DEVELOPMENT OF THE INDONESIAN TANGIBLE HERITAGE WEB EQUIPPED WITH VIRTUAL REALITY TO STRENGTHEN THE CULTURAL INSIGHTS OF SIJB STUDENTS, MALAYSIA

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Abstract: *This research contains a study of efforts to strengthen the cultural insights of Indonesian Johor Bahru School (SIJB) students, Malaysia through virtual reality-based learning media for cultural heritage. The focus of this research is to develop Web Indonesian Tangible Heritage learning media equipped with virtual reality technology. The development method used is ADDIE, consisting of 5 stages, namely: 1) Analyze, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation. The study was conducted on 91 junior high school (SMP) students at SIJB, Malaysia. The results of the study show that the Web Indonesian Tangible Heritage learning media equipped with virtual reality technology has functionality that can work well, is able to strengthen cultural insights according to the target, and gets a positive response from users. Most students agree that learning integrated with technology can increase motivation in learning and improve understanding of the material.*

INTRODUCTION

Johor Bahru Indonesian School (SIJB) is one of the educational places that accommodates the children of Indonesian Migrant Workers (PMI) under the auspices of the Consulate General of the Republic of Indonesia (KJRI). There are quite large numbers of Indonesian migrant workers in Malaysia. In 2020, Indonesian Migrant Workers placed in Malaysia reached 79,663 (BNP2TKI, 2020). Some of them have children who were born in Malaysia and need to get an education (Notoprayitno & Jalil, 2020). In 2022 there will be 350 children of migrant workers studying at SIJB, Malaysia.

SIJB is an educational service facility to provide protection for the children of migrant workers in the form of fulfilling their basic rights to education (Shavira Lisdiany S., 2017). Establishing SIJB is not easy, considering the residence permit status of parents and almost all SIJB students are undocumented (Madyar Dewi, 2018). They were born in Malaysia and certainly have never set foot in Indonesia.

As an Indonesian citizen, apart from having the right to receive the same education, national insight is also a basic thing that must be understood (Putra et al., 2023; Sujatmoko, 2016). National insight can be taught, one way or another, through schools (Kebangsaan et

al., 2010). In the Big Indonesian Dictionary (2002) it is stated that etymologically the term "insight" is: 1) the result of insight, review, view and can also mean, 2) conception or point of view. National Insight is very identical to Cultural Insight, namely the way society views culture and the environment in its existence (Wijayanti, 2021).

In its application, increasing national insight can not only be done using classical methods, but can also be integrated with modern technology. Nowadays Virtual Reality (VR) is developing rapidly as a supporting facility in education and learning (Putra et al., 2023; Sholihin et al., 2020). VR is able to provide an interactive and immersive learning experience, so that users can feel as if they are in that place (Putra et al., 2023; Fitria, 2023). Apart from being interactive and immersive, VR is also able to stimulate the user's imagination while in the VR world (Putra et al., 2023; Hedberg & Alexander, 2006).

VR technology can effectively help realize and realistically depict the material cultural heritage that exists in Indonesia (Fauzan & Tolle, 2022). Cultural heritage can tell the history, location, time and events that occurred in Indonesia (Karmadi, 2007). By experiencing material cultural heritage directly, this can increase students' cultural insight. Supported by the characteristics of VR which can be accessed anytime and anywhere, VR can be a stimulus to increase students' interest in getting to know Indonesia (Hanugrah & Putri, 2021). The technology developed aims to integrate cultural heritage and be able to become a facility for students to strengthen students' cultural insight and preserve existing culture.

This study focuses on enhancing students' cultural insight through the development of a Virtual Reality (VR)-enhanced Web Indonesian Tangible Heritage, an open-access website. These following questions were proposed:
1. Why can a Web Indonesian Tangible Consul Heritage be developed?
2. How can Web Indonesian Tangible Consul Heritage improve students' cultural insight?
3. How do students perceive learning in immersive virtual surroundings?

