International Journal of Engineering &Technology, 8 (3) (2019) 308-314

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper



Virtual reality use in online learning

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Abstract

This study aims to describe the application of virtual reality use in online learning for students' in Higher Education. The research located at Educational Technology study program, Universitas Negeri Jakarta, Indonesia. The study focused on learning theories, learning method and learning model used in technology to improving learning outcomes in the classroom. The method uses explanatory sequential mixed method research. The first phase, data collected by a quantitative approach by distributing instruments to 300 respondents. The second phase, analyze the result through a qualitative approach. The data conducted by observation in the class, collaboration with 30 students' in the academic year 2016 and 6 lecture of Learning Theories and Learning for an interview. The results shows indicate that using virtual reality can be foster motivation to learn develop students' skill in learning model simulation and learning can be efficient and effective. Virtual reality also can improve students' to teaching practice and exercise students' to create innovation learning model use in technology.

Keywords: *Virtual Reality; Online Learning; Higher Education.*

1. Introduction

Technology affected to students' learning. In this era of technologies such as virtual reality environments allowed us to create and validate the representative environment [1]. Indonesia has an educational institution that focused on producing teachers. One of an educational institution is Universitas Negeri Jakarta. Based on the regulation in Indonesia No.14 year 2005 about teacher and lecture and the regulation Minister of Education and Culture No.16 year 2007 about academic qualification and professional teacher competences the purpose of education in the education study program is graduate preparation who has skill in scientific fields with hard skill and academic values such as creative, innovative, professional, confident and polite. Curriculum development of Universitas Negeri Jakarta as one of the Teacher Training Institution called LPTK including study program curriculum. The LPTK (Teacher Training Institution) also focused on the structuring terms of the group coherence of general subjects, primary education subject in knowledge revitalization and skill and then the other subject is considered to be able to strengthen superior and innovative soft skills and personality. In order to design learning using digital technology, educators need to be aware of the types of technology available for education and the abilities they have[2]. Educational technology in this context is considered the implementation of relevant tools and processes that improve teaching practices and facilitate increased learning. The interactive of technology that combines the real world and the virtual world is virtual reality[3]. The development of virtual reality technology is not only become markers as a place to bring up 3D objects but already entered into the mobile world [4]. Develop virtual reality use game engine technology in the form of Unity 3D [5]. It can combine various multimedia technologies into one platform. Meanwhile, unity 3D can be updated if there is a change[6].

2. Literature review

Virtual reality has soared all aspects of life and is projected to experience significant development in the future. Virtual reality also the interactive three-dimensional computer environment that simulates reality and useful for simulation and off-line programming to improve training students'[7]. Virtual Reality is a medium with tremendous potential. The ability to be transported to other places, to be fully immersed in experiences, and to feel like there present opens up unimagined ways to interact and communicate [8]. Virtual reality can cover various types of digital creations, ranging from various forms of multimedia, 3D reconstruction and so on [9]. Larsen, Oestergaard, Ottesen and Soerensen in [10] explained about virtual reality used widely in medical training. Segura and Gracia[11] also researched about intradialytic virtual reality exercise to increasing physical activity through technology. In the other side, Cabrero, et.al [12] was developed virtual reality as a learning tool in sociodemographic profile. Virtual reality research related always innovative such as the integration of properties of virtual reality by Edgar Serna [13].

. The background is the development of various new learning models to improve the efficiency and quality of teaching and learning. Among them is the emergence of technology, virtual reality in the rapidly developing and most enchanting class with various subversive

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advantages. This study solved the integration of the entire virtual reality class, including composition, scene design that is various disciplines and its main advantages. In case studies on geography, learning is provided to show strengths and strong potential. Virtual reality has attracted the attention of both industry and education. Virtual Reality Simulation: Using three-dimensional technology to teach nursing students This research is motivated by the use of rapidly evolving computerized technology in the nursing class [14]. One of them is the use of virtual reality simulations that can simulate the condition of patients in real life in a risk-free artificial environment, make it possible to do repetitive exercises, expose students to simulations with diverse patient conditions, provide immediate, quick and easy feedback.

