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Toward A Ubiquitous Learning Media: Encouraging Understanding by Virtual reality-based learning

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Abstract. The use of mainstream media is no longer attractive to students. They enjoy more and are more enthusiastic about virtual learning which provides the greatest possible opportunity for direct contact or as if to experience directly the object of the material being studied. This study aimed to develop an Android-based application with virtual reality (VR) in the material kingdom and Hindu-Buddhist heritage (SijarVi-information system of virtual reality-based learning). This product was intended to provide anti-mainstream learning media, which provides opportunities for students to be directly involved and see directly the object being studied. This development used research and development method with ADDIE model which consists of analysis, design, development, implementation, and evaluation. Data were collected through a questionnaire (via google form) and expert's validation. There were 32 students involved in this study. This study indicated that SijarVi products deserve to be used as learning media. In addition, SijarVi was also effectively implemented in learning by increasing student understanding and grades. This product could contribute to an alternative learning media that could be beneficial for students, lecturers, and teachers.

Keywords: *learning media, mobile learning, students understanding, SijarVi.*

Introduction

Students have different characteristics according to their respective background experiences to be able to effectively follow the learning process. Experiential backgrounds can be in the form of initial abilities, intelligence level, learning styles, motivation, and socio-cultural factors (K. R. Adi, Idris, & Rosyida, 2018; N. P. Adi & Kurniawan, 2018; Budiningsih, 2011). The characteristics of student learning styles also vary from one individual to another. Some are accustomed to absorbing information using visual, auditory, and kinesthetic assistance (Artawan, Sudarma, & Arsa Suyadnya, 2018; Rachman, 2017; Widayanti, 2013). Recognizing the characteristics of student learning styles will lead to a learning process that is fun, efficient, effective, and in accordance with the abilities and needs of students (Wahyuningtyas & Rosita, 2019; Widayanti, 2013). In addition, to fulfill each of these characteristics, educators really need to find alternative ways in the learning process by integrating public speaking skills and adaptive learning media with student learning styles, for example by utilizing information technology in the learning process (Perguna, Idris, & Irawan, 2020; Wahyuningtyas & Idris, 2020).

Technological advances that have driven changes in various fields, especially in education, make educators have to respond quickly to all these developments (Kurniawan, Idris, Purnomo, Wiradimadja, & Sukamto, 2019; Sulisty, Nafi'ah, & Idris, 2019). Because it has been proven that the use of technology in education has a significant role (Hong, Ridzuan, & Kuek, 2019; T. Jung, Chung, & Leue, 2015; Y. Jung & Lee, 2018). The integration of technology in learning can be easily utilized by students without time and

space boundaries (Abbad & Jaber, 2014; Joo, So, & Kim, 2018; Khlaisang & Mingsiritham, 2016; Laeeq & Memon, 2018). This progress requires educators to get out of their comfort zone and carry out cultural transformation in the learning process by developing adaptive learning innovations, for example by utilizing smartphones and virtual reality in learning (Artawan et al., 2018; Rachman, 2017; Wahyuningtyas & Rosita, 2019).

Massive use of smartphones that can be accessed by all can be used effectively as a source or means of learning (Dewi, 2018; Permana, 2019). The use of smartphones as learning media allows students to learn independently according to their learning styles (Yuniati & Ratmanto, 2017). In addition, it also provides opportunities for educators to convey learning through various intermediaries which make teaching materials more attractive, creative, innovative (Dewi, 2018) and relevant to the characteristics of Generation Z (Wahyuningtyas & Rosita, 2019).

The use of VR in education allows students to feel and be able to interact directly with material objects in virtual or virtual ways (Artawan et al., 2018). In addition, VR also provides a virtual environment replica platform that matches the original object (Sinambela, Soepriyanto, & Adi, 2018). This condition provides opportunities for students in class or outside the classroom to learn in the real environment without having to come to the location of the object (Rachman, 2017). The use of VR as a learning medium has also been proven to increase student interest and motivation in learning (Herlambang & Aryoseto, 2016). Thus, SijarVi is intended to provide a new learning experience in a ubiquitous learning environment for students to learn history virtually and dynamically. The novelty of this development is shown by the integration of the use of android smartphones and virtual reality which have not been optimally applied and developed as a learning medium, especially in the Archipelago History course which requires a lot of object visualization.