METHOD
Research Design

The method used in this research is ADDIE. ADDIE has five stages in its development (Drljača et al., 2017), namely 1) Analysis, 2) Design, 3) Development, 4) Implementation, 5) Evaluation. The ADDIE method shown in Figure 1.
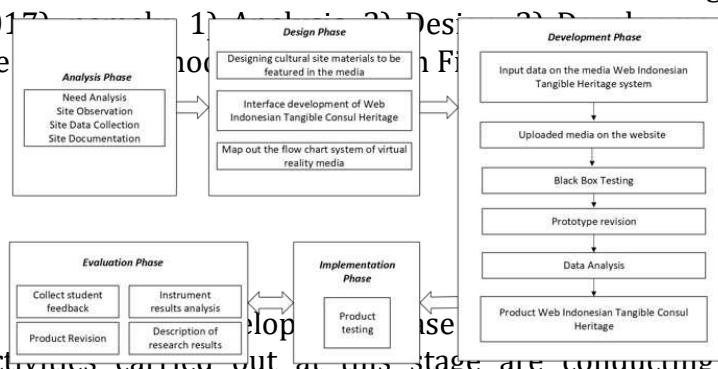

1. Analyze. Activities carried out at this stage are conducting initial observations, collecting information related to the research topic and analyzing partner needs in detail. This stage took place on January 24 2023, by conducting observations and interviews with the head of the curriculum and one of the teachers at the Johor Bahru Indonesian School, Malaysia.

2. Design. At the design stage, you create a design that will be displayed in the application. The design created is in the form of designing site material that will be displayed in the media, mapping the virtual reality media flow diagram system, software interface design.

3. Development. Product development begins with inputting data and documentation into the system in VR then uploading it to the website, after the product has been uploaded to the website then the media will be black box tested and analyzed. If there are still deficiencies then revisions will be made.

4. Implementation. The media will be implemented in the classroom during learning for all 73 students in grades 7, 8 and 9 at the Johor Bahru Indonesian School, Malaysia.

5. Evaluation. Evaluation is carried out to analyze instruments and describe the results of product trials, as well as accumulating student response questionnaires to the media using descriptive statistics. Questionnaire data will be calculated using percentage techniques and categorized on a Likert scale. Further evaluation calculations, namely student and teacher opinions on the media, are carried out using interview techniques to determine the advantages, disadvantages and expectations of the media.

Conceptual Framework

The conceptual framework is used to provide an overview of the important points that form the formulation of the elements discussed. Figure 1 describes the flow of the conceptual framework for developing Indonesian Tangible Heritage Web media with Virtual Reality Technology to strengthen the cultural insights of Indonesian School students in Johor Bahru, Malaysia.
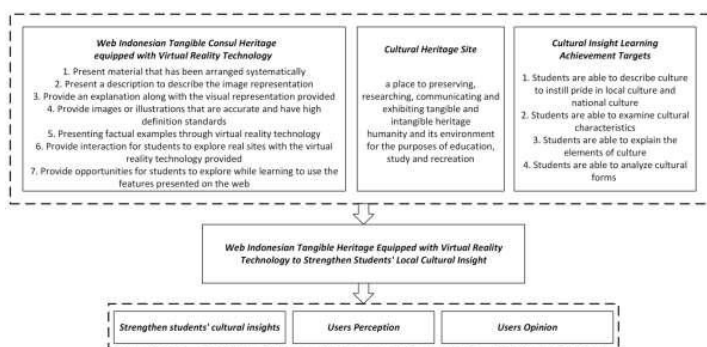
Framework Development

