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Preserving Balinese Folklore: The Development of 'The Origins of Buleleng and Singaraja' via Augmented Reality

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***Abstract*— This study presents the development and validation of an Augmented Reality (AR) application centered on the Balinese folklore "The Origins of Buleleng and Singaraja." Utilizing the Multimedia Development Life Cycle (MDLC) model, which includes six stages—concept, design, material collection, assembly, testing, and distribution—the research aims to enhance public engagement, awareness, and understanding of Balinese cultural heritage. The application underwent rigorous testing, including expert content validation, media expert assessment, and user response evaluation. The content and media tests, analyzed using Gregory's formula, yielded a perfect validity score of 1.00, indicating a "very high" level of accuracy and effectiveness in both historical narrative presentation and AR content delivery. User feedback, collected from 35 respondents, showed a 97.30% response rate in the "very positive" and "very good" categories, with the remaining 2.70% in the "good" category. These results demonstrate strong user approval and the potential of AR technology to preserve and promote Balinese folklore.**

***Index Terms*— augmented reality; Balinese folklore; development.**

I. INTRODUCTION

Indonesia has a rich cultural heritage, history and traditions that are of value to each generation and thus require preservation. One efficacious method for the conservation of culture is the introduction and education of that culture itself, extending to the teaching of literature [1]. The Indonesian literary tradition is replete with prose narratives [1], [2]. Some of these have been collated and subjected to critical analysis; however, a considerable number remain in the oral tradition. One of prose narratives is folktale.

The term 'folktale' denotes a type of oral tradition that has been transmitted from one generation to the next within the context of specific communities. Folktales are also a distinctive feature of each nation, reflecting its diverse cultural and historical background [3]. Folktales frequently convey ethical or moral teachings whose applicability extends beyond the realm of fiction. These are narratives from bygone eras, transmitted orally and subsequently acknowledged on a vast scale, thus constituting a significant cultural legacy that must be safeguarded. The Balinese folktales convey a wealth of values that are integral to Balinese culture. These include the values of honesty, loyalty, dedication, and politeness. When these stories are communicated effectively and accurately, the younger generation is able to absorb them and internalize a set of values.

A multitude of Balinese folktales, encompassing a vast array of forms and variations, have been transmitted across generations. Among these, the regency of Buleleng has its own folktale, such as the "The Origins of Buleleng and Singaraja." The name "Singaraja" is thought to mean "mighty king," akin to a lion. An alternative interpretation is that the term 'Singaraja' refers to a 'king's resting place', derived from the phrase *'singgah raja'* (king's stopover). With the passage of time, the Balinese community has gradually lost familiarity with some of its local folktales, including "The Origins of Buleleng and Singaraja." This is due to the fact that these stories are primarily documented in books, which has resulted in limited accessibility.

The prevalence of digital devices has also contributed to a decline in interest in Balinese folktales. The transmission of local folktales among the Balinese population has become less common recently, reflecting a decline in the retention of these traditional narratives. A survey on the public's knowledge of the Balinese folktale "The Origins of Buleleng and Singaraja" was conducted with 106 respondents across Bali, which provided evidence of a decline in familiarity with this particular tale. The survey was done by distributing simple survey through WhatsApp. The question of the survey only includes one question that is “Do you know The Origins of Buleleng and Singaraja folktale?” with five likert scale (not knowledgeable = 1, slightly knowledgeable = 2, neutral = 3, knowledgeable = 4, and very knowledgeable = 5). Based on the result of quantitative analysis with percentage, the survey revealed that 42.5% of respondents were unaware of the "The Origins of

Buleleng and Singaraja" folktale, 20.8% had limited knowledge, 23.6% were unsure, 7.5% knew about it, and 5.7% were very knowledgeable. The data suggests a low level of public awareness regarding the folklore of Buleleng and Singaraja, with only 7.5% of respondents claiming to be knowledgeable and just 5.7% indicating a high level of familiarity with these traditional stories. This data indicates that the folktale is still not well-known among the community.

