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Development of Virtual Tour Media of Sambisari Temple as a History Learning Media in High Schools

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Abstract

This study aims to develop a Virtual-based learning media centered on Sambisari Temple to enhance the quality of history education. The research employed the Research and Development (R&D) method using the ADDIE model. Data were collected through interviews, observations, and questionnaires involving 30 tenth-grade students at SMA Angkasa Adisucipto. The data analysis revealed that the Virtual Tour Sambisari Temple application, developed using tools like Blender, Unity 2022, and Canva, demonstrated high feasibility. The material validation received an average score of 93%, and media validation achieved 79%, both categorized as "feasible". The trial with students showed an average response score of 81.76% classified as "very practical". The application features interactives tools, 260-degree visual panoramas, and historical information aligned with the curriculum, presented in an engaging format. It operates both online and offline, allowing students to explore historical sites effectively without visiting the location in person. The findings indicate that the Virtual Tour Sambisari Temple application enhances students' understanding of history topics and motivates them to learn through innovative and engaging approaches. This study provides a framework for integrating technology inti learning media, paving the way for future developments in educational technology.

Keywords: Virtual Tour, Sambisari Temple, Historical Education, ADDIE

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INTRODUCTION

History education is one of the subjects taught at the high school level. This subject carries a vital mission in shaping the nation's character by instilling positive values derived from the historical journey of Indonesia, spanning from ancient history to modern times (Kurniawan, 2021). History is not only about recounting events but also about understanding perspectives and beliefs. The purpose of history education is to reconstruct the past for the benefit of the present (Fajri et al., 2023). Rather than just memorizing facts, history seeks to raise students' awareness of their rights and duties in society, the nation, and the state (Kebumen, 2012). Therefore, history education serves as the application of social science theories and concepts in everyday life.

History plays a crucial role in shaping national identity and values, but history education often struggles to engage students effectively. Traditional methods, such as PowerPoint and modules, lead to passive learning, limiting critical thinking and problem-solving skills (A. F. Firdaus et al., 2021). This disengagement is worsened by long, monotonous textbooks (Harismawan, 2020). To foster active learning,

teachers need more engaging methods and modern media (Fauziyah et al., 2022). A promising solution is Virtual Tour technology, which uses panoramic images, videos, or 3D models to provide detailed, visual information about historical sites, enhancing the learning experience for visual learners (Lauryn et al., 2022; Hikmawan & Sofiani, 2021).

Previous studies demonstrate the effectiveness of virtual tours in history education. Samsiyah et al., (2023) showed that using a Virtual Tour of Sukuh Temple successfully raised historical awareness among middle school students. Similarly, Hilda & Ofianto, (2023) highlighted the role of virtual reality in enhancing history education at SMA N 1 Padang. However, further development is needed to ensure these technologies meet students' needs and educational goals. Triastuti & Sridiyatmiko, (2023) research indicates that the Virtual Tour of Vredeburg Fortress Museum can enhance the quality of history education in high schools. Mahardi & Pratama, (2024) research indicates that the use of Virtual Tour can enhance student engagement in history learning. Virtual visits to museums or local historical sites allow students to better understand and appreciate local history without the need for physical visits. Hikmawan & Sofiani, (2021) research suggests that the use of virtual tour media integrated with e-handouts is recommended for history education, as it can enhance student engagement. Umar Syarif Hadi Wibowo et al., (2020) research shows that virtual tour services can provide an interactive and enjoyable learning experience, helping students better understand historica material.

In the millennial era, history education must adapt to technology, with smartphone-based learning being an underutilized yet effective tool. Although smartphones are allowed in classrooms, history lessons often rely on PowerPoint presentations, leading to student disengagement. Mr. Yan Driya Samodra, a history teacher at Angkasa Adisucipto High School, believes that innovative methods like Virtual Tours could provide a richer learning experience.

This research focuses on the Oldest Hindu-Buddhist Kingdoms in Indonesia, particularly the Ancient Mataram Kingdom and its cultural landmarks, such as Sambisari Temple. Ancient Mataram played a crucial role in shaping Javanese cultural identity and was influential in education, emphasizing Hinduism, Buddhism, and astronomy (Raffi Arrazaq, 2019). Sambisari Temple, a significant cultural heritage site, offers valuable insights into the era's architecture, art, and history (Hadi & Yulianto, 2022).

The objective is to develop a Virtual Tour of Sambisari Temple to improve history teaching about the Hindu-Buddhist kingdoms in Indonesia. This interactive, visual tool will allow students to explore historical sites remotely. Unlike previous virtual tours, which faced issues with limited sites and high storage demands, this research aims to create an accessible, offline-friendly, and storage-efficient solution to enhance student historical thinking skills.