The results of the study describe the importance of virtual reality simulation as one of the online learning strategies. Simulations presented with virtual reality are also able to increase students' knowledge of intravenous catheter insertion procedures. Students have various learning experiences that can connect directly with supporting literature and can offer quick feedback to students in the event of a procedural error. Based on the two previous studies, it appears that there is no link between the learning of virtual reality objects and online learning, and no one has discussed the development of learning virtual reality objects such as those suitable for simulation and tutorial approaches, strategies and effective learning methods. For this reason, the focus is on learning virtual reality objects for online learning that are used in lecture activities in the subjects of Theory of Study and Learning at Jakarta State University.

In this study, the developing of virtual reality is a technology that enables one to simulate methods, strategies and learning approaches contained in theory of study and learning courses by using virtual reality devices that are able to evoke a three-dimensional atmosphere (3-D) so as to make students seem to be physically involved in the existence of the class, see the classroom environment and carry out activities that mimic the atmosphere in the real classroom with the addition of 360 ° technology, allowing students to observe the classroom like real.

3. Methodology

This study used mixed methods involving combining or integration of qualitative and quantitative research by Cresswel [15]. The models for this research are explanatory sequential mixed methods. In this online learning program is in the form of tutorial videos and simulations on material approaches, strategies and learning methods that are packaged using virtual reality with the help of cardboard (VR glasses). All virtual reality are integrated into modular online learning using the Chamillo Learning Management System (LMS) which is expected to help students gain knowledge and experience in learning materials in the subject of Theory of Study and Learning which is a cluster of Basic Education Courses. The virtual reality was developed by taking into account the advantages of subject matter, auxiliary information, affective considerations, interfaces, navigation, pedagogy, invisible features, robustness, and supplementary materials. Research using mixed methods is a research approach by combining qualitative and quantitative research. Mixed methods produce more comprehensive facts in researching research problems because these researchers have the freedom to use all data collection tools according to the type of data needed. While quantitative or qualitative is only limited to certain types of data collection tools. Mixed methods are methods that combine qualitative and quantitative approaches in terms of methodology (such as in the data collection stage), and mixed model studies combine two approaches in all stages of the research process. Ritchie and Lewis[16] said that mixed methods research questions are concerned with unknown aspects. Mixed methods are also referred to as a methodology that provides philosophical assumptions in showing directions or giving instructions on how to collect data and analyze data and the combination of quantitative and qualitative approaches through several phases of the research process. Like the trans-formative design, the multiple stages design are complex design that builds on the basic convergent, explanatory, exploratory and embedded designs. Multiple stages mixed methods designs occur when the team of researchers examines a series of phases or separate studies[17].

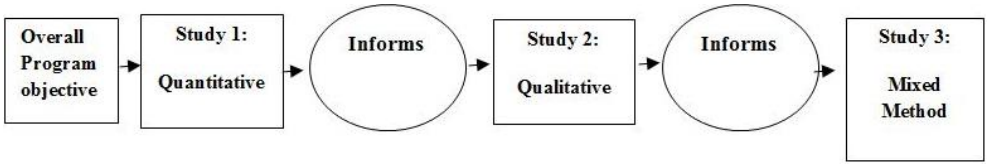


Fig. 1: Multiple Stages Design (Source: Creswell, p.54).

From the graph above in this design, according to Plano Clark [17], it consists of first collected quantitative data and then collected qualitative data to help explain to elaborate on quantitative results. For this reason, the researchers decided the initial stage was done by collecting data quantitatively. The researcher surveyed 300 respondents using a closed questionnaire that was validated using a Likert scale and contained ten questions. The second stage was carried out by collected qualitative data that is worked together with 6 lecturers of Theory of Study and Learning. Three of six lectures able to use educational technology well for example web-based applications and e-learning. while three other lecturers use Power-point more often. And also interviewed with 30 students selected by purposive sampling to conduct interviews. This student was chosen from 300 respondents who had conducted the survey. In the implementation of online learning, researchers acted as facilitators and admins. This study was conducted on 3 classes that did not use online learning and 3 classes using online learning. The researcher then explained that students would take online learning the time provided for attending this study for 5 meetings. While participating in online learning, they studied the material in each session and work on the questions at the end of each session before being able to continue to study the next meeting material. Student's identities and it was relationship with their engagement in online learning. They studied learning virtual reality objects repeatedly, regulated the speed of their learning in online learning everywhere. After conducted online learning for 5 meetings, researchers evaluated students to find out the effectiveness of the online learning. Learning evaluation refers to the evaluation of the effectiveness of learning presented which consists of four phases, there are reaction, learning, behavior, and results.There are evaluation of reactions and evaluation of learning. Reaction evaluation aims to find out the feelings of students after participated in learning.