This gap is suspected to be caused by the influence of gadgets, which is one of the reasons for the declining interest in Balinese folktales. Therefore, a potential solution to enhance public knowledge of Balinese folktales is to leverage modern technology, such as Augmented Reality (AR). It is because Augmented reality is a technology-based medium that helps individuals acquire information through engaging audio and visual elements. [4], [5]. Augmented Reality (AR) is a field of computer research that combines 3D computer graphics with the real world [6]. Several experts also elucidate, augmented reality (AR) is a technology that fuses the tangible and the virtual realms, enabling the integration of virtual objects, such as videos or images, into the physical environment in three-dimensional form [7], [8]. Augmented Reality (AR) is one of the technologies for the communication of digital images and animations [9], [10], [11], [12]. It facilitates the visualization of abstract concepts.

Augmented Reality technology is increasingly being applied across various fields, offering diverse benefits in multiple sectors. In education, Augmented Reality is used as a learning tool to visualize objects, making learning more interactive [2], [13]. Using folklore-based virtual reality as a teaching tool can enhance learning experiences and foster a deeper understanding of cultural heritage and identity [14]. In entertainment, AR is utilized for game development. In industry, it speeds up tasks, controls quality, and provides real-time data access. In medicine, AR is crucial for surgical training, vaccine development, and understanding human anatomy [15]. In preserving culture, augmented reality aids to creating interactive culture learning [4], [7], [16], [17], [18]. Developing folklore based augmented reality offers benefits such as an appealing and easy-to-use design, incorporates language games, and is accessible via smartphones [19], [20].

Several studies on Augmented Reality have been extensively analyzed and published. A study was developing folklore application with object orientation method and the MDLC (Multimedia Development Lifecycle) prototype [21]. The findings showed that the design of the Ceria Mentari application could provide a new experience for children in reading folklore through digital equipment. The central concept of this application is to make children feel closer to the folkloric characters through the medium of ARs, giving a sense of interactive learning. An interactive folklore based application was also developed by [19] which revealed that the folklore application has been validated by multimedia and language learning experts with a product validity level of 85.5%. A combined mean score of 93.3% was obtained from the usability questionnaire. Further, [22] creating Balinese folklore through augmented reality. The content validity test results indicated that SABAR has a high validity coefficient. Feedback from both practitioners and students revealed that SABAR is user-friendly, visually appealing, and beneficial for student learning. Augmented reality also developed to present Balinese folklore "Lubdaka" [23]. An investigated study found by [24] that the questionnaire results, assessing respondents' views on the application's content, storybook illustrations, and augmented reality animations, yielded a score of 88.76%, falling into the very good category.

A review of the literature reveals that Augmented Reality (AR) has been a highly researched area. However, this study is distinctive in its focus on the development of a Balinese folktale, entitled "The Origins of Buleleng and Singaraja," through the use of Augmented Reality (AR). The selection of AR technology over other digital platforms is based on its unique ability to merge virtual elements with the real environment, thereby creating immersive and interactive learning experiences. Unlike traditional digital applications that rely heavily on static text or two-dimensional visuals, AR enhances user engagement through dynamic 3D visuals, audio components, and real-time interaction, making it particularly effective in conveying abstract cultural values and oral narratives in a more tangible and memorable manner.

Furthermore, the novelty of this research lies in its integration of a specific, localized Balinese folktale "The Origins of Buleleng and Singaraja" into an interactive AR application, which has not been previously developed or documented in existing literature. While earlier studies have focused on AR-based folklore applications in general, this research pioneers the digital transformation of a regionally significant tale that is currently experiencing a steep decline in public awareness. The application not only serves as a cultural preservation tool but also offers a culturally responsive learning medium that aligns with the current digital behaviors of society, especially among the younger generation. Thus, this study contributes both to the preservation of local heritage and the innovation of educational technology by combining traditional content with advanced immersive media. The study has two purposes: 1) to develop an Augmented Reality application about the folktale "Origins of Buleleng and Singaraja," and 2) to analyze the public's response to the AR application for this Balinese folktale.

II. METHOD

A. Design

The development of the Balinese folktale "Origins of Buleleng and Singaraja" using Augmented Reality in

this study employs a Research and Development (R&D) approach. R&D is described as a research method aimed at creating a specific product and testing the effectiveness of the produced product (Alisyafiq et al., 2021). The MDLC (Multimedia Development Life Cycle) model is an interactive learning media development model that involves six stages: Concept, Design, Material Collecting, Assembly, Testing, and Distribution (Alisyafiq et al., 2021). It could be seen in Figure 1.