METHODS

This research is a research and development (R&D) study that that adopts the ADDIE model (Hess & Greer, 2016). The research approach aligns with the

research objective, which is to develop the Virtual Tour Sambisari Temple application as a learning platform to explore the historical site of Sambisari Temple. The population in this study consists of tenth-grade students at a high school in Yogyakarta. Meanwhile, the development model adopted by the researcher is the ADDIE model, which consists of the stages: Analysis, Design, Development, Implementation, and Evaluation (Rosmiati, 2019). However, this research focuses only on testing the effectiveness of the product being developed, which falls under the Development stage. In this stage, the process of creating the revised Virtual Tour Sambisari Temple media will be carried out based on input from experts. This stage aims to validate the Virtual Tour media for Sambisari Temple. This aligns with the research objective, which is to develop the Virtual Tour Sambisari Temple application as a learning platform to explore the historical site of Sambisari Temple. The following are the research and development procedures focusing on the product development stage.

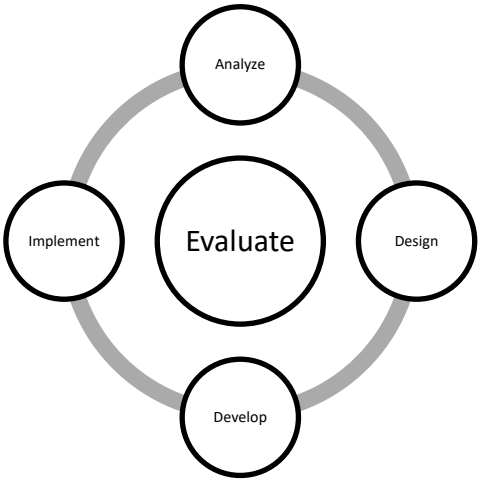

Figure 1. ADDIE Development Model

The sample in this study consists of two subject matter expert validators, two media expert validators, totaling four samples. The data collection technique used is a non-test technique, which aims to measure the quality level of the developed virtual tour media. The data collection instrument used is a validation questionnaire, which includes validation from subject matter experts and media experts. The instrument validity technique uses expert judgment, where an expert from each type of instrument is selected to be consulted on the quality and validity of the media selection questionnaire from various perspectives (Sugiyono, 1967).

The product underwent validation by experts in material and media. Validators included professionals in their respective field:

Table 1. Research Validator

Material Validators	Position	Media Validators	Position
Prof. Dr. Djono, M.Pd	Lecturer S2 TP UNS	Dr. Eka Budhi Santoso, M.Pd	Lecturer, S2 TP UNS
Insiwi Febriary Setiasih, S.S., M.A	Lecturer S1 Ilmu Sejarah	Dr. Fatma Sukmawati, M.Pd	Lecturer S2 TP UNS

The media feasilility was tested with 30 tenth-grade students from SMA Angkasa Adisucipto. Data were collected using questionnaires with a 1-4 rating scale. The questionnaire adopted from Akbar (2015) in Masyarakat et al., 2024) had been validated for reliability. Data were analyzed quantitatively using frequency distribution formulas. The research used a developmental approach focusing on educational technology. The object of study was the Virtual Tour Sambisari Temple application. The operational focus involved testing the feasibility, usability, and effectiveness of the application in enhancing students' historical thinking skills. Data were collected using validated questionnaires, interviews with teachers, and direct feedback from students. The primary instruments included the questionnaire and observation tools designed to measure students' engagement and understanding of the historical material presented through the application. Data were analyzed quantitatively using a Likert scale to determine user responses and media feasibility. Frequency distribution formulas were applied to calculate overall results, categorizing the media as feasible, practical, or needing improvement.

RESULTS & DISCUSSION

Researchers developed the Sambisari Temple Virtual Tour application adopting the ADDIE model R&D method from research by Masyarakat et al., (2024)

Analyze (Interview and Distribution of Questionnaires)

The analysis stage assesses the need for learning media through observations and interviews to evaluate students' abilities in improving historical thinking skills. It was found that current media for learning about Indonesia's oldest Hindu-Buddhist kingdoms still rely on traditional methods like PowerPoint and modules. There is a need for more updated media that aligns with students' learning preferences. At the target school, smartphone use for learning is limited, making Virtual Tour-based media a promising solution in the digital age (Bintari Kartika, 2017).

Material analysis focuses on subtopics related to the Hindu-Buddhist kingdoms, aiming to help students grasp historical events and legacies. Given students' visual learning styles, providing media that displays the Sambisari Temple and detailed information is an effective approach. Developing Virtual Tour-based media is a viable solution.

Design (Planning)

After the needs analysis, the researcher moved to the design phase, creating a draft of the Sambisari Temple Virtual Tour product. This phase focused on content selection, preparing evaluation questions, and designing the app’s cover. Tools such as Canva, Blender, and Unity 2022 were used to develop the Android-based Virtual Tour application. The researcher also created a questionnaire grid to assess the impact and feasibility of the Virtual Tour as a history learning medium, incorporating feedback from both validators and students.