Reaction evaluation is done by giving questionnaires to students; the question indicators for reaction evaluation refer to the indicators developed [18]. The indicator of questionnaires was made in the form of an attitude scale whereas learning evaluation is the giving of test questions to students in the form of multiple choices. Based on the results of online learning evaluation, it was program can be said to be

effective because achieved with a score of 80 from all learning outcomes and performance tests. When researchers conducted experimental feasibility trials, there were several data in the form of numbers (quantitative data) sourced from questionnaires and test results. The assessment questionnaire for the development of virtual reality material and questionnaires to measure the ability of students to carry out learning simulations as a positive impact of the results after the trial was conducted. Tests are used in two types, there are pretest, and post-test. The pretest was used to see the ability of students before and post-test conducted after learning using virtual reality for online learning. And each observation sheet and test are given in the small group and field test phases. After collected the questionnaire and test data, then the authors processed according to the method of each calculation. The statistical data processing of questionnaire and test data is used to measure the effectiveness of the results of virtual reality material that has been developed. The following are the results of statistical tests for processing questionnaire and test data in the small step of the group and field tests. The results of the trial phase of small group research on the development of online learning based on virtual reality. To measure the effectiveness of the results of the development of this virtual reality researchers do not only measure learning outcomes through a comparison of pretest and post-test, but researchers also measure the level of respondents' satisfaction with the products that have been successfully produced. Respondent satisfaction with the product is to provide convenience in the learning process. The respondent's attitude towards the level of satisfaction was measured using a questionnaire at the stage of testing small group and field tests. Each question asked refers to the same indicator.

4. Results and discussion

The researcher gave several questions to students about Theory of Study and Learning subject. The following are some of the findings obtained in the field regarding teaching materials, methods, field activities, and others. The main difficulties that students felt about applying approaches, strategies, and methods of learning. Students understood the material while lecturer explained about it. After the lecture is finished the material approaches, strategies and methods of learning that have been learned are forgotten. The habit of students who only studied with a system of memorizing and learning during the test alone is one of the causes of short term memory. In terms of technology, 78 percent of the 300 respondents had facilities to access the internet. More than 96 percent of them have mastered computer applications because on average they have been studied in high school. As many as 89 percents of students often open the internet to look for learning materials. In the last question about the learning model they wanted, there is more than 95 percent of students expecting online learning. The results of the preliminary study show that online learning has been used, the implementation is still constrained by several problems, such as the learning process that runs only as a drop box where uploads of learning materials are considered important so students can download them. Even though there is an interaction between students and passing variable lecturers with the content contained in the class only on the ppt. format, pdf. or a link to the material for a particular file in the form of an e-book. The finding shows indicate that using virtual reality can be foster motivation to learn, develop students' skill in learning model simulation and learning can be efficient and effective. Virtual reality also can improve students' to teaching practice and exercise students' to create innovation learning model used in technology.

4.1. Learning virtual object reality to develop students' skill in learning model simulation

To find out the development of students' skills in the learning simulation model of virtual reality, researchers conducted an empirical feasibility trial. There were several data in the form of numbers (quantitative data) sourced from questionnaires and test results. The assessment questionnaire for the development of virtual reality material and questionnaires to measure the ability of students to carry out learning simulations as a positive impact of the results after the trial was conducted. Tests are used in two types, namely pre-test, and post-test. The pre-test was used to see the ability of students before and post-test conducted after learning using virtual reality for online learning. Each observation sheet and test are given in the small group and field test stages. After collecting the questionnaire and test data, it is then processed according to the method of each calculation. The statistical data processing of questionnaire and test data is used to measure the effectiveness of the results of virtual reality material that has been developed. The following are the results of statistical tests for processing questionnaire and test data in the small step of the group and field tests.