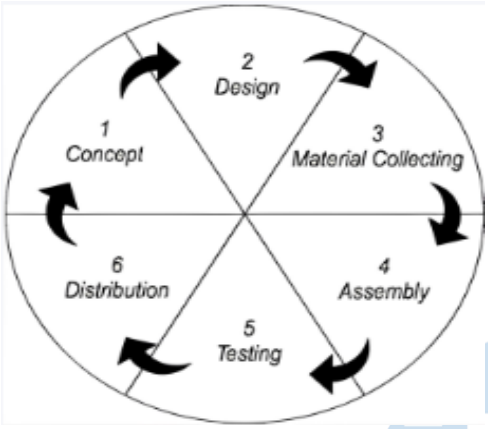

Fig. 1. Research design

The development through MDLC model can be specified explained in the following descriptions.

- Concept
  In the concept development stage, the animation tells the story of the origins of Buleleng and Singaraja using a barcode marker. When the barcode is scanned, an animation depicting the folktale "Origins of Buleleng and Singaraja" will appear.
- Design
  In the Design stage, the user interface layout is created as the application flow for the Augmented Reality folktale. The design flowchart outlines the user journey for interacting with the application.
- Material Collecting
  Next, in the material collecting stage, materials needed for the application development are gathered. This includes 3D models and barcode images. The prepared materials consist of marker images, narrator voice recordings, background music, sound effects, 3D characters, and supporting backgrounds.
- Assembly
  At this stage, the author is designing 3D characters of the Origins of Buleleng and Singaraja using Blender, Unity 3D, and Vuforia software.
- Testing
  Subsequent to the completion of the application, the testing phase ensues. In this phase, the application is subjected to rigorous evaluation by experts in their respective fields and on a range of smartphones to assess its suitability for use in augmented reality. The testing phase encompasses a range of techniques, including black-box testing, content expert testing, media expert testing, and user response testing.
- Distribution
  In accordance with the MDLC model, the final stage is distribution, whereby the application is uploaded to online platforms such as the Play Store or Google Drive, ensuring its accessibility to users.

B. Instruments

The research instruments were questionnaire and the expert validity sheets (content experts and media experts). The test questionnaire is designed as a checklist with five options: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), Strongly Disagree (SD). The objective of the test is to ensure that the folklore content within the application accurately reflects the original narrative and aligns with the specified criteria and user requirements.

The objective of content expert validity is to establish an assessment standard for the suitability of folklore content in the augmented reality application "The origins of Buleleng and Singaraja". he content expert testing process was conducted by two experts: a lecturer specializing in information technology and a lecturer specializing in history. The content expert instrument blueprint consists of three main aspects: content feasibility, language, and presentation, encompassing a total of 10 items. The content feasibility aspect covers the accuracy and alignment of the folk tale with the original version, the clarity of narrative delivery, and the logical flow of the storyline to ensure it is engaging and easy to follow. The language aspect evaluates readability, clarity of the conveyed information, and the appropriateness of language use in accordance with standard Indonesian grammar, ensuring the text is understandable for users, especially students. The presentation aspect focuses on user-friendliness, the accuracy and visual quality of 3D objects, the application's ability to present content effectively through multimedia elements, and the consistency of the presentation with the application's educational and cultural objectives.

Meanwhile, the purpose of the media expert testing is to provide a reference point for the assessment of the suitability of the augmented reality application, "The origins of Buleleng and Singaraja", in terms of media aspects, including visual elements, audio, and other related aspects. The expert review instrument comprises two main aspects: media design and software, totaling 15 indicators. The media design aspect includes several components: media suitability (marker-object alignment and layout appropriateness), text (text readability and text placement), 3D objects (clarity, appropriate size, and proper coloring), audio (clarity and relevance of narration), and navigation buttons (layout and appearance, as well as accessibility). These components aim to assess the visual, auditory, and functional quality of the augmented reality application. Meanwhile, the software aspect evaluates the operation of the application, including its smooth performance and ease of use. It

also assesses communicativeness through the accuracy of information delivery and interactivity based on the appropriateness of how information is presented to engage users effectively.