Methods

This study used the research and development (R&D) method with ADDIE model consisting of analysis, design, development, implementation, and evaluation (Pribadi, 2009). It is a model in an interactive learning process through the basic stages of dynamic, effective, and efficient learning (Branch, & Kopcha, 2014). The stages used in this development include; 1) analysis, including identifying problems, needs, and alternative solutions that could be used in application development. In addition, this section was important for tabulating various library sources that could be used as references to enrich the content of product. 2) Design. This stage was carried out in order to compile the categories, facilities, and tools needed in the application system according to the alternative solutions obtained in the previous stage. 3) Development. This stage was product development, building a system in accordance with the results of the predetermined analysis and design. In this section, validation was conducted by material, media, and language experts. Product validation assessment criteria can be seen in Table 1.

Tabel 1.

Product criteria

Percentage	Criteria	Information
80% - 100%	Very Good	No revision
60% - 79%	Good	No revision
40% - 59%	Bad	Revision
0% - 39%	Very Bad	Revision

Source: Arikunto (2010)

Tabel 2.

Practical use criteria

Percentage	Criteria	Information
75,01% - 100%	Very Good	It can be used without revision
50,01% - 75%	Good	It can be used with minor revision
25,01% - 50%	Bad	It is recommended to do not used the product
0% - 25%	Very Bad	It cannot be used as learning media

Source: Akbar & Sriwiyana (2011)

Tabel 3.

Effectivity criteria

Categories	Percentage	Criteria
A	80-100	Very Good
B	60-79	Good
C	40-59	Bad
D	<40	Very Bad

Sumber: Arikunto (2010)

The fourth step was implementation. At this stage, the implementation or testing of products that have been developed and validated by a team of experts was conducted. The product was tested directly in the lecture learning process. Last but not least, it was Evaluation. This last stage was to evaluate the steps taken previously. In this stage, the product was assessed whether suitable for use or not. Table 2 and 3 are some of the criteria used in the product development test.

Results and Discussion

Analysis

This stage is intended to identify problems and needs related to the provision of effective learning media. In fact, students prefer and are more interested in learning directly from the object which is the topic of the material. They, especially in historical studies where there are many abstractions about historical relics of the past, are more able to understand comprehensively by inviting them to come directly to a certain location or object. However, the existence of time and place constraints which are sometimes far from within causes this to become a problem in itself in the learning process. Therefore, the development of the SijarVi application can be an alternative solution for students to study history by seeing historical artifacts and relics directly through virtual reality technology, which provides real-time virtual experiences.

Design

The product of this development was packaged in the .apk file format that could be installed and operated personally on a smartphone using the Android operating system. Some of the core features of this product consisted of text, VR images, videos, user manuals, learning materials, discussion rooms, and evaluations. The choice of Android operating system was based on the high usage of the android system in Indonesia compared to other operating systems such as iOS (iPhone Operating system), Windows Phone, Web OS, Symbian, PalmOS, and others. VR was used to create a virtual illusion in the form of a virtual environment that matches the original object. In the use of VR, users could perform activities multiple times without having to fear damaging objects, because it is only a visual illusion or simulates a process, event, and situation in a virtual environment. In the context of this development, VR was used to simulate or virtualize material objects related to archipelago historical material and Hindu-Buddhist heritage such as temples, monuments, and other sites.

The features available in the SijarVi application consisted of 1) Home. Home is the initial display that contains the application name, logo, application visualization and menus provided in the application. This section also displays a user manual feature that can be used as a guide for users before exploring other parts of the application. 2) Navigation. This section is a feature to make it easier for users to use various menus in the application, such as returning directions, returning to the main menu (Home), and others. Meanwhile, the application menu consists of 1) Subject (Materials). Subjects or materials are the core menu of this development which contains archipelago historical materials in which VR technology has been integrated into material objects that require virtual simulations such as temples, monuments, and other sites. 2) Instructions for Use. This section is provided for users as user's manual or application usage instructions. Users can download features before using this learning media. This is intended to make it easier for users to run the application. 3) Discussion. A discussion menu is provided for those who wish to confirm the information in the application. In addition, this menu can also be used as a medium of communication between one user and another in discussing the various topics provided. 4) Evaluation. The evaluation feature is a facility for measuring the effectiveness of learning using SijarVi. This menu is also provided for those who want to measure their ability to understand each material that has been provided in the application.