Table 1: The Description of Percentage the Results of the Learning Simulation Model Pretest and Post-Test Small Group Stage

Score Interval	Category	Pretest Frequency	Percent	Post-Test Frequency	percent
80-100	Very Good	0	0	2	16,7
66-79	Good	0	0	1	8,3
56-65	Enough	1	8,3	6	50
40-55	Fewer	7	58,3	1	8,3
0-39	Failure	4	33,3	2	16,7
Total		12	100	30	100

Based on the table above, the percentage of results obtained at the trial stage of the small group research is the development of online learning based on virtual reality. The percentage of the results of the pretest with the highest percentage is in the fewer categories with a range of values (40-55) of 58.3 percent, then the second category fails (0-39) by 33.3 percent and for category enough (56-65) only 8.3 percent. When compared with the results of the post-test, a significant percentage is different. At the post-test, the largest percentage in the category was enough (56 - 65) of 50.0 percent. Followed by an very good category (80-100) obtained 16.7 percent when compared to the pretest category of very good only 0.0 percent. There is still value in the less category (40-55), but only 8.3 percent and this percentage decrease from 58.3 percent. In the category of failure (0-39), there is also still, but it has decreased from 33.3 percent to a decline of 16.7 percent, which means it is reduced by half than before. Therefore, from the description, it was concluded that there was a significant increase in the percentage of pretest and post-test at the small group trial stage. There is a change in a positive direction compared to the results of the pretest and post-test results. So that this change indicates that the results of the pretest and post-test trials in the small group stage obtained significantly increased results. This gives the meaning that the results of the testing of network-based development products based on virtual reality at the small group stage are declared effective to use.

Table 2: The Description of Percentage Learning Model Simulation Pretest and Post-Test Results Stage Field Test

Score Interval	Category	Pretest		Post-Test	
		Frequency	Percent	Frequency	Percent
80-100	Very Good	0	0	0	0
66-79	Good	1	3	5	17
56-65	Enough	1	3	11	37
40-55	Fewer	18	60	12	40
0-39	Failure	10	33	2	7
Total		30	100	30	100

The percentage of the results of the pretest and post-test stage in the table above shows a very significant difference. This is shown in the inversely proportional percentage figures. Although the highest percentage was in the same category, namely in the fewer category (40-55), at the pretest, it was 60 percent, but there was a reduction or decrease in the post-test of 40 percent. The percentage difference of both is 20 percent, and this reduction indicates that there is an increase. Meanwhile only in the fewer category, accompanied by the percentage in the failing category (0-39) experienced an increase in the pretest and post-test. This shows that the percentage at pretest amounted to 33 percent and decreased very drastically when the post-test only reached 7 percent. The reduction in the percentage for the failing category is also one of the proofs that also have a very significant increase. The increase in achievement of the percentage of failed categories above is also accompanied by good categories (66-79). When the pretest only reached 3 percent, it increased to 17 percent during post-test.

More than 10 percent percentages were obtained. This can also be evidence that a significant increase occurred during this study. From the description of the percentage above, it is clear that the results of the pretest and post-test have significant differences. The significance of the very significant difference in the research on the development of online learning materials based on virtual reality at the Theory of Study and Learning in the Faculty of Education Science, Universitas Negeri Jakarta was seen. Based on the description above, then both the results of the pretest and post-test conducted during the small group trial and field test trials obtained significant results. Therefore, the researchers concluded that the results of the research on the development of learning virtual reality objects were effective to use. This means that if the reader wants to use the results of this study, this research has been feasible and appropriate to be used mainly for students.

Table 3: Comparison of Small Group Questionnaire Results and Field Tests for Online Learning Materials Based on Virtual Reality

No	Indicator	Frequency	Small group		Field test	
			Average	Classification	Average	Classification
1	Learning Subject	300	4,22	Very Good	3,44	Good
2	Learning Material	300	4,42	Very Good	4,11	Good
3	Learning Activity	300	4,29	Very Good	3,72	Good
4	Learning Test Evaluation	300	4,08	Good	3,71	Good

Indicators of learning subject available on learning materials obtained attitudes that were stated in the small group test with very good categories or classifications and in the trials the classification test field was good. The statement for the learning material indicator obtained a very good classification on the small group trial and good in the field test. Learning activities have been very good according to Respondent in the small group test and have been good according to field test respondents. Likewise for the evaluation of learning outcomes (test) indicators developed according to small group respondents and the field test was good. Relying on the attitude of the respondents described above, the results of network-based development based on the learning of developed virtual reality objects have received good responses. This means that attitudes towards physical satisfaction developed in harmony, are directly proportional and support the results of the pre-test and post-test at the small group trial and field test stages. Thus the researcher concluded that the respondent's attitude questionnaire towards the results of online learning material based on virtual reality had strengthened the results of the effectiveness test. This adds to the evidence that the products produced in this study are effective. The above data is also reinforced by the results of interviews conducted by researchers on 6 lecturers of Theory of Study and Learning. C [male]….I felt that learning outcomes are by the curriculum in Higher Education.

