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Historical interactive virtual reality learning in college

Risky Setiawan *, Alifi Nur Prasetia Nugroho, Kuncoro Hadi, Novianto Yudha Laksana, Hardian Wahyu Widianto
Universitas Negeri Yogyakarta, Indonesia.
* Corresponding Author. E-mail: riskysetiawan@uny.ac.id

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ABSTRACT

Virtual Reality provides many benefits in learning because it can create a variety of simulation situations that can not be done due to obstruction of danger or high costs. This research aims to research and develop learning media in history using virtual reality technology. This research and development use ADDIE's research steps method (analyze, design, develop, implement and evaluate). The Delphi method carried out product validation using four media experts and four historians. The product trial phase uses 400 students in two study programs to see the effectiveness of the products developed. Research & development have produced a prototype product website platform with expert feasibility assessment (product validation) results. The results of the media expert assessment are 3.88 (feasible), and the expert assessment material of 4.09 (possible). The media tested on 400 students obtained satisfactory results, with the average overall score reaching 4.23 or in the category of "very worthy."

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INTRODUCTION

The education factor largely determines the quality of the nation's life. The role of education is very important to create an intelligent, peaceful, open, and democratic life. Therefore, educational reform must always be carried out to improve the quality of national education. In the context of educational reform, three main issues need to be highlighted: curriculum renewal, improving the quality of learning, and the effectiveness of learning methods. Learning in the pandemic era requires all learning to be carried out using the online process. Based on the results of student survey responses conducted by Setiawan et al. (2019), they concluded that the perception of e-learning is beneficial and improves the student learning experience.

The quality of learning must be improved to improve the quality of educational outcomes. On a micro level, it is necessary to find an effective learning strategy or approach in the classroom that can better exploit students' potential. The quality of education plays an important role in life in society. Through education, humans can find breakthroughs to make life easier. Until now, the quality of education in Indonesia is still relatively low. The Trend In International Mathematics and Science Study (TIMSS) results show that students' abilities are still low (Scientific Literacy, October 24, 2014). Indonesia's big challenge is the Industrial Revolution Era 4.0 (R.I. 4.0), where all machines are connected, relying on a cyber-physical system that will radically change how humans live, work,

and communicate. Machines and information technology have replaced work that was originally done manually by relying solely on human labor. Currently, the quality of education in Indonesia still needs improvement. The 2015 PISA (International Program for Student Assessment) results show that Indonesia ranks 63rd out of 70 countries evaluated (Iñiguez-Berrozpe & Boeren, 2020). The rapid development of technology and information in the Industrial Revolution 4.0 encourages the readiness of educational institutions to develop interactive and interesting learning media. These efforts have led to intense competition for technological products at the regional and even international levels. History learning media, considered old-fashioned and boring, makes students unmotivated to obtain knowledge and materials about Indonesian history.

The development of Science and Technology (IPTEK) is getting faster and more sophisticated. Various forms of technology are developed, one of which is animation technology. The development starts from 2 dimensions (2D), three dimensions (3D), four dimensions (4D), and even up to 5 dimensions (5D). The 3D form is often used, developed, and combined with various fields. 3D viewing is the best choice for building virtuals to display real reals into your computer. According to Daryanto (in Hastuti, 2011) stated that 3-dimensional media is a group of media without projections that are visually presented three-dimensional. The term is commonly used in art, animation, computers, and mathematics. Hastuti (2011) states that, according to the limitations of experts, 3-dimensional animation media is a form of information presentation using visualization techniques with computer programs that display static images that are made as if moving to have a more real impression like natural objects.

Virtual Reality (VR) is one of the potential options in presenting 3D viewing today. VR means an actual situation, but the user is in a virtual environment. VR media has a main character that allows users/students to directly interact with the computer to solve problems using natural environment imitation results (Burdea & Coiffet, 2003). Environments in VR have advantages over other media because it has navigation, interactivity, and immersion features (Trindade et al., 2002). Existing studies show that VR in learning can trigger the emergence of positive learning outcomes and increase interest in a topic.

The development of virtual reality began in 1962 by Heilig as a prototype with experience in the Hollywood Motion Picture industry patenting a device called telesphere mask. The app uses all the senses so the viewer can do activities on the screen, including moving three-dimensional images. Until its development in 1977, MIT created a new creation in the form of an Aspen Cinema Map. Then in 1980, the virtual name reality was used until now by Lanier, the inventor of the latest virtual reality aids, such as virtual reality glasses, to the gloves used to feel the inside of virtual reality (Mustaqim, 2016).