Development (Development)

The development stage focuses on creating the Sambisari Temple Virtual Tour media. This product, an Android-based application, allows users to explore the temple from various angles using a 360-degree panorama. It can be accessed anytime and anywhere, serving as an engaging supplementary tool to enhance history learning through visualization. The steps in developing the application include:

1. Preliminary Planning and Design

a. Features to be developed:

1) Analog for navigation (roads)
2) Interaction button to display information about parts of the temple environment
3) Jump button to jump
4) Realistic 3D environment visualization

b. tools used:

1) Canva: Create storyboards and application design interfaces (UI/UX)
2) Blender: Creates a 3D model of the temple environment
3) Unity 2022: Develop VR-based applications and unite all design elements and interaction features

2. Creating Interface Design (UI/UX)

a. The steps

1) Use Canva to design wireframes and interfaces

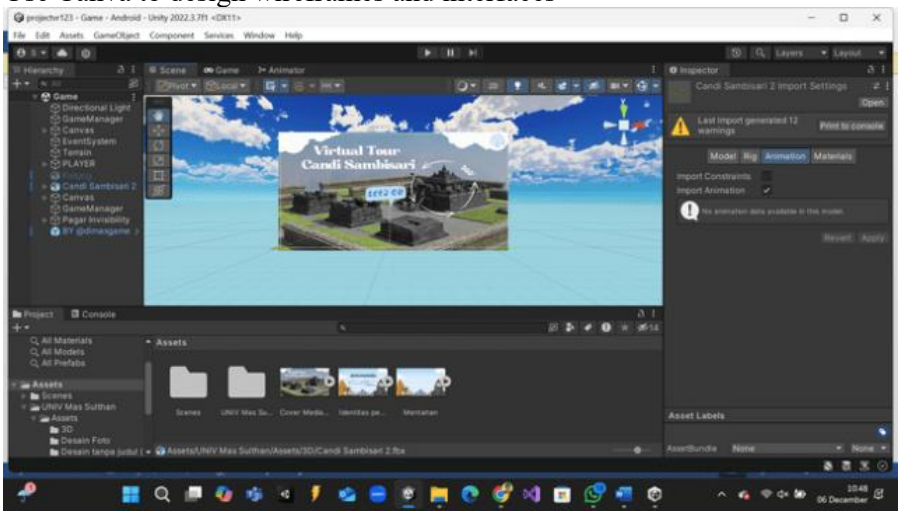

Figure 2. Design with wireframe and interface layout

2) Design interaction buttons such as information, navigation (analog), and jump buttons

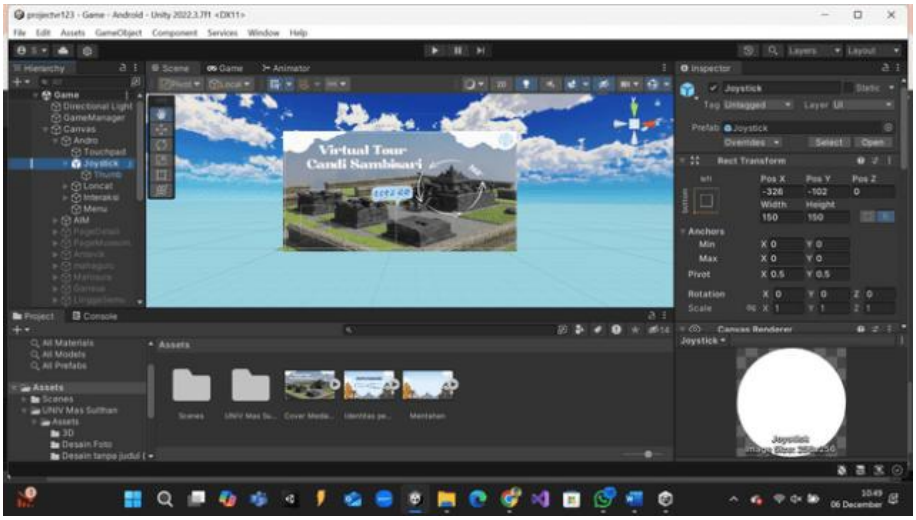

Figure 3. Design interaction buttons

3) Make sure visual elements such as colors, icons and text have a cultural theme according to Sambisari Temple
4) Export designs to PNG or SVG format for use in Unity

3. Making 3D Models of Temple Environments

a. The steps

1) Collecting References:
   a) Look for visual references for Sambisarii Temple through photos or direct visits
   b) Make sure details such as the texture of the temple stone, building structure and layout of the temple yard match its original condition
2) Environment Creation in Blender
   a) Create a 3D model of Sambisari Temple using Blender

