

The Development of Simulation Video for Problem Solving

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Abstract

This paper examines the development of simulation video using virtual reality technology to enhance students' understanding in Problem Solving & Program Design (DFC10042) course. This simulation video is captured by using 360 camera and edited using VR technology applications (Wonda VR) which is it provides a variety of interesting and easy features in exploring the simulation process. In the process of developing this application, the ADDIE model is used as a development methodology. This video shows a simulation of 3 scenarios in daily life. For each scenario, the Input, Process and Output (IPO) are clearly stated and detailed with descriptions and evaluation questions provided at the end of the video. The findings found that this simulation video gave a positive impact to students where more than 75% gave a score of 4 and 5 for a questionnaire, involved 114 respondents. Assessment scores involved the topic of problem solving techniques also increased by 65% compared to data for students who did not use simulation video. The intention for the development of simulation video are focusing to teaching aids that can help to improve students' understanding of problem solving and logical thinking in order to increased student's ability to learn better. Extend from that, this method can be applied more widely by the students and lecturers whose involves in the teaching and learning of DFC10042 in Malaysia's Polytechnic in general, which make the learning process more dynamic and interesting.

Keyword: simulation video; virtual reality; problem solving

1. INTRODUCTION

1.1 New Teaching and Learning challenge

The significant wave of the Industrial Revolution 4.0 in the field of Information Technology and Communication (ICT) coupled with the technology infrastructure and optimal internet usage has resulted in various technological growth in Malaysia. Among them are technologies in the field of Artificial Intelligence (AI) such as virtual reality (Virtual Reality, VR), Augmented Reality (AR), Robotics and so on. Therefore, planning curriculum for the 21st century teaching and learning must be of a futuristic, flexible and dynamic in order to determine the pattern of the community and technology arise. Citizens for the 21st century must be able to deal with the challenges that will be brought by the tide of globalization, the explosion of knowledge and information. Conventional teaching methods such as 'chalk and talk' merely less successfully in attracting students instead need a method of dynamic and creative with relevant teaching contents in accordance with current developments. All parties directly involved with the world of education need to be aware that there is no space to not follow the same transformation of education. Even changes in education should always hand in hand development of era or one step forward (Norhafidzah, 2015).

1.2 Virtual Reality Technology

Virtual Reality can be defined as a three-dimensional, deep, and interactive multi-sensory digital environment that has sparked the imagination of society as a future technology that will dominate our work, education, and leisure (Roussou, 2004). The term virtual reality (Virtual Reality, VR) was coined in 1989 by Jaron Lanier from VPL research, to differentiate between the immersive digital worlds, he tried to create and

simulate traditional computers (Pimentel, 1994). Virtual reality (VR) technology is a computer simulation through imitation of the environment in an attempt to resemble the real or physical state of a thing, situation or product. Virtual reality (VR) technology can be produced using in-depth multimedia applications that use computers to create a simulated world using computers. This virtual reality (VR) technology focuses on 3 dimensional (3D) reality implemented through a head mounted display and data glove for input purposes. In the field of information technology and programming, this can help designers understand problem solving techniques by watching real life scenarios created to solve problems.

2.0 RESEARCH BACKGROUND

2.1 Objectives

The objectives of this study are:

- a. To explore the potential of simulation as an alternative approach in teaching and learning.
- b. To develop a simulation video for problem solving techniques using virtual reality technology.

2.2 Literature Review

2.2.1 Virtual Reality Technology

This virtual reality application can be used for the production of virtual sensory experiences, including taste, sight, smell, sound and touch. VR can be adapted with the use of 360 video. 360 video technology has been launched earlier by the famous video site YouTube since 2015. But at that time the quality of the video was still at an unsatisfactory level. After a year of launch, the video that allows you to enjoy this full panorama can be watched at a better quality and use VR equipment that is in a more sophisticated market. With the use of 360 video, virtual display surrounds the user with 3 Dimensional stimulation. User will have a sense of feeling in the real place not just by looking at the photo image. Using the concept of 'walk-through' is able to put the user as if walking in a real place. The development of advanced virtual reality technology is widely used in the fields of military, aviation simulation, medicine and not to be missed in the field of education. Therefore, the use of virtual reality applications, namely video 360, can change the pattern of teaching and learning in the classroom. Indirectly, learning will be more fun and exciting.