Learning is a systematic effort made by teachers to realize that the learning process runs effectively and efficiently, starting from planning, implementation, and evaluation. The ability to learn is an absolute requirement for teachers to realize their professional competence. Consequently, teachers must have a complete and proper understanding of the conception of learning and teaching (Aqib, 2013). According to Musfiqon and Widodo (2015), learning is a process of developing each student's potential and character development as a result of the synergy between education in schools, families, and communities. The process provides opportunities for learners to develop their potential into increasingly increasing abilities in the spiritual and social attitudes, knowledge, and skills necessary for their lives to live in society and nationhood and contribute to the well-being of humankind.

Virtual Reality (VR) provides many benefits in learning because it can create a variety of simulation situations that sometimes can not be done because of obstructed hazards, high costs, and others. In addition, simulations created through VR are not tied to time so that participants can do it repeatedly (Dávideková et al., 2017). VR's advantages are, therefore, following the needs of learning that must be implemented remotely because of the Covid-19 peterrent. Although carrying out learning activities from home, participants can still do various practical simulations using VR.

Historical studies are one of the areas of learning that has great potential. Unfortunately, the discussion about VR has not touched on historical learning. The fields of medicine Satava still dominate some existing virtual reality studies and Satava and Jones (1998) and psychology (Satava & Jones, 1998) aimed at understanding empathy (Schutte & Stilinović, 2017) to the risk of disorders

(Valmaggia et al., 2007). While in the field of education, VR is often still limited to learning in science and engineering (Abulrub et al., 2011). Virtual reality is more often adapted to help organize construction practice activities (Whisker et al., 2003) and building design (Wolfartsberger, 2019).

The study aims to fill this shortfall by developing prototypes of virtual museums using VR technology. This virtual reality-based museum was developed to support history learning at the university level. The study of the link between VR and the museum has indeed been developed (Jung et al., 2016). The study, however, focuses more on understanding the experience of museum visitors using VR and Augmented Reality (AR) technology. More specifically, in contrast to this study put VR museums as a medium of learning.

METHOD

This research design is development research that applies the model method of Cennamo and Kalk (2005). This model refers to the development of a spiral consisting of phase I, namely: (1) preliminary study (research), (2) definition (define), (3) design, (4) demonstrate, (5) development (develop). While in the second stage, namely: (1) socialization and dissemination (dissemination), (2) application (applied), (3) measuring effectiveness, (4) evaluation. The research was conducted from March 21 to November 15, 2020, at Universitas Negeri Yogyakarta. This location was chosen because of the need for maximum media utilization in historical learning. ADDIE's research steps guide this research and development (analyze, design, develop, implement and evaluate) (Branch & Kopcha, 2014).

The analysis stage was conducted with observations and interviews with lecturers and students of the Department of History Education, Faculty of Social Sciences, Universitas Negeri Yogyakarta, to identify the implementation process and problems in historical learning. The design stage begins with selecting materials that follow the basic competencies and indicators chosen by researchers. This researcher chose material about prince Diponegoro. The development phase began with the design of the Historical Interactive Virtual Reality Learning Media Prototype. The Delphi method carried out product validation using four media experts and four historians. Delphi is one of the methods to validate by distributing product assessment forms to be filled out by appraisers. Researchers also conducted product testing by media experts as well as material experts. In the fourth phase, implementation, the prototype of Historical Interactive Virtual Reality Learning Media was tested and declared worthy of being implemented in history learning to 400 Universitas Negeri Yogyakarta History Education Study Program students. The last stage is evaluation, conducted after the user feels the experience of using Historical Interactive Virtual Reality Learning Media to understand the material of the Diponegoro War. Once used, an evaluation questionnaire is then given to the user to accommodate feedback.