C. Data Analysis

Before the Distribution stage in the final MDLC model, data analysis will be conducted through validity testing. The participants in this research include 2 content experts, 2 media experts, and 35 respondents as users. The experts were lecturers in Ganesha University of Education who master in content or multimedia. Further, the respondents were visitors in Museum Buleleng. The participants were chosen to fulfill the response in the questionnaire. Content validity testing will be performed using two different methods: Gregory's validity formula and a Likert scale. Following this, user response to the developed AR application will be analyzed. To assess the level of achievement in the development of the Augmented Reality application, refer to Table 1.

TABLE I. PERCENTAGE OF AUGMENTED REALITY APPLICATION FEASIBILITY

No	Interval	Qualification	Criteria
1	90% - 100%	Highly positive	No revision
2	75% - 89%	Positive	No revision
3	65% - 74%	Enough	Revised
4	55% - 64%	Negative	Revised
5	0% - 54%	Highly negative	Revised

III. RESULTS AND DISCUSSION

This research has produced an Augmented Reality application for introducing the folktale of the formation of Buleleng and Singaraja, called "AR The Origin of Buleleng and Singaraja". This AR application focuses on the origins of Buleleng and Singaraja. The results of this research can be described as follows.

A. The Specification of Balinese Folklore "The origin of Buleleng and Singaraja" based Augmented reality

The application was developed through several software such as Blender 3.1.2, Unity 2019.4.12f1, Vuforia SDK (Software Development Kit), Adobe Photoshop 2022, and Adobe Illustrator 2022. The results of the initial design/interface implementation for the AR application "Origins of Buleleng and Singaraja," created using features in Unity. During the design process, there were several features in this application i.e. splash screen, menu, camera AR, and instruction. It could be seen in Figure 2 until Figure 5.

The splash screen of the Augmented Reality application in Figure 2 presents a three-dimensional visual design featuring a traditional Balinese red-brick gate as the background, symbolizing the region's cultural heritage. Centrally positioned is the title "Balinese Folktale: The Origins of Buleleng and Singaraja," displayed in a clear and visually prominent typeface to emphasize the thematic focus of the application. Institutional logos are placed in the upper-left corner, indicating formal affiliation with relevant educational and technological entities. Additionally, animated figures in traditional Balinese attire are depicted on the right side of the screen, contributing to the cultural ambiance and enhancing the application's interactive and educational appeal.

Fig. 2. Splash Screen of the AR application for *"The Origins of Buleleng and Singaraja"*

Fig. 3. Main navigation screen of the AR-based Balinese Folktale Application

Figure 3 showed that The main menu interface of the Augmented Reality application is visually designed with a vibrant 3D environment that reflects traditional Balinese culture. At the center of the screen stands a prominently featured male character dressed in traditional Balinese attire, holding a ceremonial weapon, symbolizing a key figure in the folktale narrative. In the background, a group of animated villagers is depicted standing in formation near a large stone monument and lush tropical trees, reinforcing the cultural and historical setting of the story. The left side of the screen presents a vertical menu with four interactive buttons labeled: "Mulai Cerita" (Start Story), "Panduan" (Guide), "Tentang" (About), and "Keluar" (Exit), offering intuitive navigation for users. Institutional logos are displayed in the top-left corner, indicating the application's official backing. The menu design is straightforward and user-friendly, facilitating easy access to the main features of the application while maintaining cultural relevance through its visual elements.

Figure 4 illustrates the implementation of the Augmented Reality (AR) camera interface as developed in this study, utilizing the Vuforia platform for marker-based tracking. The interface projects two three-dimensional animated characters standing on a

circular virtual stage designed with traditional Balinese motifs, integrated seamlessly onto a real-world surface through a mobile device screen. This stage represents a narrative scene from the folktale *"The Origins of Buleleng and Singaraja."* Functional control icons are aligned at the bottom, enabling users to interact with the digital content, including options to rotate, zoom, or play animations.