The development of Indonesian Tangible Consul Heritage Web media goes through several stages from preparation, data collection, data processing, prototype development process, black box test, and in the final stage, the resulting web-based virtual reality media is ready to be used using a smartphone or using a virtual reality device. VR development utilizes 3D Vista and 360 camera to build. 360 camera allows developers to collect the materials to serve in. These units take multiple pictures from different angles simultaneously and wholly. 3D Vista is used to integrate the picture/video has been taken with 360 camera into the prototype. After the media has been developed, the product will go through blackbox test to determine the level of usefulness of the media and any deficiencies in the media to be revised. The framework development to develop Web Indonesian Tangible Consul Heritage was developed through several processes in its design as shown in Figure 2.
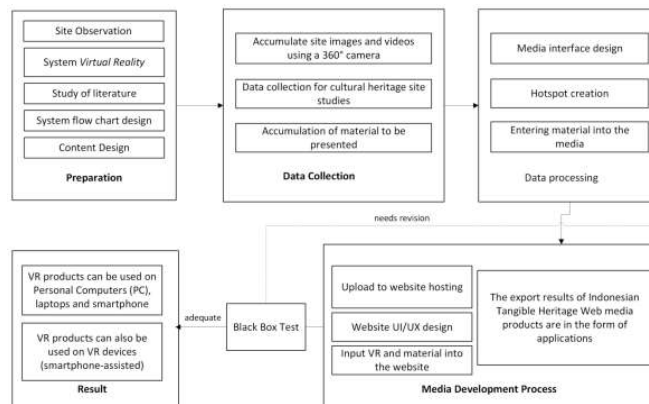
Figure 2. **Development process**

Device Specifications

Indonesian Tangible Heritage Web Media is web-based media that is integrated with virtual reality technology. In its creation, it requires several devices and software so that it can be accessed either using the web or with a virtual reality device. It is compatible with the Asus Tuf Gaming FX505DD personal computer (PC), which runs on the Windows 11 home single language with 22H2 version. The PC system type includes a 64-bit operating system, x64-based processor, and an AMD Ryzen 5 3550H with Radeon Vega Mobile Gfx 2.10 GHz processor, Monitor Size: 15.6" (16:9) LED-backlit FHD (1920x1080) 120Hz Anti-Glare IPS-level Panel with 45% NTSC, and 16,0 GB installed RAM with 1TB HDD for storage. Users can also access the VR website using smartphones that have Android operating systems, and HD displays, and are located in areas with a minimum version of Android 6.0 Marshmallow.

Data Collection

The data collection in this study employed a multifaceted approach to comprehensively evaluate the Web Indonesian Tangible Heritage with VR technology. First of all, the Black box testing method is carried out to determine the success of an application creation by testing the functionality of the features on the website before implementing them in learning. The application will be tested using the black box testing method to test whether the features in the application are running well and can be used as a measuring tool for whether this application is suitable for use or not. If there are discrepancies after testing, an evaluation is carried out. The design that has been created will be evaluated together with the user with the aim of adjusting several features according to the user's wishes and needs. If there are still deficiencies, they can be added.

Furthermore, if the prototype is proven successful and feasible in the functionality test, implementation will be carried out on 79 students at SIJB Malaysia. There are two types of data taken, namely questionnaires for all students and interviews with a number of teachers and students. A questionnaire consisting of 23 multiple choice questions was used to collect quantitative data. Interviews with teachers and students were also conducted to determine the advantages, disadvantages and expectations of the media. This test aims to assess the usefulness of the media and its suitability to the learning material.

Qualitative data was collected through open questions that allowed trial participants to convey comments, suggestions and overall assessments of the media. Qualitative data, as cited in the research of Aylward et al. (2021) is the basis for researchers to revise the product

if necessary. Qualitative and quantitative data are considered complementary in this research. Quantitative data obtained from assessments carried out by students using a Likert scale provides a percentage value that shows the suitability of the Indonesian Tangible Consul Heritage Web media. On the other hand, qualitative data includes students' assessments and input regarding their experiences with the Indonesian Tangible Consul Heritage Web. During product trials, questionnaires were given to students and teachers to evaluate various aspects such as practicality, effectiveness in improving understanding of the material, local wisdom-based approach in learning media, level of interactivity, usability, and user instructions for the Indonesian Tangible Consul Heritage Web.