F [female]… When I got a learning simulation model for online learning is appropriate and involves students actively and uses detailed activity procedures. J [male]…. I though it is appropriate to use embedded systems and hyperlinks. A [male] …..I interested in background music was by the characteristics of students. R [female]….. I was applying learning virtual reality objects are following the elements of the display. K [male]…. with virtual reality based learning, I can simulate learning through cyberspace. According to the results of the interview, it can be shown that the simulation of the virtual reality based learning model provides a positive attraction to students and lecturers.





Fig. 2: Virtual Reality Application Source: Private Document.

To simulate the learning model of virtual reality, students are required to download the application with the help of the internet. Students one by one simulate the learning model. The picture below is a catch from a simulation of a learning model that uses virtual reality.



Fig. 3: Classroom Situation at Virtual Reality Application Source: Private Document.

The picture above shows the class situation when students use virtual reality in the learning process simulation. Students use virtual reality tools and start doing teaching exercises in the classroom. This exercise is the goal of Theory of Study and Learning in preparing students to practice teaching in the next semester. From the results of this simulation, students gave their statements. B [male] ... I was simulating between products produced with Operation System (OS), compatibility between images, videos and sounds with virtual reality so that the material communicates well. M [female].When I was using virtual reality, the access to learning simulation becomes easier; this learning innovation spurs student motivation, designed that are displayed such as playing online games make it easy to understand the material. L [female] when I was trying some of the tests conducted are by the material studied and virtual reality for online learning increase critical analysis power, it was easy to understand learning the material and balanced the right brain and left the brain. F [male] ……. Students were using one learning material to gain various material knowledge and can replace the real class situation directly. Virtual reality was also found to have a very positive impact on mood, and an overall increase in positive emotions and an overall decrease in negative emotions. Based on the above statements, conversely, the other conditions showed a decrease in positive emotions. Moreover, the enjoyment of the important part of student performance. Then from that, virtual reality can develop students' skill in the learning simulation model.

4.2. Virtual reality can be to foster students' motivation to learn

Virtual reality provides convenience to students in conducting the learning process. Definition of a conceptual model consists of units with attributes such as concepts, theoretical constructs and the relationship between attributes and concepts based on theoretical construction. They also added that the conceptual model could not be separated from speculative theories or ideas. Without theoretical input, it is not possible to create a specific and focused reality construction. From the findings, students gave their opinions through the results of the interviews.

Table 4: Students' Responses to Virtual Reality

No	Respondent	F/M	Responses
1	D	M	I thought Virtual reality is interesting to apply in class because it increases motivation to learn
2	L	F	I able to minimize learning time with the presence of virtual learning
3	M	F	When I was using virtual reality learning is very clear.
4	A	M	I saw there are no illustrations or images or videos that are disturbing because they are all systematic and appropriate material.
5	R	M	With virtual reality application, I have the motivation to learn and practice to be a teacher

From the results above, it can be shown that this learning virtual reality object gives an impression that attracts students in the learning process. Especially to understand the concepts of Theory of Study and Learning. As prospective teachers, they feel that the use of virtual reality is effective and efficient so that students and lecturers can work together. The results of the interviewed data also show that students in experimental groups performed better in two constructs of attitude toward technology as compared to their pre-course performance. M [female]… Virtual reality is by the Theory of Study and Learning because it attracts I can develop my ability to teach. L [Male]…When I was Learning consists of material input in the form of events and figure facts so that I able to understand the concept well. The learning process was a series of processes of transfer of knowledge and transfer of value. Ideally, through this process, the outputs produced by students have knowledge and values in long-term memory. In the learning estuary, nationalism is expected to be born. However, in the reality that exists, currently, there is still a lack of a varied, interesting and enjoyable learning process. The learning strategies using this model have relevance to teacher center learning methods, discussions, tourism works, and role-playing can be held. The application used is file.apk, so when using the Android operating system, it is necessary to install the program first. The products can be applied to independent learning, in class or out of the class. This simulation-based virtual reality is a medium that is used to simulate certain techniques and learning strategies.