Development

SijarVi application is equipped with documentation that displays images with a resolution of 360 degrees. It can display images in more detail from various sides of the building. SijarVi is a mobile phone application that provides online learning services to students in getting to know more about Kingdom buildings and Hindu-Buddhist heritage, not only displaying 360-degree visual images. SijarVi has been equipped with explanations of materials and stories of the origins of the formation of buildings and kings or royal rulers and various other related information.

Table 4.
SijarVi's features

No.	Categories	Features
1	Splash and Home	The initial display contains the application name, logo, application visualization and menus provided in the application
2	Technical Instructions	It is provided for users as user's manual or application usage instructions. Users can download features before using this learning media
3	Navigations	This section is a feature to make it easier for users to use various menus in the application, such as returning directions, returning to the main menu (Home), and so on.
4	Materials	Subjects or materials are the core menu of this development which contains archipelago historical materials in which VR technology has been integrated into material objects that require virtual simulations such as temples, monuments, and other sites
5	Evaluation	This feature is a facility for measuring the effectiveness of learning using SijarVi
6	Discussion	This menu is provided for those who want to confirm the information in the application

In the Material feature, users can immediately see realistically the temple's historical remains through a 360-degree visual photo. Furthermore, the user test feature presents several questions as an evaluation after reading the previous material. In the discussion feature, users are presented with information sharing services such as finding answers and sharing opinions. Meanwhile, on the splash page, the logo and name of the SijarVi (figure 1-2) appear with a duration of 5 seconds. Furthermore, on each menu there is an explanation that can help students in independent learning. The Main Menu provides several views of the learning media menu that can be accessed by the user.



Figure 1. Splash

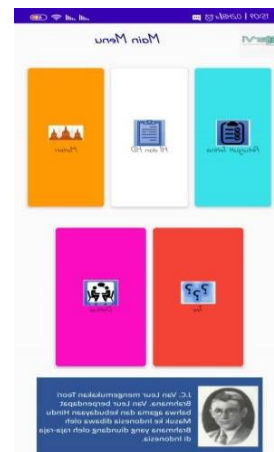


Figure 2. Menu

The material menu presents learning material that can be learned by the user. In the material menu, there is a scroll-bar feature for text, images, and videos. The scroll-bar text feature functions to continue long text by swiping the smartphone screen upwards. In addition, there is an image feature that is used to clarify the material on the display of learning media. Figure 3-4 contains the contents of the sub material discussed in SijarVi. In

addition, there are videos related to materials such as royal and Hindu-Buddhist material that developed in Indonesia.



Figure 3. Materials



Figure 4. Sub-materials

Apart from the video, the sub-material section is also equipped with a VR image that shows a 360-degree image of the temple. In this section, the user can see from all sides of the temple image like seeing the original temple. In other words, the visible image of the temple can be seen in detail like a user walking around the temple yard. This clear and detailed image display provides the user with a virtual image of the temple without having to come to the location.

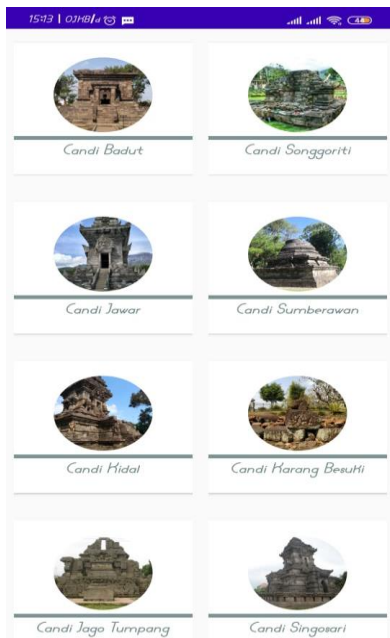


Figure 5. Menu for virtual reality



Figure 6. Virtual reality image

Product validations

The product, in this development, was validated by Nurul Ratnawati as a material expert, Neni Wahyuningtyas as a media expert, and Mega Selviah as a language expert. Product validation was carried out to provide recommendations whether the product being developed is suitable for use or not. The validation instrument was measured using a Likert four scale with a range of 1-4 (1= Very Bad, 2= Bad, 3 = Good, and 4 = very good) (Maskur, Nofrizal, & Syazali, 2017). The results of expert validation can be seen in table 5. In general, the results of product validation by experts indicated that the product can be implemented.