User Testing

User try out took place at Sekolah Indonesia Johor Bahru (SIJB) Malaysia in 2023, during which practical and feasibility tests were conducted for each feature in Web Indonesian Tangible Heritage. These tests involved both quantitative and qualitative assessments, employing the think-aloud method. Through this method, participants were able to verbally express their thoughts while completing specific tasks, aiming to gain insights into their cognitive processes. Verbal comments provided qualitative data, allowing participants to reflect on their experiences with Web Indonesian Tangible Heritage usage. This approach eliminated the need for participants to possess prior experience with VR devices and reduced the usual requirement for socialisation when adopting new technologies.

The study presents an analysis of participant responses regarding the utilisation of Web Indonesian Tangible Heritage. During the user trial stage, researchers were able to gather and evaluate qualitative data based on participant feedback. The research focused on the development of Web Indonesian Tangible Heritage media as a learning technology environment, specifically aimed at enhancing students' comprehension of cultural insight. Notably, Web Indonesian Tangible Heritage proved to be an efficient tool for remote fieldwork, particularly during the COVID-19 pandemic. The findings derived from user trial responses influenced subsequent improvements, resulting in enhanced products compared to previous iterations.

Participants

This research involved 73 junior high school students at SIJB Malaysia, aged between 12 and 14 years, to evaluate the effectiveness of the Indonesian Tangible Consul Heritage Web. This group consists of students who actively take geography subjects, with a gender distribution of 35 women and 38 men. The selection of participants was based on certain criteria to ensure their suitability for the VR-enhanced learning media trial. Before the pilot began, a baseline survey was conducted to ascertain students' previous exposure to VR technology. This initial assessment revealed that 4 students had prior experience with VR technology, whereas the remaining 69 students had no prior experience. The diversity in understanding of VR among participants provided a balanced perspective for evaluating the usability and effectiveness of learning tools across different levels of technology proficiency.

Tabel 1. **Sociodemographics characteristics of participants**

Category	Frequency	Percentage
1. Experience using VR		
Ever	4	5%

Never	64	95%
2. Sex		
Male	38	52%
Female	35	48%
3. Age		
12	23	32%
13	25	34%
14	25	34%

Data Analysis

The data analysis in this study was multifaceted, incorporating both quantitative and qualitative methods to ensure a comprehensive evaluation of the Web Indonesian Tangible Consul Heritage. For the assessment of student perceptions, descriptive statistics were employed. The outcomes of product trials involving students and teachers, collected via questionnaires, were converted into Likert scale scores. These scores were then analyzed using percentage techniques and interpreted against a set of predefined criteria to ascertain the product's feasibility, as detailed in Table 2.

Tabel 2. **Practicality and effectiveness level**

An average score of practicality (Pr)	Interval of percentage	Category
1 < Pr < 2	20%-0%	Very less
2 < Pr < 3	40%-21%	Less
3 < Pr < 4	60%-41%	Enough
4 < Pr < 5	80%-61%	Good
Pr = 5	100%-81%	Very good

Furthermore, an analysis of student feedback to find out individual opinions about the use of media and structured interviews to find out the strengths, weaknesses, and expectations of students towards the media.

Result and Discussion

The Development of Indonesian Tangible Consul Heritage Web Media equipped with Virtual Reality Technology as a medium to strengthen students' cultural insight

The product developed is entitled Web Indonesian Tangible Consul Heritage and has been equipped with virtual reality technology to support virtual exploration of cultural heritage sites in Indonesia. The media developed can be applied using two methods, namely by web display or using virtual reality mode display. Figure 3 shows a flow diagram of the display system in web mode.
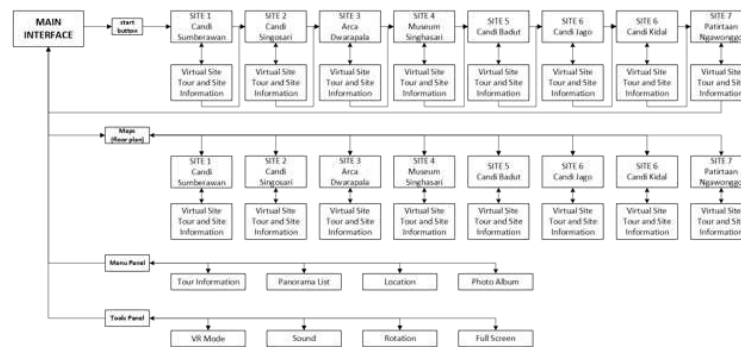
Figure 3. The Indonesian Tangible Consul Heritage Web system flowchart on a web mode