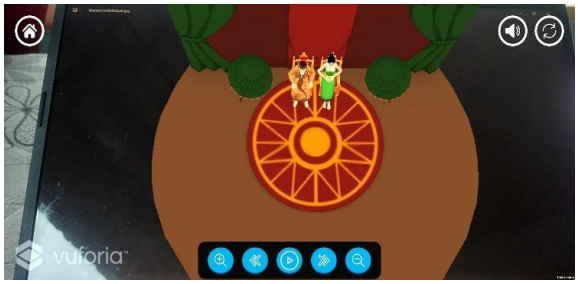

Fig. 4. Camera AR of *"The Origins of Buleleng and Singaraja" folktale*

Fig. 5. User manual of AR-based Balinese Folktale Application

The image presents the user manual interface of the AR-based Balinese folktale application. It provides step-by-step instructions for operating the augmented reality features. The manual includes directions such as selecting the story menu, preparing a marker image, choosing a language, ensuring good lighting, and scanning the marker slowly to activate the 3D content. The instructional text is displayed in a green dialog box, centrally placed against a background scene featuring animated Balinese characters and traditional architecture. This interface is designed to assist users, especially beginners in accessing and experiencing the AR content smoothly and effectively.

In addition to the application interface design, there are also 3D object designs for the Augmented Reality application "*The origins of Buleleng and Singaraja*." The application consisted of 31 scenes which described the story. The results of the 3D object designs used in the augmented reality application entitled "Origins of Buleleng and Singaraja", created with the computer graphics software Blender, it is presented in Figure 6.

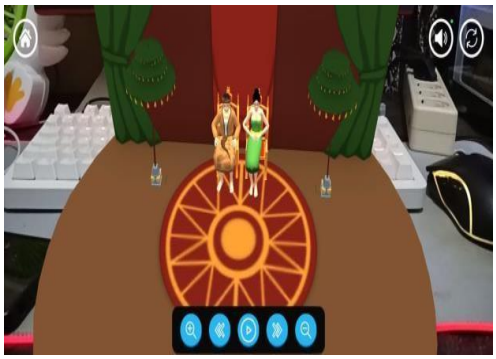

Fig. 6. Scene 1 and Scene 2 of "The Origins of Buleleng and Singaraja" folktale

Scenes 1 and 2 are set in a kingdom showcasing King Sri Bagening and Queen Ni Luh Pasek.

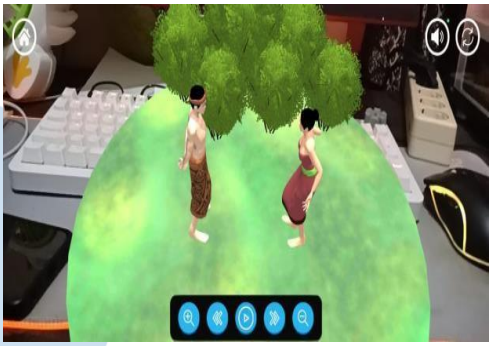

Fig. 7. Scene 3 of "The Origins of Buleleng and Singaraja" folktale

Scene 3 depicts the king and queen who are respected by their people.

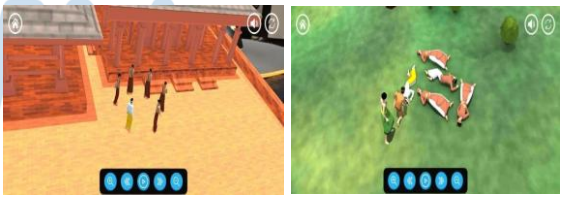

Fig. 8. Scene 4-7 of "The Origins of Buleleng and Singaraja" folktale

The king and queen are blessed with a son, Ki Barak Panji, who is also highly esteemed by the populace, as shown in Scenes 4, 5, 6, and 7.

Fig. 9. Scene 8 of "The Origins of Buleleng and Singaraja" folktale

One day, the king instructs Ki Barak Panji to travel to Den Bukit, as depicted in Scene 8.