Table 5.
The result of product validation

Validator	Indicators	Total	Percentage	Inf.
Learning Material	15	37	62	Good
Learning Media	19	67	88	Very Good
Language	10	28	70	Good

Table 5 shows that the validation results from material experts are 61.7%. This value can be categorized as good and with minor revisions in several sections according to criticism and suggestions. For media validation, it gets a score of 88.2% which is categorized as very good without revision (Arikunto, 2010). Meanwhile, the results of the language validation indicated that a value of 70% was given by the validator. This means that the product developed is suitable for use with minor revisions in several parts. This indicates that the product that has been developed was feasible to be continued in the next phase or process, product implementation. This stage involved students from Social studies program, Universitas Negeri Malang.

Implementation and evaluation

The implementation phase was conducted by testing the practicality and effectiveness of using SijarVi with two tests. The first one was tested by the teacher and the second one was assessed by the students. The examiner for this stage was a senior teacher from junior high school, Halimatus Sa'diyah, S. Pd (considering practical use at the secondary school level). A questionnaire sheet was given to determine the practicality of the learning media that had been developed. The questionnaire consisted of 12 components that could be assessed by education practitioners consisting of media aspects and material aspects. Furthermore, 32 students were also asked to fill out a questionnaire via google form after they used SijarVi. At this stage, SijarVi was tried out during the Covid-19 pandemic by paying attention to the direct contact limits. Before being distributed to students, they were asked to install the application to ensure the practicality of SijarVi.

Table 6.
The result of practical use assessment

Item	Examiner	Total	Percentage
12	Teacher	48	100
10	Students	1027	80

Table 6 shows that the SijarVi practicality score obtained 100% from the teacher and 80% from the students. These scores fell into the perfect and very practical categories

respectively. This indicated that SijarVi is suitable to be used as a learning medium (Akbar & Sriwiyana, 2011).

The next step was to determine the effectiveness of SijarVi by giving test questions to students who had used SijarVi. Previous test questions had been tested for the level of difficulty and the power of difference in questions. The use of the test questions had also been verified. The results of the effectiveness test can be seen in table 7.

Table 7.
The result of effectivity assessment

Respondents	Passed	Remedial	Percentage
32	26	6	81.3

Table 7 shows that of the 32 students who did the test through SijarVi, 26 students got very good scores and could be categorized as passed. Meanwhile, 6 students scored below the qualifying requirements (Minimum Passing Criteria-KKM), or with a percentage of 81.3%. This percentage is included in the very effective qualification. It means that SijarVi can be categorized as being used as a learning medium (Arikunto, 2010).

Both theoretical and empirical literature have noted, over the last few decades, the importance of the use of technology in learning, especially the use of smartphones (Dorouka, Papadakis, & Kalogiannakis, 2020; S. Papadakis, 2018; Stamatios Papadakis, Vaiopoulou, Kalogiannakis, & Stamovlasis, 2020). The main focus of this study is to develop SijarVi which aims to provide learning that can be accessed by students regardless of time and space (Kurniawan, Purnomo, Idris, Adi, & Eskassnanda, 2020; Perguna et al., 2020; Ratnawati & Idris, 2020; Wahyuningtyas & Idris, 2020). Apart from that, they can also experience, during the learning process, virtual illusions which bring them into direct contact with virtual objects and environments. VR visual illusions are used to simulate material objects related to archipelago historical material and Hindu-buddha relics such as temples, monuments, and other sites that are difficult to record and remember related to the past.

The use of online-based technology, especially virtual experiences, in learning can create an effective learning process (Gregory & Michelle, 2017). In addition, the ease with which a smartphone can be carried anywhere and can be operated easily can make learning more effective (Ismanto, Novalia, & Herlandy, 2017), more fun, more efficient and more practical (Alhafidz & Haryono, 2018). Furthermore, to increase student interest and success in learning can be done by utilizing interesting learning media (Setyadi & Qohar, 2017). Learning media can be said to be practical according to whether or not the media is used easily (Hestari & Lisdiana, 2016).

Conclusion

The development of SijarVi can be an alternative medium for students, lecturers and teachers to study historical material that requires abstraction and high illusory power on certain objects. Furthermore, for students, SijarVi can be an attractive and easily accessible learning medium anywhere and anytime. Based on the validation results of media experts, linguists, and material experts, which had been processed and analyzed based on the instruments that have been distributed, it can be concluded that SijarVi is feasible to be used and utilized as a learning medium. Substantively, this media can also increase their insight into interesting learning alternatives and support the learning process independently and can

improve the quality of the learning process at school and outside of school. Thus, smartphones owned by students can be used properly for the learning process.

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