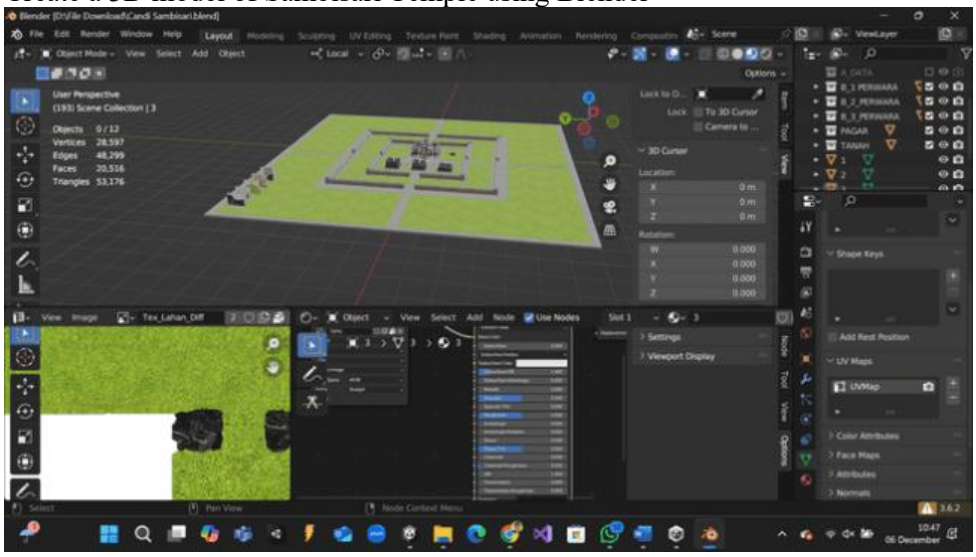

Figure 4. 3D Model of Sambisari Temple

   b) Add detail to the stone texture with realistic materials (use UV Mapping to adjust the texture)

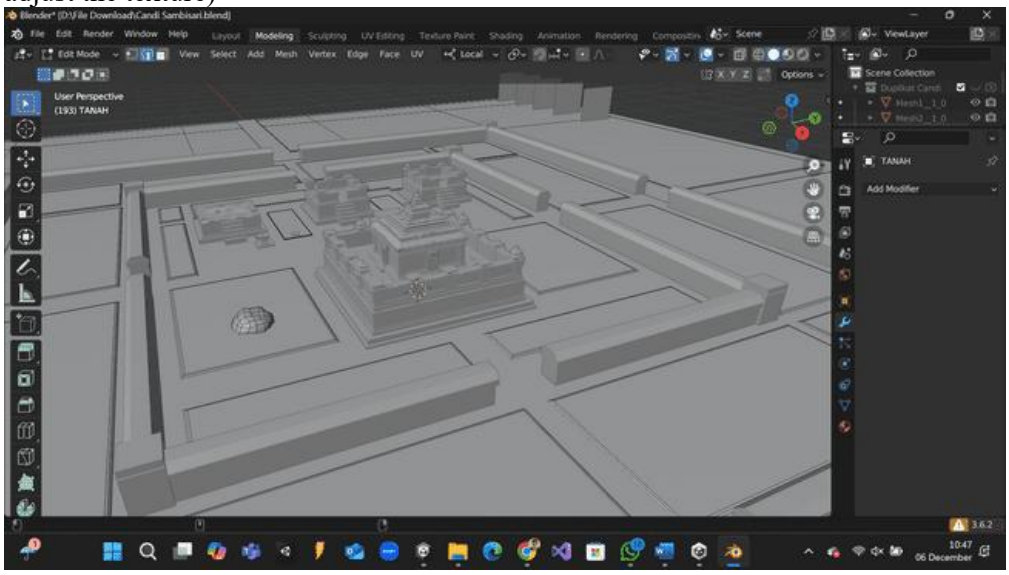

Figure 5. Detail the stone texture with realistic materials

c) Render the model and make sure the scale of the object matches the actual size

3) Export Model

a) Save in FBX or OBJ format for import into Unity

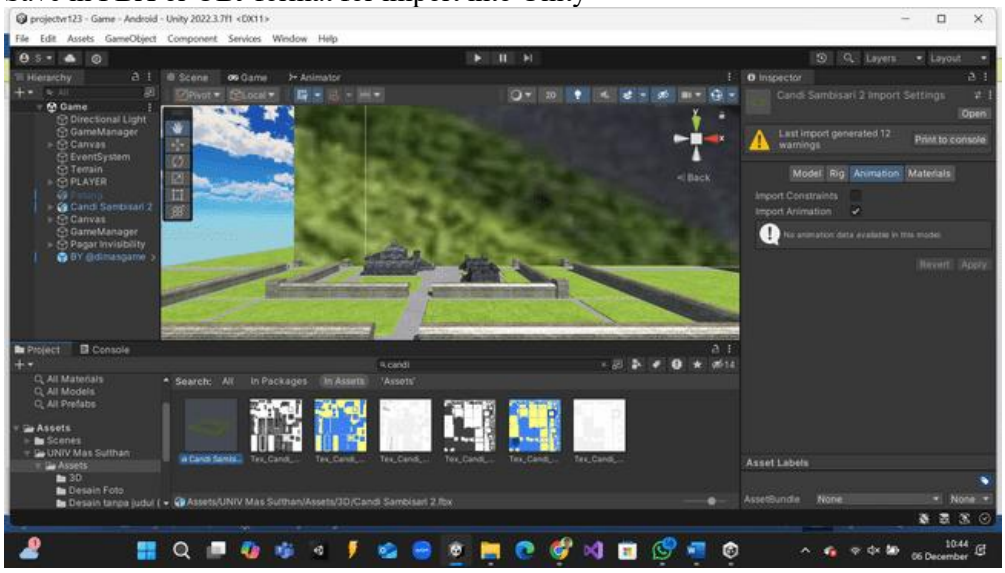

Figure 6. Save the file in FBX or OBJ format

4. Application Development in Unity 2022

The main steps

1) Set Up Project:

a) Create a project in Unity (use 3D or VR templates as needed)

b) Import the 3D model of the temple that has been created from Blender

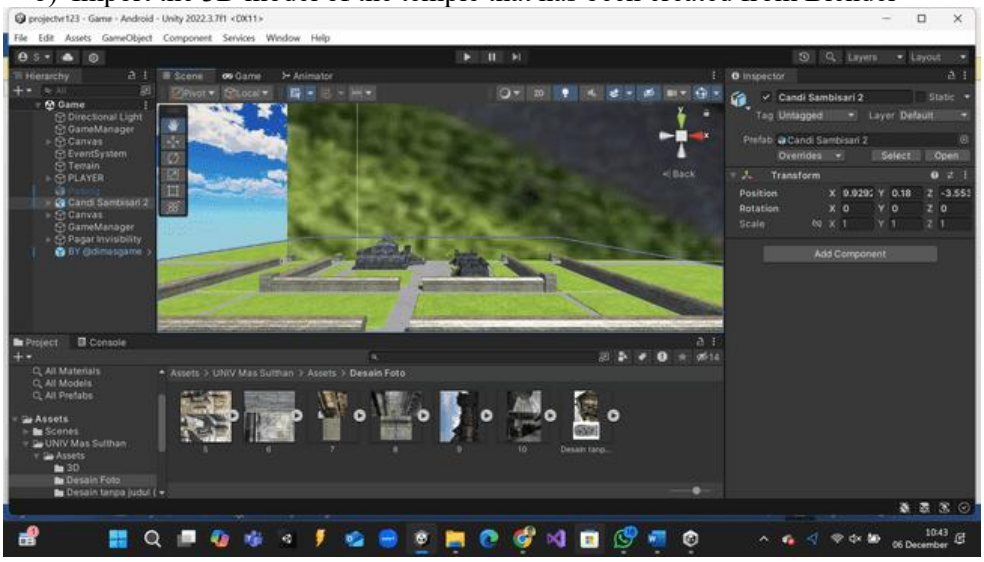

Figure 7. Import 3D model into Blender

Added Navigation (Analog)

a) Add a Player Controller to allow users to move around

b) Use the virtual joystick analog system to navigate with WASD controls or on touchscreen devices

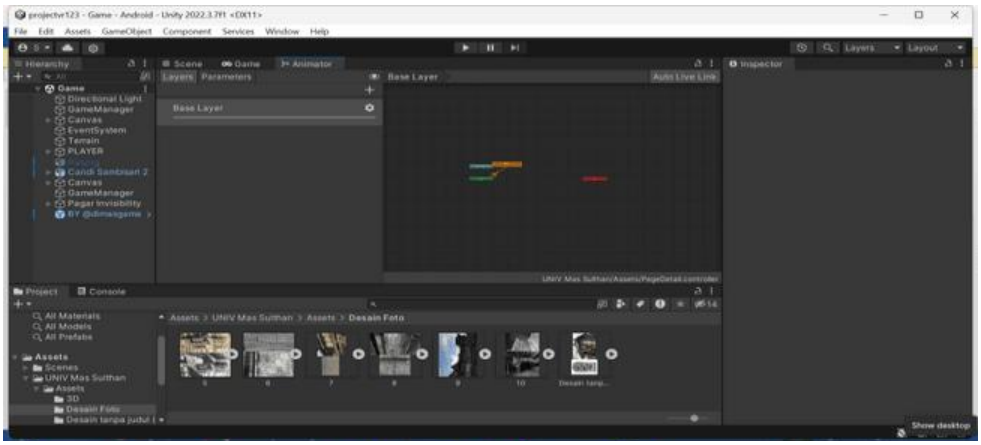

Figure 8. Navigation with WASD controls

Interaction Buttons:

a) Create interaction buttons using UI Canvas in Unity
b) Add an OnClick (!) function for each button:
c) Information Button: Displays pop-up text or audio about certain parts of the temple and Skip Button: Add script to increase the Player's vertical position