2.2.2 Simulation in Teaching and Learning

Simulation is one of the styles for teaching and learning which is it involves the experience for the students. Experiential learning such as simulation has been promoted as a means to challenge student's misconceptions (McClintock, 2000). When students practically experience the process of learning, it will be easier for them to relate and understand the concept of learning. Hakeem (2001) found that students involved in experiential learning have a greater understanding of their subject matter than students in a traditional lecture-only class. The tools and technologies that would be suitable for a simulation exercise strongly depend on the situation or scenario that is being simulated. In addition to enabling students to develop experience in expensive and rare situations, simulations using technology can provide a way to relieve pressure on resources. For example, the forensic science students can make use of simulated crime scenes in the 'Forensic House' on the main campus, however the physical constraints mean that only a handful of students can be in the space at the same time and the time to 'reset' the simulation between students is quite high (Kaufman, 2010).

2.2.3 Problem Solving

Problem solving techniques in programming require logical thinking techniques that need to be sharpened and polished. Problem solving is important in programming because it forms the basis before students design a solution and develop program codes. This problem solving technique involves the identification of Input, Process and Output (IPO) by the students and also involved logic thinking which is very complex and difficult to understand. With the help of this increasingly sophisticated virtual reality technology can indirectly become an added value in the basic field of programming itself. Therefore, apart from being very potentially used in industry, this virtual reality application can be a visual tool that can help students in understanding the basics of programming, especially problem solving techniques.

3.0 RESEARCH METHODOLOGY

ADDIE Model has been used as a methodology and guidance in developing simulation video. There are 5 phases in ADDIE Model shown in Figure 1.0.

Analysis: Do the analysis of group of students, learning targets, learning environment and learning resources. Developer also need to setting up the learning objectives and specify the basis of user knowledge.

Design: Source of teaching and learning used along with the planned activities must be appropriate to the student's ability, learning objectives, environment and tools or device used. The design must facilitate and adhere the ways of student learning process.

Development: Referring to the idea in design phase, developer needs to identify how to create and develop the learning materials.

Implementation: Developer needs to identify how the learning material that has been developed can be implemented in student's environment.

Evaluation: Developer needs to clarify how to evaluate either the learning objective can be achieved or the learning material has the good standard. The result from evaluation process will be used to enhance the learning material from time to time.

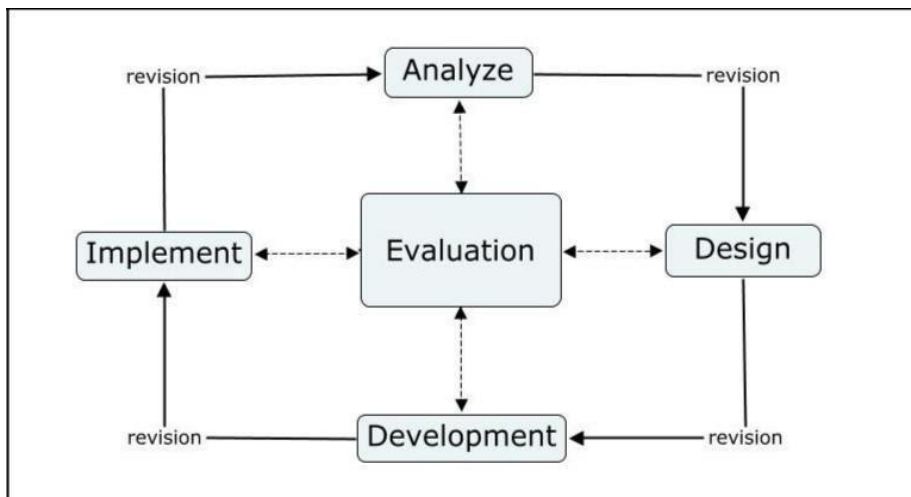


Figure 1.0: ADDIE Model

Phase 1: Analysis

In this phase, the research methodology included the analysis towards result for final examination and Course Learning Outcome Review Report (CLORR) for Problem Solving & Program Design (DFC10042) course for June 2019 and December 2019. Along with the reports, observation are conducted towards the teaching and learning process for the DFC10042 course at ICT Department, Ungku Omar Polytechnic. Based on the analysis towards result for final examination and CLORR, identified that CLO1 only gets 61.08% (Session Jun 2019). Even CLO2 and CLO3 results show the minimal target. Regarding to the results, lecturers and Course Coordinator suggested for the upcoming semester, lecturers need to diversify in class activities such as the practice exercises using web 2.0 Kahoot, notes using prezi, video presentation and group discussion to attract the students to understand the content of learning session. Other than that, Course Coordinator encourage lecturer to develop an innovation project such as Augmented Reality (AR)/ Virtual Reality(VR)/ Mobile Application Project as an alternative towards learning process.