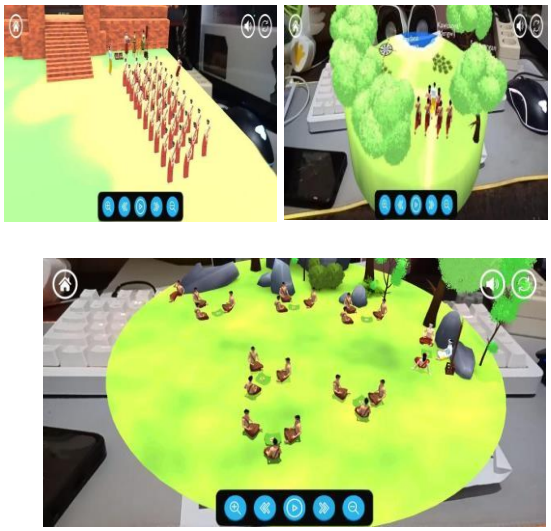

Fig. 10. Scene 9-15 of "The Origins of Buleleng and Singaraja" folktale

Ki Barak Panji, accompanied by forty guards led by Ki Dumpiung and Ki Dosot, along with his mother, embarks on their journey, which is illustrated in Scenes 9 through 15.

Fig. 11. Scene 16-17 of "The Origins of Buleleng and Singaraja" folktale

Scenes 16 and 17 introduce Panji Landung, who reveals a region that will eventually become Ki Barak Panji's domain.

Fig. 12. Scene 18-19 of "The Origins of Buleleng and Singaraja" folktale

Then Ki Barak Panji continues his journey to the area indicated by Panji Landung, as shown in scenes 18 and 19.

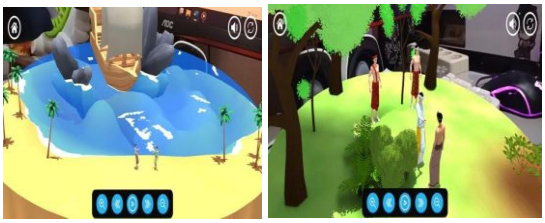

Fig. 13. Scene 20-23 of "The Origins of Buleleng and Singaraja" folktale

In Scenes 20 through 23, the character Ki Mpu Awang appears, appearing very distressed because his ship has sunk.

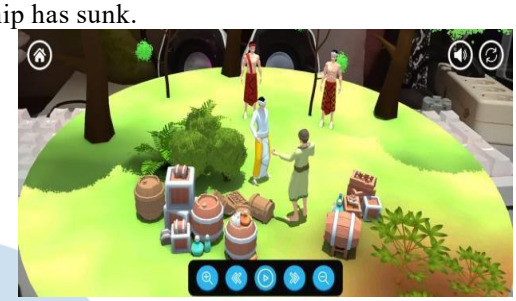

Fig. 14. Scene 24 of "The Origins of Buleleng and Singaraja" folktale

Then, he promises to reward anyone who helps him with all the treasures on the ship. Unable to find anyone capable, Ki Barak Panji successfully helps and receives the reward, as depicted in Scene 24.

Fig. 15. Scene 25-31 of "The Origins of Buleleng and Singaraja" folktale

With the treasure, Ki Barak Panji and his followers begin to clear the forest and establish a kingdom, portrayed in Scenes 25 through 31.

B. The Results of validity and user feasibility on the developed Augmented Reality of Balinese Folklore "The origin of Buleleng and Singaraja"

The results of this data analysis were obtained through expert feasibility tests and user response testing. The content validity results tested by content experts can be found in Table 2.

TABLE II. THE RESULTS OF CONTENT VALIDITY

Tabulated data		Judges 1	
		Irrelevant	Relevant
Judges 2	Irrelevant	(A)	(B)
	Relevant	(C)	(D) 1,2,3,4,5,6,7,8,9,10
	Total of validity content = 1.00		

Based on the validity criteria table for content experts, a score of 1.00 indicates a "Very High" level of validity.

Further, the results of the media expert testing demonstrate an exceptionally high level of suitability. The evaluation was conducted in accordance with Gregory's formula. The results of the media expert testing are presented as follows.

$$\text{Media validity} = \frac{D}{A+B+C+D} = \frac{15}{15} = 1.00$$

The media expert testing, using Gregory's validity formula, yielded a validity score of 1.00, indicating a "Very High" level of validity.