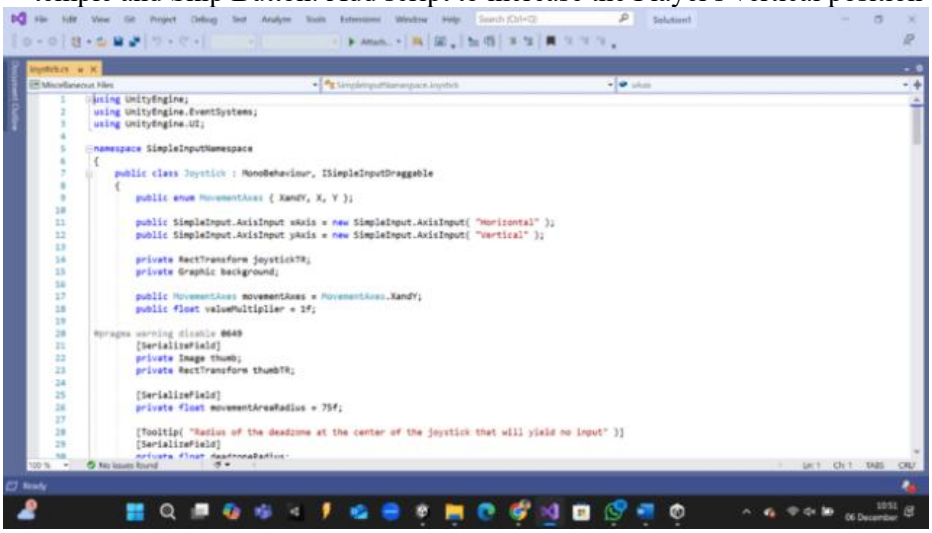

Figure 9. Addition of script

2) Added Interaction Information:
   a) Create a Collider object on a specific building or area
   b) Use Script on TriggerEnter to display information when the user approaches an object or presses a button
3) Application Optimization:
   a) Make sure the 3D models and textures are not too heavy for mobile devices
   b) Use the Occlusion Culling feature in Unity to optimize rendering performance
4) Building and Testing:
   a) Test the app on the target device (PC or Mobile)
   b) Perform debugging to ensure all features work as planned
5) App Export:
   a) Build the application according to the target platform (Android, iOS, or PC)

Application Features

1. **Information for Each Building**
   a) When the interaction button is pressed, detailed information appears such as the history, function and uniqueness of each building
   b) Information can be in the form of text or audio
2. **Analog Navigation**
   a) Virtual analog buttons are used to navigate the temple area
   b) The navigation buttons are designed for an intuitive experience, for both PC and mobile users
3. **Jump Button (Jump)**
   a) This function allows users to jump for exploration of certain areas
4. **Realistic Environment**
   a) The temple model and its surroundings display visual details that are close to their original condition

The final result

1. The Sambisari Temple Virtual Tour application offers an educational and interesting interactive exploration experience
2. The combination of Blender technology, Unity 2022, and Canva's interface design creates an application that is rich in functionality, interactive, and easy to use

After developing the Sambisari Temple Virtual Tour application, the researchers tested the material and learning media with material experts. According to Hidayah et al., (2020), material validation is essential to assess the completeness, accuracy, and organization of the content in the learning media. Material experts evaluated the suitability of the content both quantitatively and qualitatively. Quantitative assessments focused on content relevance and learning support, while qualitative assessments explored suggestions from validators. The average scores from material validators were 95% and 92%, resulting in a combined score of 93%, classifying the material as "very feasible" based on the criteria for material and learning media (Akbar, (2015) in Masyarakat et al., (2024). The material is considered highly appropriate as it is presented in simple language, making it easier for students to understand. The explanations are contextual, with examples and media to help students observe and analyze artifacts from the ancient Mataram kingdom in Sleman.