The use of Indonesian Tangible Consul Heritage media in web mode can be applied using a personal computer (PC) or using a mobile phone. This display has several menus that can be selected, users can explore the site using the map at the bottom of the display. Figure 4 is the Indonesian Tangible Consul Heritage interface using web mode.

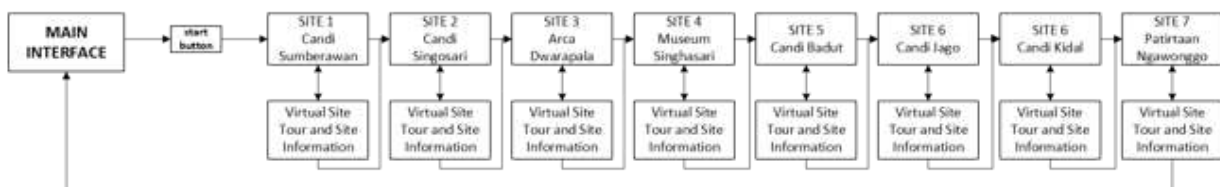**Figure 4.** Display of the Indonesian Tangible Consul Heritage interface in web mode

Figure 5. Flowchart of the Indonesian Tangible Consul Heritage Web system with virtual reality devices

Users can directly explore the sites presented. There is a small white dot on the display flashlight in Figure 5 which functions as a cursor to direct the user to the next location. This point also functions to show information on the icon that is presented when directed at a moving sight.
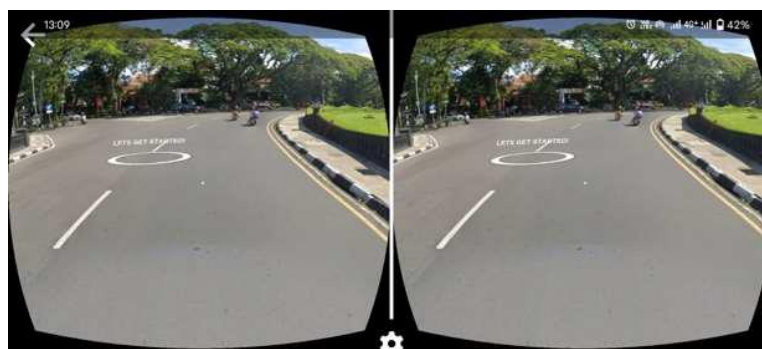
Figure 6. **The media interface uses virtual reality mode**

Web Analysis Indonesian Tangible Consul Heritage Black Box Test

The black box test is carried out to find out and map the deficiencies in the media being tested on a limited scale. Testing is intended to determine whether the software being developed meets the criteria in accordance with the media development design objectives (Cholifah et al., 2018). The black box test design is presented in Table 3.

