	0	Very good
6	I find it easier to prepare for practicum by using a virtual laboratory	100%	0	Very good
7	I find it easier to retrieve practicum data by using a virtual laboratory	100%	0	Very good
8	I find it easier to analyze lab results using a virtual laboratory	100%	0	Very good
9	I'm safer using a virtual laboratory	100%	0	Very good
10	I feel it is faster to do practicum by using a virtual laboratory	100%	0	Very good
11	I feel less stressed when using the virtual laboratory	46%	58%	not much
12	Is using phet in learning a good idea?	100%	0	Very good
13	Do you agree that using phet helps you study anytime and anywhere?	98%	8%	Very good
14	Does learning through phet increase your learning motivation?	100%	0	Very good

PhET's virtual simulation features are interactive and visualization making it effective for increasing understanding of abstract physics concepts, even those that contradict intuition [33]. 92% of students agree that Virtual laboratory used phet simulation makes it easier for students to do practicum. Student surveys indicate that students perceived the virtual CVD laboratory as the most effective learning medium used, even above physical laboratories [34].

Based on the results of the questionnaire, there are 46% of students experiencing stress in the use of Phet simulation. Students are not familiar with the use of phet so students have difficulty using existing features. This causes the abstract information is not clearly known [33]. The success of virtual laboratory-assisted learning depends on the independence of students to follow the learning process [35]. Therefore, a practical guide is needed. Next, virtual laboratories have been proposed to reduce cost and simplify maintenance of lab facilities while still providing students with access to real systems. [36]. Even though virtual laboratory is easier, more effective, and simple, but we can't leave the real laboratory. For many students, however, a lack of familiarity with the laboratory was not seen as the major source of their anxiety and therefore a resource allowing them to become familiar with the laboratory did not have a major impact on their learning experience [37] [38][39][38][40][41][42][43][44]. Interaction between fellow students in discussions is less effective in virtual laboratories [15]. This is because virtual learning has limited interaction. Students can only stare at the screen to discuss without physical interaction.

IV. CONCLUSION

Based on the explanation and discussion that has been described, it can be concluded that virtual laboratory learning is effective in learning. Students feel safe, fast, and easy in doing practicum. Virtual laboratory helps students in understanding physics concepts, both abstract and concrete concepts. Phet simulation has several drawbacks, namely the interaction of discussions among students is not effective.

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