Fig. 4: Program Description Source: Private Document.

The display above provides information to students about the description of the program that will be carried out using virtual reality. Because the Theory of Study and learning relate to the concept then, learning virtual reality objects provides convenience in summarizing the material. This was also conveyed by one of the previous respondents. O [Male]….. I interested in materials and learning activities can be incorporated into virtual reality so that I can improve my skills in making teaching materials. The above display is also one of the materials in virtual reality programs that use online learning. This view explains the program briefly but clearly. So that the response from students to the learning material outlined in virtual reality learning is very clear. X [male] … I thought, in general, the learning tools developed have included learning books, lecturer guidelines, student guidelines, online learning and applications that contain material. A very open learning strategy that asks students to be actively involved facilitates students to engage in multi-purpose interactions, allowing them to think, analyze, and solve problems. This learning strategy can facilitate students to be cooperative, collaborative or compete in a healthy manner if they utilize the learning facilities carried out through this strategy. This learning strategy is expected not only to give positive feedback but to bring up follow-up learning activities that students must do. This strategy also provides a learning experience that is significantly greater than conventional learning. Teachers are easier to assess through this strategy. So it can be concluded that the learning strategy of virtual reality objects for online learningis appropriate and involves students actively and uses detailed activity procedures.

5. Discussion

The results of the above research show that the existence of virtual reality enhances student skills in teaching practice. Online learning combined face to face and online learning. According to cognitive Theory of Study in its implications for online strategies states that online learning material must incorporate different learning style activities so that students can choose activities that are appropriate to their learning style tendencies. Moreover, the concept is realized through virtual reality use in online learning. This can improve their abilities such as Virtual reality simulator developed welding technology skills [19]. Because as we know the future of interpersonal skills development through immersive virtual reality training with virtual humans [20]. The progress of a country's retreat depends on the creativity possessed by the citizen. For that, virtual reality is present to increase student creativity in making learning models. The virtual reality presents an opportunity for learning with real situations. The development of virtual reality material displays phenomena, events or past events, objects in the form of images that have been described above and direct experiences made in the form of virtual reality. The implementation of this learning aims to build and create knowledge by giving the meaning of knowledge based on the experience gained by students. This research also strengthens that virtual reality affects teachers' education. From the results of this study shows the concepts of virtual reality, various types of digital creations, 3D reconstruction and so on. Giving students 'motivation to learn, develop students' skill in learning simulation and learning models can be efficient and effective. Virtual reality also can be students improve teaching to practice and exercise students to create innovation learning model use in technology being a professional teacher in the era of industrial revolution 4.0 [21]. The motivation that is grown is that students become very enthusiastic in Theory of Study of Study and

Learning material. Then, students and lecturers work together to develop their skills in the simulation by using the model by the instructions. So that students who will become teachers have the motivation to train themselves in innovating to create effective and efficient learning models.

6. Conclusion

Virtual reality is often researched by previous researchers. Technology that continues to evolve makes these applications widely used in various countries. The development of virtual reality technology is not only a mark as a place to bring up 3D objects but has entered into the mobile world. For this reason, this research continues to increase its capacity to a better level. Through the use of technologies such as virtual reality and instant communication, students can be more aware of their classmates and can communicate in real time with them.

For this reason, this study developed the learning of virtual reality objects used in online learning. The suitability of pictures, material, videos, and supporters of the learning model has a positive impact on students. The findings from quantitative and qualitative shows that the learning model can grow students 'motivation to learn, develop students' skill in learning. Simulation and learning models can be efficient and effective. Virtual reality also can be students improve teaching to practice and exercise students to create innovation learning model use in technology. So that research can provide a repertoire of knowledge for students and lecturers in developing virtual reality technology. The implementation of this research is expected to motivate students who have the goal of becoming teachers able to develop their creativity in making learning strategies, learning media and learning models that use technology. Then provide a reference for lecturers to innovate in learning that is creative and attracts students because developing technologies are being used continuously in learning environments. Moreover, virtual reality technology has become one of the tea technologies that experts have often been dwelling on.

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