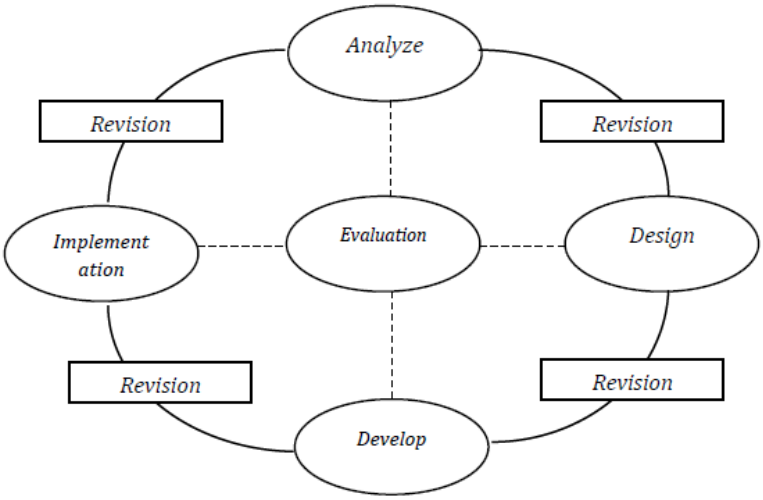

Figure 1. ADDIE Model Research Stage Design (Branch & Kopcha, 2014)

RESULT AND DISCUSSION

Developing Prototype

The initial stage in product development was the creation of blueprint designs from historical interactive virtual reality prototypes. This stage begins by selecting an interaction design with an auto reflection with a gyroscope sensor to detect range and motion reflexes. After that, the features and interactions are applied to the frame images and interface that have been created. Next, the researcher organizes the screen into a flow, draws links between screens, and describes interactions for each screen to serve as the primary reference for developers working on the project. Finally, set the canvas size to fit the width of the dimensions and face the canvas size to 360 degrees. Composing content and templates on a 360-degree canvas is done by uploading the board on the Vista 3D app.

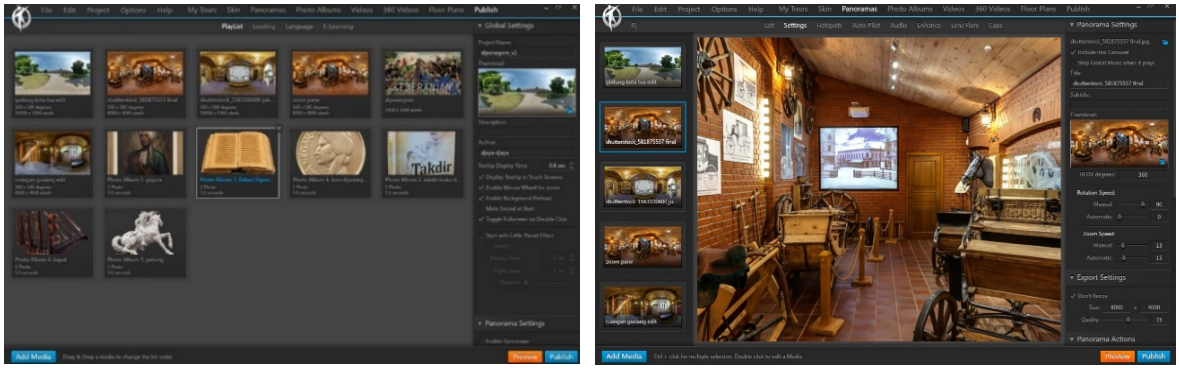

Figure 2. Creation of Historical Interactive Virtual Reality Using 3D Vista

The next stage is creating a Virtual Reality Media design divided into four parts. First is importing materials (image and video), determining the view, the following review and final adjustment, and finalization of the product. Once the Prototype is built, we will go to the next stage of product validation from experts. The experts who will assess this product consist of four experts from experts in the field of image processing and digital watermarking from the University of Pahang Malaysia, software engineering experts from Universitas Negeri Yogyakarta, multimedia experts from Ivet University, and virtual reality media experts from Politeknik Harapan Bersama.

Validation of media feasibility is based on an assessment in the form of a Likert scale containing four leading indicators (accessibility, up-to-date, audiovisual, and virtual reality mode). The results of the assessment on accessibility indicators show if the built media is qualified from the ease of access, media when used by users smoothly and running properly, and the media has a large enough frame in loading VR on the website, but the data consumption required is not too large.

Source: http://djaya.researcher.my.id/prototipe/vr/

Figure 3. Prototype Historical Interactive Virtual Reality

Evaluating the Historial Interactive Virtual Reality

Evaluation is done to obtain an overview of the quality of products that have been developed. In this study, the focus of the media evaluation was aimed at several important aspects. The assessment aspect leads to the ease of use, usefulness, and attractiveness of developed learning media. In general, the results of this development are satisfactory because the average user rating score reaches 4.23 or is in the category "Very Decent" (Table 1).