Phase 2: Design

Based on the result from analysis phase, the design for the development are focussing on the simulation by using virtual reality technology that can facilitate students to understand the flow and process involves in problem solving. The simulation was captured by using 360 camera to produced 360 video views which is compatible to be editing in Wonda VR application. The sequence mapping to develop the simulation is describes as in Figure 2.0. In this phase, the script writing for the simulation also being developed as in Figure 3.0.

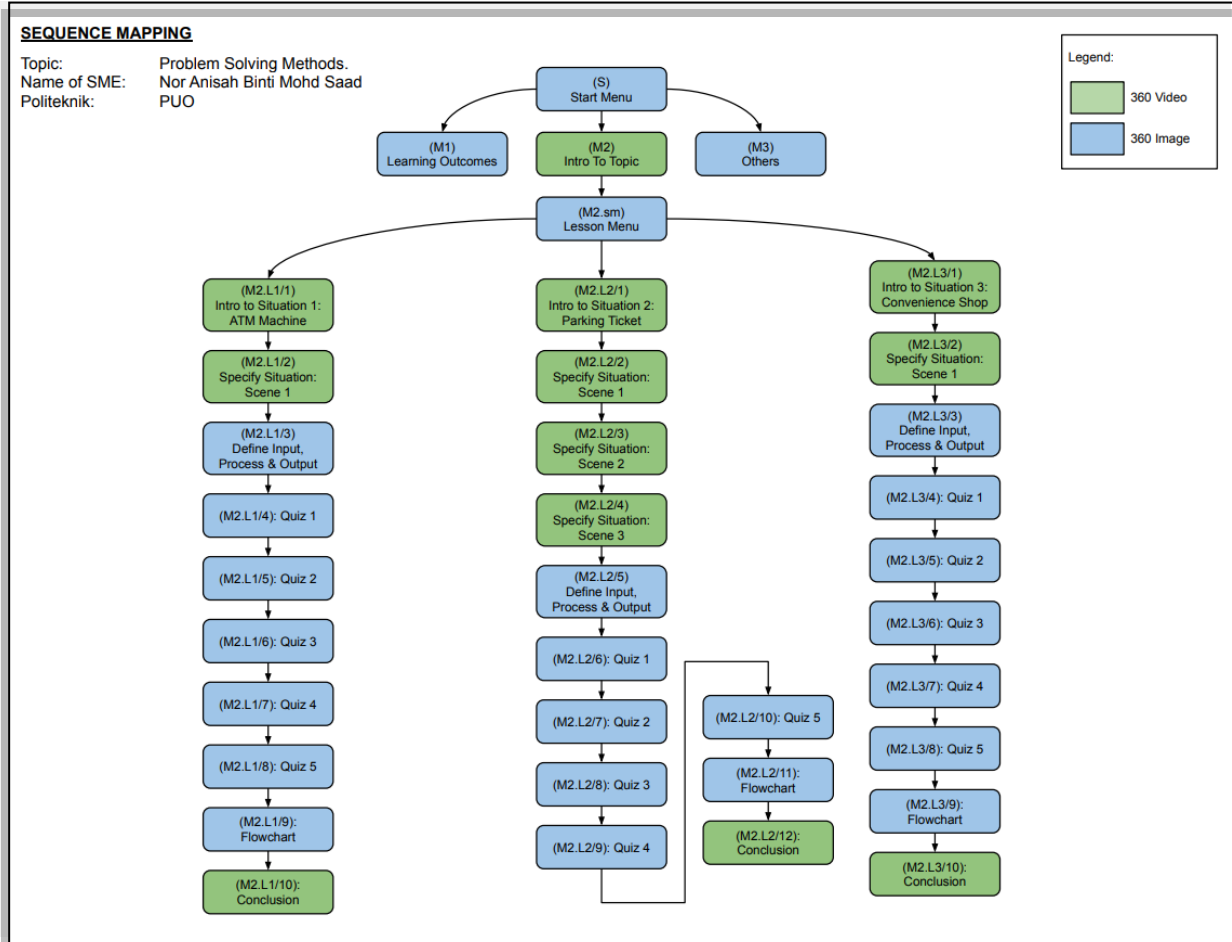


Figure 2.0: Sequence Mapping

SCRIPTS AND TEXT CONTENT

Topic: Problem Solving Method
 SME Name: Nor Anisah Mohd Saad
 Politeknik: PUO

Instruction: Please fill in the content as per each sequence in the DETAILS section.

*ref - refer to Storyboard Content Checklist

REF*	SEQUENCE TOPIC	TYPE OF CONTENT	DETAILS	PROOFING REMARKS
S	Main Menu	n/a	n/a	-
M1	Learning Outcome	Text Content	Upon completion of this topic, you should be able to: <ul style="list-style-type: none"> Understand what is Input, Process, and Output in real-life situations from the perspective of Computer Science. Describe Input, Process, and Output in Computer Science problem-solving methodology. 	
M2	Introduction to Topic	Script	<ul style="list-style-type: none"> Hai everyone! My name is Edelin. Today, I will be tutoring you about Input, Process, and Output in Computer Science Problem Solving Method. You will learn how to identify those 3 elements in common daily-life situations. In this case, those situations are: <ul style="list-style-type: none"> withdrawing money from the ATM machine, 	

Figure 3.0: Script Writing

Phase 3: Development

Basically, the content of simulation video is based on the curriculum syllabus for Problem Solving & Program Design (DFC10042). All the scenarios are prepared by the Subject Matter Expert (SME) and go through the procedure and flow to make sure the content of simulation video can achieve the objectives and give benefits to the students. The development of simulation video was using 360 videos captured from 360 camera and edited by using Wonda VR application. Wonda VR is a special application used to make editing and synchronizing of 360 videos. It is also can include several interactive features to the 360 videos so the students can communicate with the simulation video through activities and quizzes at the end of the video.

Phase 4: Implementation