After distributing the product of AR application which developed based on Balinese folklore, the user feasibility was measured through the data of questionnaire. A usability test was conducted to evaluate user satisfaction with the augmented reality application, "Origins of Buleleng and Singaraja." A questionnaire was distributed to the general public, particularly visitors to the Buleleng Museum, as part of the aforementioned testing. Prior to completing the questionnaire, respondents were invited to trial the application on their own devices, either their own smartphones or devices provided by the researchers. The results of questionnaire could be seen in Table 3.

TABLE III. THE DISTRIBUTION DATA OF USE FEASIBILITY OF AR APPLICATION BASED FOLKTALES

Statements	Percentage (%)				
	SD	D	N	A	SA
The application is easy to use by users	0	0	0	45.7	54.3
The application has an attractive appearance	0	0	0	40	60
The layout/design of the application is not attractive	37.1	62.9	0	0	0
The application has good audio clarity	0	0	0	48.6	51.4
The application uses appropriate audio selection	0	0	0	57.1	42.9
The application uses language that follows linguistic conventions	0	0	11.4	51.4	37.1
The application conveys information clearly	0	0	0	42.9	57.1
The application uses language that is difficult to understand	48.6	51.4	0	0	0
The application uses appropriate 3D objects	0	0	11.4	45.7	42.9
The application uses inappropriate coloring and textures on 3D objects	37.1	62.9	0	0	0
The layout of the navigation buttons is good and appropriate	0	0	2.9	51.4	45.7
The navigation buttons function properly and are easy to use	0	0	0	57.1	42.9
The application runs smoothly and properly	0	0	0	54.3	45.7
The application is quite difficult to use	45.7	54.3	0	0	0
The information in the application is delivered clearly and communicatively	0	0	0	37.1	62.9
The information in the application is relevant and interactive	0	0	2.9	45.7	51.4

The historical story in the application is difficult to understand	51.4	48.6	0	0	0
The portrayal of historical figures in the application is poor and difficult to understand	71.4	28.6	0	0	0
The application makes me interested in learning about the history of the formation of the Buleleng and Singaraja regions	0	0	0	37.1	62.9
The application makes me interested in visiting the Museum of the Origin of Buleleng and Singaraja	0	0	0	51.4	48.6
The application helps me understand the history of the formation of the Buleleng and Singaraja regions	0	0	0	22.9	77.1

Details:
SD : strongly disagree
D :disagree
N : neutral
A : agree
SA : strongly agree

The data shows that the AR application *The Origin of Buleleng and Singaraja* is perceived positively by users in terms of usability, design, clarity, and content. Most respondents agreed or strongly agreed that the application is easy to use (45.7% and 54.3%), visually appealing, has clear audio, and conveys information effectively. Negative statements such as the layout being unattractive, language being difficult to understand, or the portrayal of historical figures being poor, were predominantly disagreed with, showing positive user perceptions. The majority also found the 3D objects appropriate and the navigation buttons functional. Furthermore, the application sparked user interest in learning about history (62.9% strongly agreed), encouraged museum visits, and helped users understand the historical narrative of Buleleng and Singaraja (77.1% strongly agreed), demonstrating its educational and interactive effectiveness.

TABLE IV. THE CATEGORY OF USE FEASIBILITY OF AR APPLICATION BASED FOLKTALES

No	Response Category	Percentage (%)	Description
1	Very Positive	97.30%	Majority of users rated the application very highly, indicating strong satisfaction with the content and features.
2	Positive	2.70%	A small number of users gave a moderately positive rating, showing general approval with minor notes.
3	Neutral / Fair	0%	No respondents rated the application as average or neutral.
4	Negative	0%	No negative feedback was recorded.
5	Very Negative	0%	No respondents expressed strong dissatisfaction with the application.

The questionnaire were completed by respondents via a Google Form link integrated into one of the buttons in the AR application, or manually through the provision of a hard copy of the instrument. The responses were subsequently classified according to the following categories: The vast majority of respondents (97.30%) rated the application as "very positive" and "very good," while a smaller proportion (2.70%) rated it as "positive" and "good." These results demonstrate that users of the augmented reality application, entitled "Origins of Buleleng and Singaraja", responded favourably to the application's development.