Table 1. User Scoring Results

No.	Indicators	Score	Criteria
1	Ease of accessing media on the website	4,38	Very Decent
2	Smooth access to media operations	4,06	Worth
3	Save data consumption and internet quota	3,58	Worth
4	Useful media in supporting knowledge of the history of colonialism	4,47	Very Decent
5	Level of motivation in studying history	4,42	Very Decent
6	A virtual history museum	4,41	Very Decent
7	Historical tourism alternatives in the midst of the COVID-19 pandemic	4,34	Very Decent
8	Delivering a real history museum experience	4,21	Very Decent
9	The appeal of material about Prince Diponegoro	4,33	Very Decent
10	Minimize saturation	4,19	Worth
	Average Total	4,239	Very Decent

Based on the results of the survey that has been conducted (Table.1), Historical Interactive Virtual Reality media obtained a satisfactory assessment. From the description of the results of the user assessment "ease" of use of learning media, this media obtained an average score of 4.0 or classified in the category worthy. In more detail, the assessment of the ease of access is classified in the category of "very decent." This indicates if the media that has been developed has qualified for ease of access. The next indicator of the smooth media access obtained "worth" results. This indicator illustrates if the use of media by the user does not encounter any significant or smooth obstacles according to its function. Meanwhile, on indicators related to media data consumption, it obtained a "worth" rating. This is quite interesting, considering this media strives to display large frames with high quality in VR, but it has a high level of data consumption.

Usefulness is the next aspect that is shaved to determine the validity of historical interactive virtual reality media. In this aspect, several indicators can describe the quality of the media in terms of usefulness. First, the description of the results of this media user's research obtained an assessment of "usefulness" in the category of "very decent" with a score of 4.41. Furthermore, in more detail, the indicators about the usefulness of this media in Historical Learning got a "very decent" review. It can be interpreted in historical interactive virtual reality media that has qualified to be used as one of the materials in learning in college. Further indicators related to motivation show if this media is considered "very decent" in improving the motivation to learn history. It can be understood if this media can bring more engagement to make learning participants more effective to participate. Furthermore, on the reality indicator, this media obtained a "very decent" rating as well, so it is considered to have been able to simulate conditions in the real world. In addition to being a learning medium, this media is also seen as having other benefits as an alternative to tourism during the Covid 19 Pandemic. This is seen in indicators of travel alternatives that also get a "very decent" rating.

Attractiveness is the next indicator assessed in the product evaluation process. A description of the user's rating results has shown that the average score in this aspect is rated 4.24 or classified in the "very decent" category. In general, it can be known if historical interactive virtual reality media is in demand by users to learn material about the Diponegoro war. In more detail, on the indicators of the assessment of presenting the real experience of the virtual museum of history, this media obtained a "very decent" rating. This assessment shows that the developed historical interactive virtual reality media has qualified as a real virtual museum. The following detail is related to the material attractiveness indicator about Pangeran Diponegoro, which obtained a "very decent" rating. It can be understood if the selection of material about Prince Diponegoro is an appropriate step because this material is still in demand by many parties, especially in history. Furthermore, to

minimize saturation level, the media attraction indicator obtained a rating with a "worth" result. This indicates that this media is effective enough to reduce user saturation.

Effective results on VR media will optimize historical learning so that students do not get bored with using that medium. Research from Kabassi et al. (2019) conducted VR media evaluations for museum tours that evaluate virtual museums before visitors come directly to them. The same results were obtained from studies that looked at the Fang's et al. (2019) feasibility of VR to evaluate the presence of ADHD (Attention Deficit Hyperactivity Disorder) symptoms with the results that the right items, incorrect items, and accuracy rates of VR tests of children with ADHD differed significantly from children in the control group. Thus, VR evaluation is important to ensure how the media application can be felt by users, especially the academic community in college.

CONCLUSION

Media Historical Interactive Virtual Reality was developed to support historical learning activities at the university level. This research and development stem from the need for VR technology in social science learning, such as history. Meanwhile, VR has been widely used to support learning activities in other fields of study. As a result, this research and development have produced a prototype product website platform with the results of expert feasibility assessment (product validation). The results of the media expert assessment are 3.88 (feasible), and the material expert assessment of 4.09 (feasible). The media tested on 400 students obtained satisfactory results, with the average overall score reaching 4.23 or in the category of "Very Decent." However, Media Historical Interactive Virtual Reality products still have some actionable flaws. The product that has been developed is still in the form of a prototype and needs to be further refined to be used as a medium that the public can use to study history. Media products are also not widely available, so the public can not use them to the maximum. In addition, media products also need to be tested directly in the learning process to obtain more realistic data.

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