Simulation video being given to target group of students for trial session and application usage that has been developed. Students are given a time to explore the simulation video to improve their understanding on Topic 2 (Problem Solving Method) in DFC10042. After they viewed the videos, students evaluate their understanding and also the performance of simulation videos through survey in Google Form.

Phase 5: Evaluation

Evaluation process are being implemented through survey that has been published by using Google Form. Total respondent are 114 students. All respondents need to answer 12 questions from Section A and 13 questions from Section B to evaluate the user satisfaction towards the usage of simulation video. The questions item is as stated in Table 1.0 and Table 2.0.

Table 1.0: Section A (Using video 360 in simulation video)

No.	Questions
1	I've heard about 360 video before
2	I know about 360 video
3	I've used 360 video before
4	The content of this 360 video is interesting
5	360 Video is easy to use
6	The 360 video interface is simple and attractive
7	I can understand the topic clearly through this 360 video
8	360 videos help improve my understanding of the topic
9	This 360 video tests my understanding of the topics
10	This 360 video can help in my self-learning
11	This 360 video can attract me to learn
12	I am always positive to accept learning methods using technology.

Table 2.0: Section B (Explore simulation video for Problem Solving)

No.	Questions
1	Objectives for the scenario are displayed
2	The scenario is clearly displayed
3	Scenarios are easy to understand
4	Scenarios interest me
5	Scenarios displayed are commonly viewed / used
6	I can choose the content of the scenario I want to watch
7	Scenarios describes input, process and output
8	The scenario displays a detailed description
9	The scenario gives a clear example
10	Quiz questions are easy to answer
11	Quiz questions related to scenarios
12	Quiz questions help understanding the input, process and output
13	Quiz questions help me understand the concept of problem solving

4.0 RESULTS AND FINDINGS

For the findings of the study from the questionnaire that has been distributed, it was found that more than 75% gave a positive response. On average they gave scores of 4 and 5 for the entire questionnaire involving 25 questions from two sections. A summary of the analysis of the questionnaire is displayed as Figure 4.0, where the average student expresses through simulation videos.