Tabel 3. **Black Box Testing Scenarios**

Item tested	Testing scenarios	Test type
Displays the Globe Homepage	Displays the Globe Interface	Blackbox
	Displays the Homepage Interface	Blackbox
Displays the Menu Bar	Displays Toggle Menu Bar	Blackbox
	Open the Tour Information Menu	Blackbox
	Open the Panorama List Menu	Blackbox
	Open the Location Menu	Blackbox
	Open the Photo Album Menu	Blackbox
Displays the Tool Bar	Displays the Toggle Tool Bar	Blackbox
	Activate Virtual Reality Mode	Blackbox
	Enable Volume	Blackbox
	Enable Rotation	Blackbox
	Activate Full Screen Mode	Blackbox
Displaying a Map (Floor Plan)	Displays Toggle Floor Plan	Blackbox
	Open Floor Plan	Blackbox
	Open every site icon provided	Blackbox
Starting a Virtual Tour	Select the Start Menu	Blackbox
	Exercising Control	Blackbox
	Running Navigation	Blackbox
	Finished the Tour	Blackbox
Enable Navigation Arrows	Arrow Next Site	Blackbox

	Arrow Next Step	Blackbox
	Arrow Back	Blackbox
Exercising Control	Select the Virtual Reality Menu	Blackbox
	Exercising Control	Blackbox
	Look Right, Left, Up, and Down	Blackbox
	Walk Or Stop	Blackbox
Site Information	Displays the Site Information Menu	Blackbox
	Close the Site Information Menu	Blackbox

After conducting black box testing on the Indonesian Tangible Heritage Web with virtual reality, it can be concluded that the existing functions can work properly. In line with (Cholifah et al., 2018), black box testing is important to do to test media functionality to find out the input and output of the software according to the expected specifications.

Indonesian Tangible Consul Heritage Web Media equipped with Virtual Reality Technology as a medium to strengthen students' cultural insights

The Web Indonesian Tangible Consul Heritage media presents a variety of cultural heritage packaged in virtual reality technology. The cultural heritage sites presented on the Indonesian Tangible Consul Heritage Web consist of 8 sites in Malang City, including: 1) Sumberawan Temple, 2) Singosari Temple, 3) Dwarapala statue, 4) Singhasari Museum, 5) Clown Temple, 6) Jago Temple, 7) Kidal Temple, and 8) Patirtaan Ngawonggo site.

Some of the cultural heritage sites above are several sites that are packaged in the media where there are many more sites that have not been included in the media. This is a manifestation and proof that even the city of Malang has a lot of cultural heritage, especially if the area under study is expanded to a national scale (Fernanda & Kusuma, 2017). The knowledge of Indonesian students at the Johor Bahru, Malaysia School of Indonesian culture is very minimal because students have never set foot in Indonesia. The Indonesian Tangible Consul Heritage Web media is also equipped with unique information and facts about the sites visited as supporting information to strengthen students' cultural insights.

Tabel 4. **Comparison of Students' Performance**

Learning Achievement Targets	Material	Evaluation	Average	Percentage (%)	Category
Students are able to describe culture to instill pride in local culture and national culture	Culture definition	Essay Questions	18.9	94.5	Very good
	Differences in culture and civilization	Essay Questions	19.1	95.5	Very good
Students are able to examine the characteristics of culture	Cultural characteristics	Essay Questions	17.8	89	Very good

Students are able to explain the elements of culture	Language, art, and belief systems	Essay Questions	17.9	89.5	Very good
Students are able to analyze the form of culture	Cultural form	Short Presentation	18.7	93.5	Very good

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Implementation is carried out when learning takes place, students are invited to do virtual exploration first and then evaluate using HOTS (high order thinking skills) questions in the form of description questions. When the lesson is finished, students are also assigned to provide conclusions orally and explain what sites have been visited.

Table 12 displays the results of the evaluation of the description questions and short presentations that students worked on when the media was implemented. Students get grades with an overall average above 89 in a very good category. The average student gets the highest score on achievement targets 1 and 2, namely 94.5 and 95.5. able to explain the elements of culture. All the formulated achievement targets are in very good categories, so it can be concluded that the formulated cultural insight learning achievement targets are appropriate and reach the target. With the application of virtual reality media that has never been used before, this will create meaning in studying culture. In line with research (Prabowo & Supardi, 2022) by presenting a real picture as if the individual is actively participating in it, will generate a sense of curiosity followed by a sense of belonging which is manifested through the preservation of cultural heritage sites in Indonesia.