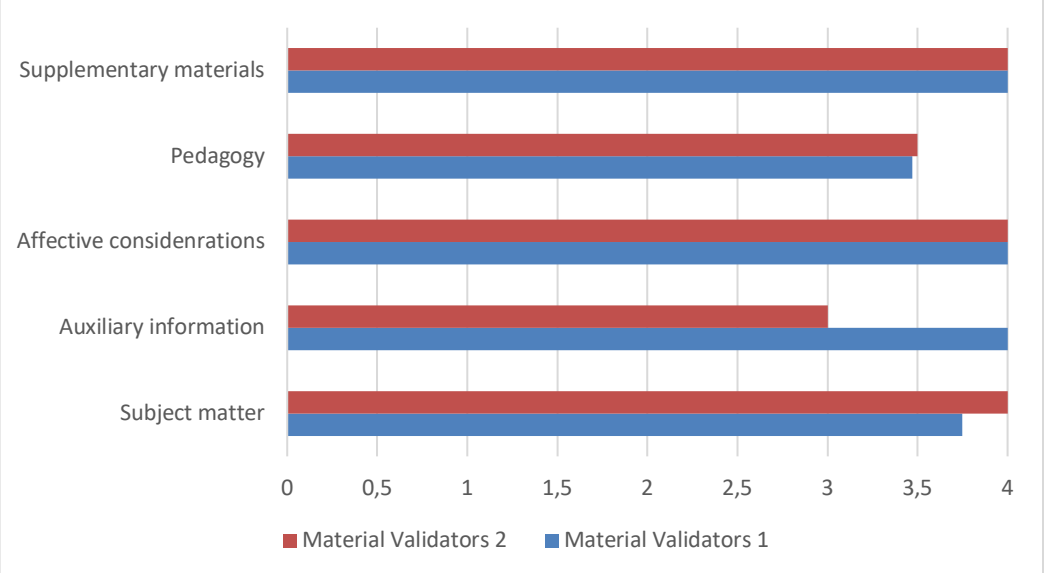

Figure 10. Summary of material expert validator results

Qualitatively, it was obtained from input and suggestions from the validators regarding the material presented which must include quotations and the second expert provided suggestions so that the material prepared was deeper in the content of the Sambisari Temple material located in Purwomartani and improved the practice questions using the HOTS (High Order Thinking) level. This note is supported by research by Destiniar et al., (2020) which explains that evaluation questions at the HOTS (High Order Thinking) level aim to hone students' historical thinking skills which will later have an impact on students' high-level thinking abilities. At the validation test stage, the Sambisari Temple Virtual Tour product material was improved and declared very suitable based on the suggestions and input provided by the two material validators.

The next stage is assessing media aspects. which involved media experts in the Sambisari Temple Virtual Tour application. Saski, N.H. & Tri, S., (2021) explain that learning media requires media validation tests so that the learning media that has been produced is in accordance with students' needs, and can be maximized in the learning process. Media experts assess media suitability using quantitative and qualitative. Quantitatively, the assessment was carried out on the Interface (display), Navigation, Invisible features and Robusmess indicators. Qualitatively explore input and suggestions from validators. Quantitatively, the value given by media validator 1 gives an average value of 81% and validator 2 gives an average value of 77%. If the two average values are divided by 2, they become 79% so that the media in developing the Sambisari Temple Virtual Tour application as a history learning media is feasible based on the appropriateness criteria for material and media Akbar, (2015) in Masyarakat et al., (2024). The media in the Virtual Tour Sambisari Temple application is included in the "Decent Enough" category because the media developed uses a neat and attractive product appearance and also includes information/instructions for use in the Virtual Tour Sambisari Temple application which will make it easier for users. The results of the validation test by media experts are listed in Figure 8

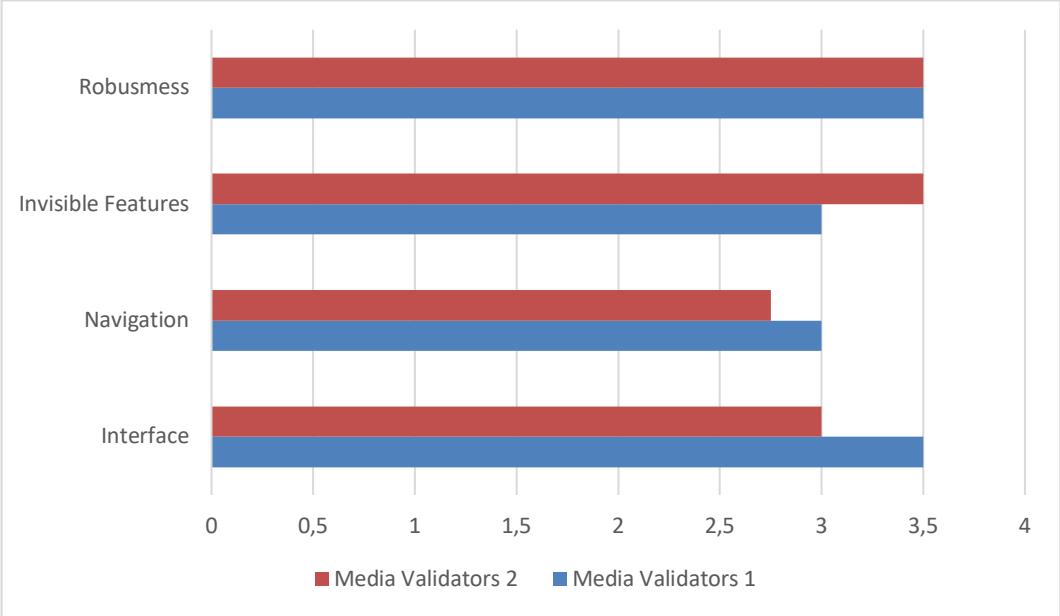

Figure 11. Summary of media expert validator results

Qualitatively, it is obtained from input and suggestions from validators regarding the media being developed which must provide information on the initial appearance of the product and considerations for developing access for all students. Ease of access to learning

media must be an important consideration in developing learning media (Dwiharja, 2015). At the stage of media validation testing, the Sambisari Temple Virtual Tour product had been improved and declared very suitable based on the suggestions and input provided by the two media validators.

Before the product is tested, the following is a display of instructions for the features contained in the Virtual Tour of Sambisari Temple to provide the function of each button to the user. The first button "Let's Go" functions to enter the home page. This button will take you to the application's main interface, where you can access various features in Figure 11.