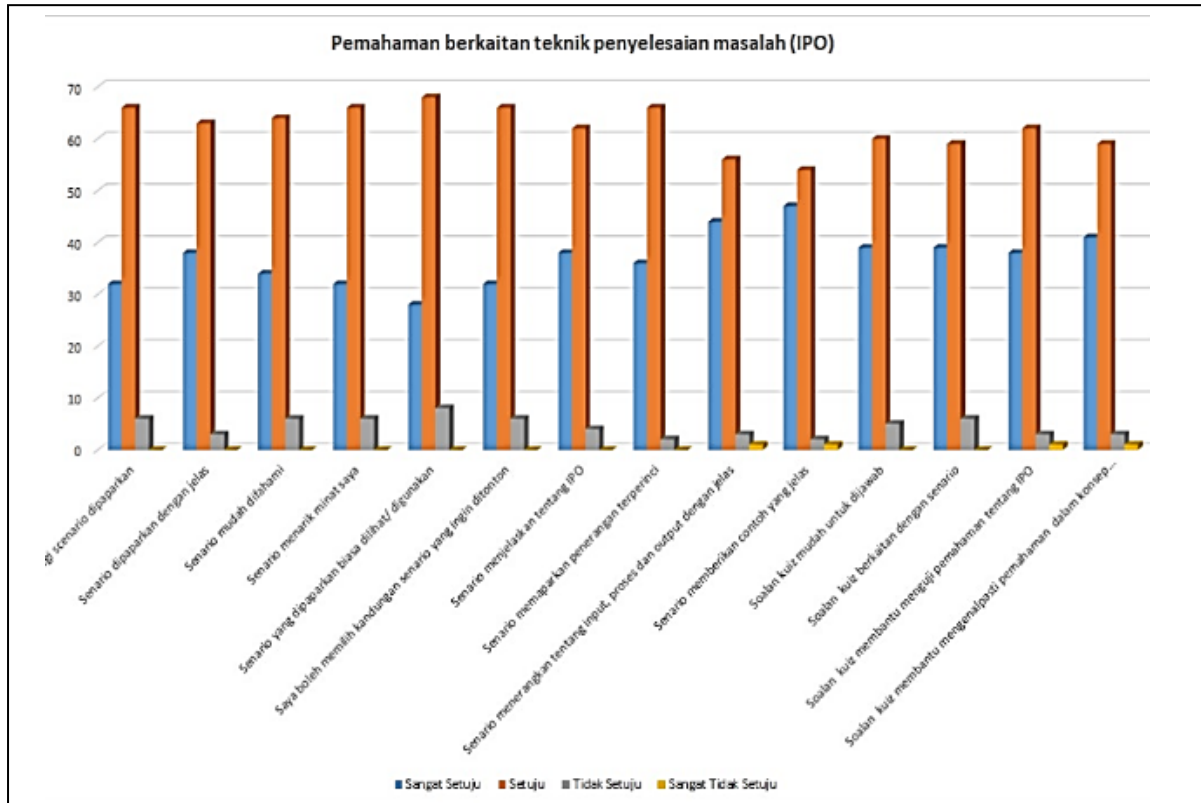


Figure 4.0: Analysis of the questionnaires

This is the result of an analysis of procurement study data to test the effectiveness of innovative products. Control over continuous assessment is implemented with standards of developing assessment items based on setting controls on the level of taxonomic domains as well as Course Learning Outcome (CLO). So the comparison range is consistent and authentic. Apparently, through the bar chart on Figure 5.0, there is an increase in the average range of marks for sessions with the use of innovative materials, compared to the Figure 6.0. This is further strengthened by the display of an increase in the percentage of mark rating percentage exceeding half of the full mark value.