Figure 7. **Implementation of Web Indonesian Tangible Consul Heritage**
Users Opinions Analysis of Web Indonesian Tangible Consul Heritage on Its Implementation

The interviews were conducted based on several aspects, namely the advantages of the media, the disadvantages of the media, and the expectations of using the Indonesian Tangible Consul Heritage Web media to strengthen the cultural insights of the students and

teachers of the Johor Bahru Indonesian School. Table 5 shows the results of the interviews which are summarized from the students' answers. The results of the interviews show that the Indonesian Tangible Consul Heritage Web media can arouse students' enthusiasm and provide convenience in the learning process. The following are excerpts from the opinions of students and teachers:

Tabel 5. **Student feedback to Web Indonesian Tangible Consul Heritage**

Questions Item	Answers	Thematic Conclusion Point
Excellence of Web Indonesian Tangible Consul Heritage media	S1: With the virtual walks that are presented, I can get new information to understand material form this media and get very memorable experiences that increase my enthusiasm for learning	• Support understanding of the material • Increase learning enthusiasm
	S2: It's fun, being able to travel virtually to Indonesia is very impressive, using sophisticated technology this doesn't make me bored and increases my curiosity when learning takes place	
	G: The application of innovative media that has never been used before at SIJB provides a memorable experience in learning, this media is also able to provide an overview of the concept of sites they have never visited before. Students are able to study independently on this material because it can be accessed anytime and anywhere.	
Web Indonesian Tangible Consul Heritage media weakness	S1: Using the website requires internet so I have to share it with my friends who don't have a data plan.	• Requires adaptation • Causes dizziness when used for a long duration
	S2: This is a technology that we are new to using, so we need to adapt at the start of using the device.	
	G: The use of the VR box device is a little dizzy in the eyes if it is used for a long duration, but students can open the media with a PC or mobile phone in web mode without needing a VR box	
Expectations for Indonesian Tangible Consul Heritage Web media	S1: I really enjoyed and enjoyed the learning process, I hope this can be applied in the next lesson	• Hope can be applied onwards • Hope it can be applied in other subjects
	S2: I hope that similar media innovations can be continued and applied in other subjects	
	G: Similar media is absolutely necessary for further learning because this is in line with the principle of independent learning where students are encouraged to explore material	

The results of the interviews show that the Indonesian Tangible Consul Heritage Web media equipped with virtual reality technology is able to assist in understanding the material, assisting the independent learning process, provide learning motivation, and increase

student activity. In addition, students think that the use of the Indonesian Tangible Consul Heritage Web equipped with virtual reality technology has weaknesses related to personal accessibility, and students feel dizzy if the VR device is used for a long duration. But on the positive side, this can increase student collaboration and form communication in groups, especially with fun learning methods so that students are not afraid to ask questions and give opinions. Users hope that similar innovations and methods will absolutely continue to be applied even to other materials.

The existence of innovative media in the classroom can build new knowledge and provide meaningful learning experiences. Learning media that is integrated with technology is able to encourage student involvement during learning. The Indonesian Tangible Consul Heritage website is equipped with virtual reality technology to provide convenience through the various features provided. Ease is also obtained through the acquisition of meaningful experiences and active learning due to a pleasant learning environment. Students provide positive ideas during larning takes place. The Indonesian Tangible Consul Heritage website is equipped with virtual reality technology to support students' cultural insights.

CONCLUSION

According to the study findings, the Indonesian Tangible Consul Heritage Web media that has been developed received a very good functionality score as demonstrated by the black box test. The Indonesian Tangible Consul Heritage media has also been proven to be able to strengthen cultural insight according to the targets that have been designed by researchers. The user response questionnaires that have been distributed have all obtained very good results and positive responses. Student opinions are used to describe the advantages, disadvantages and expectations of users towards the media. The results of user opinion analysis show that users support if similar learning media is applied in other subjects and this is absolutely necessary because it can increase students' motivation to explore the culture that exists in Indonesia.

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