Furthermore, the user feedback indicates that the AR application effectively facilitates comprehension of the historical development of Buleleng and Singaraja. Furthermore, the application has been instrumental in fostering public interest and awareness about the Buleleng Museum and its historical collections, particularly the origins of Buleleng and Singaraja.

C. *Discussion*

Based on the result, it could be implied that the content validity showed a score of 1.00, indicating a "Very High" level of validity. This means that the information and historical stories presented in the Augmented Reality application "The Origins of Buleleng and Singaraja" are accurate and appropriate. Similarly, the media validity also achieved a "Very High" validity score, reflecting the appropriateness of the media choices used in the application. Gregory's validity score of 1.00 indicated a "Very High" level of validity. The media testing evaluated aspects such as (1) media design, including component suitability, text, dimensional objects, audio, and navigation buttons, and (2) software aspects, including operation, communication, and interactivity. In contrast, user response testing involved distributing a questionnaire to the general public, specifically visitors to the Buleleng Museum, with a total of 35 respondents and

20 questions. The respondents were given the opportunity to try the application before providing feedback. According to Likert scale results, 97.30% of respondents rated the application as "very positive" and "very good," while 2.70% rated it as "positive" and "good." This indicates that users responded very favorably to the development of the Augmented Reality application.

During the testing process, the researchers received several suggestions and feedback from both media and content experts. These included adjustments to the layout of 3D objects, the initial page display of the application, and the coloring used for 3D objects in the Augmented Reality application. Additionally, the positive feedback from respondents suggests that the strengths of the application lie in its engaging and innovative presentation of the formation of Buleleng and Singaraja using Augmented Reality technology, which can attract users. The historical stories are well-aligned with actual history, delivered with high-quality audio, and presented in an easily understandable manner. These findings are supported by the results from content and media expert testing.

The validity and user feasibility revealed good and positive feedback both from experts and users. It also contributed by advantages of the design in the augmented reality. It is in agreement with numerous studies which proved that creating folklore-based augmented reality provides advantages like an attractive, user-friendly interface, includes language games, and is accessible on smartphones [20], [22]. The advantages of this AR motivate users to use the application and enhance people to read the Folklore "The Origins of Buleleng and Singaraja".

The results of this study align with findings from several previous research efforts. [21] revealed that he central concept of the folklore based augmented reality application make children feel closer to the folkloric characters, giving a sense of interactive learning. Further, [22] creating Balinese folklore through augmented reality is beneficial for people as it user-friendly, visually appealing, and beneficial for student learning. It was also aligning with [23] who developed Lubdaka AR application. The study mentioned that folklore-based AR can assist users in obtaining information about character education in the story. Augmented Reality can create a new environment by combining real-world interactions with virtual environments in real-time, making the created environment feel tangible to users.

However, the Augmented Reality application also has some shortcomings. Notably, the faces of the heroic figures depicted in the application do not accurately represent the original figures due to limited historical images or photos from that era. Enhancing the use of 3D objects and animations would greatly improve user experience. Future developments in Augmented Reality applications, especially those focusing on historical figures or regional history, should address these limitations to better serve users and educate the younger generation on the importance of preserving and learning about history.

IV. Conclusion

Based on the results and discussion, it can be concluded that the development of the augmented reality application "The Origins of Buleleng and Singaraja." used the MDLC (Multimedia Development Life Cycle) model, which consists of several stages, i.e. concept, design, material collecting, assembly, testing and distribution. The process of MDLC has succeed producing attractive, user-friendly, and effective AR application. The application was distributed via Google Drive. Based on the user response testing, involving 35 respondents, indicates that the application received very positive feedback with "excellent" criteria. The questionnaire responses also revealed that the application is attractive, user-friendly, and effectively engages users in learning about the formation of Buleleng and Singaraja. Additionally, the folktale content is presented clearly, making it easy for users to understand.

Considering the study's limitations, several recommendations are made for both users and future developers. Developers should consider the application size to ensure smooth operation without issues. Furthermore, attention should be paid to the design of markers to avoid similarity between them, which will help the application accurately capture the markers and display the correct 3D objects.

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