Figure 12. The initial display of the Sambisari Temple Virtual Tour media

Next, the five main menus that will guide you in exploring the virtual tour of Sambisari Temple are shown in Figure

Figure 13. The homepage of the Sambisari Temple Virtual Tour media

The material was designed using the Canva application. In the menu there are Instructions for Use, History, Start, Developer Info, and Exit Application. The History menu contains the history of the discovery of Sambisari Temple to support students' knowledge about Sambisari Temple, which is shown in the picture

Figure 14. History menu page

Implementation

The implementation stage is the stage of implementing the Sambisari Temple Virtual Tour learning media which has been developed in real classroom situations so that students can achieve learning objectives. The Sambisari Temple Virtual Tour product is in the form of an application that can display a Virtual Tour with 360 panoramic visuals packaged in the form of an Android application. Can be used anytime and anywhere. This Virtual Tour-based learning media can also be used as additional teaching material to provide material as well as additional insight with a more interesting packaging or history learning style with the help of visualization. At this stage, trials were carried out in class X involving 60 Angkasa Adisucipto High School students. Data analysis carried out at this stage was in the form of a student response questionnaire in the form of questions responding to the application of the Sambisari Temple Virtual Tour learning media.

Based on the results of product trials (Table 4), it can be seen that the average score for the feasibility of easy-to-use virtual tour media is 83.33%, content in virtual tour media 81.67%, understanding in understanding historical material after using virtual media 81, 67%, Ease of interactive features in the virtual tour media at Sambisari Temple 81.67%, increased motivation to use virtual tour media 81.67%, Attractive appearance of the virtual tour 81.67%, Media interest in other learning 81.67%, Conformity with the curriculum 81.67%. If all data is averaged, the value is 81.76% which is included in the "Very Practical" category when applied in learning.

Table 2. Recapitulation of Trial Results on Students

No	Aspects being tested	Avarage
1.	Virtual tour media is easy to use	83,33%
2.	The content in the virtual media tour of Sambisari Temple is interesting and informative	81,67%
3.	I feel I understand historical material better after using virtual media	81,67%
4.	The interactive features in the virtual media tour of Sambisari Temple helped me learn better	81,67%
5.	I felt involved and motivated when using the virtual media tour of Sambisari Temple	81,67%
6.	The visual display of the Sambisari Temple virtual tour media is attractive and easy to understand	81,67%
7.	I want to use virtual tour media like this in other lessons	81,67%
8.	The virtual media tour of Sambisari Temple is in accordance with the curriculum we study	81,67%

Evaluation

The final stage of the research involved revising the Sambisari Temple Virtual Tour application. This evaluation aimed to assess student engagement and the benefits of using the media. According to Menendez (2019) in Masyarakat et al., (2024), Virtual Tour technology offers a realistic experience, allowing students to explore historical sites virtually, which increases their interest in learning. It also helps students focus on the material, making it easier to understand, and can be accessed anytime and anywhere, improving accessibility (Salsabila et al., 2020).

The use of Virtual Tour in education has shown positive effects across subjects, including history (Villena Taranilla et al., 2022) and geography (Ozdemir & Ozturk, 2022), and has been proven to increase student activity (Barry & Kanematsu, 2022). These findings support the idea that the Sambisari Temple Virtual Tour enhances historical learning and boosts student involvement through visualization. As noted by Maulana & Khansa, (2019), Virtual Reality applications make learning more engaging.

The Virtual Tour-based learning media developed in this research works on Android devices, and previous studies (Hafidz, M., Wardhono, W. S., & Wicaksono, 2020) show that smartphone-based media can increase student interest. Condorelli & Bonetto, (2022) emphasized that Virtual Tour media offers a low-cost method for creating 3D models of historical sites. Additionally, Maté-González et al., (2022) pointed out that these media offer more comprehensive information about historical sites beyond just historical facts. The application enables students to "visit" Sambisari Temple virtually, enhancing learning without the need for a physical visit (Dharma et al., 2022), and can also promote historical sites effectively (Lerario & Maiellaro, 2020).

The Virtual Tour of Sambisari Temple is available online and offline, which reduces connectivity issues (D. R. Firdaus, 2021). After validation by material and media experts, it was confirmed that the media is suitable for educational purposes. The experts evaluated the completeness, relevance, and visual appeal of the media, particularly the temple imagery.

The media was tested with 30 students from class X E 3 at SMA Angkasa Adisutjipto using questionnaires, showing that the application is "Very Practical" for learning. The field trial assessed aspects such as ease of use, content quality, student understanding, interactive features, and visual appeal, confirming its effectiveness in supporting student learning.

CONCLUSION

The Sambisari Temple Virtual Tour has proven to be an effective and engaging tool for enhancing history education. By utilizing interactive 360° visuals, this application provides a deeper understanding of historical sites, particularly the Hindu-Buddhist kingdoms in Indonesia, with a focus on Sambisari Temple. Validation from experts and feedback from students confirm the ease of use of the application and its alignment with the curriculum. This tool promotes active learning, enhances historical thinking skills, and offers easy access both online and offline. This development presents a promising solution for modernizing history teaching and making learning more dynamic and accessible.

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numbered section of the paper.

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