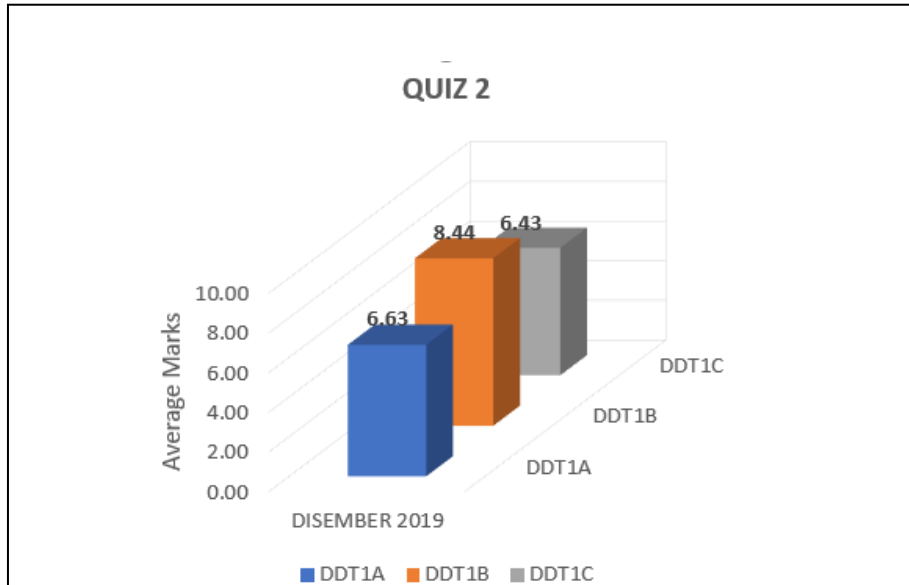


Figure 5.0: Average Marks without using simulation video

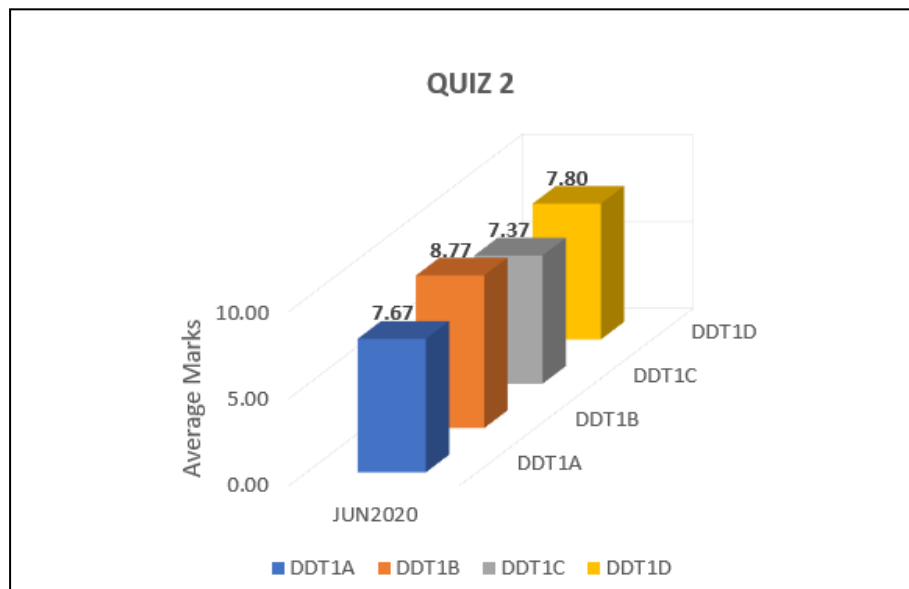


Figure 6.0: Average Marks when using simulation video

Assessment scores involving the topic of problem-solving techniques also increased by 65% compared to data for students who did not use simulation videos. This simulation video can be used as an alternative teaching material that can help improve students' understanding of problem solving and logical thinking. This shows that this simulation video is getting a good response from students in order to facilitate them with an alternative way of learning and studies.

5.0 CONCLUSION

The results of the study showed that most respondents gave positive feedback related to the questions given. Respondents are very excited to use this simulation video to improve their understanding about basics of programming. This shows that the use of virtual reality if applied in learning can greatly help lecturers and students to gain a higher understanding. The use of this virtual reality is seen to help students in understanding related to problem solving techniques involving logical thinking. The concept of understanding of problem solving is the most important foundation in programming to enable students to develop good program codes. This knowledge can be used by students for all types of programming languages later and is very helpful for students to make their final project at the end of their studies. This study is also seen to give initiative to students in diversifying their learning methods. It is also one of the initiatives for teachers to update teaching and learning techniques in the classroom to be more attractive and interesting for students. Students will be more excited to use this simulation video which is a new technology in an effort to encourage students to implement self-learning online. The results of this study can also help lecturers to be more creative and proactive in planning to diversify teaching methods using appropriate tools to ensure student involvement in the learning process in line with the government's intention to expand the education sector using digital technology.

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