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SWOT Analysis of Augmented Reality Implementation as an Educational Medium for Local Cultural Artifact Preservation Among the Younger Generation

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Abstract: The preservation of local cultural artifacts faces increasing challenges due to rapid technological advancement and the declining interest of younger generations in cultural heritage. This study aims to analyze the implementation of Augmented Reality (AR) as an educational medium for preserving local cultural artifacts using the SWOT (Strengths, Weaknesses, Opportunities, and Threats) framework. A qualitative descriptive approach was employed by collecting data through literature review, observation, and SWOT analysis to identify internal and external factors affecting AR implementation. The findings indicate that AR offers significant strengths, including interactive visualization, immersive learning experiences, and increased engagement among young users. However, its implementation is constrained by high development costs, device compatibility issues, and limited digital literacy in certain communities. Opportunities arise from the widespread adoption of smartphones, digital transformation initiatives, and government support for cultural preservation. Meanwhile, threats include rapid technological changes, sustainability challenges, and competition from other digital entertainment platforms. The study concludes that AR has strong potential to become an effective educational tool for promoting awareness and appreciation of local cultural heritage among younger generations. Strategic collaboration among educational institutions, cultural organizations, government agencies, and technology developers is essential to ensure the sustainable implementation and continuous development of AR-based cultural education.

Keywords: Augmented Reality, SWOT Analysis, Cultural Heritage, Local Artifacts, Cultural Preservation, Youth Education.

INTRODUCTION

Local culture is a vital asset that reflects the identity, history, and values of a society. Cultural artifacts, such as historical relics, traditional crafts, traditional attire, musical instruments, and other cultural objects, possess educational value that helps introduce local wisdom to future generations (Setyaningrum, 2018). However, the rise of globalization and shifting lifestyles have led to a decline in interest among the younger generation regarding local culture. Today's youth interact predominantly with digital technology and global popular

culture; consequently, innovation in cultural education methods is required to align with modern learning characteristics.

Conventional cultural education methods, such as textbook-based learning, lectures, or physical museum visits, have several limitations. Information delivery regarding cultural artifacts is often merely informational, failing to provide an interactive experience for the user. Furthermore, limited access to cultural resources, a lack of engaging learning media, and the underutilization of technology in conveying cultural information pose challenges to raising awareness among the youth about local cultural preservation (Akmalia et al., 2023).

Advancements in digital technology offer new opportunities for cultural education, notably through the application of Augmented Reality (AR). AR technology interactively integrates digital objects, such as images, animations, text, and three-dimensional (3D) models, into the real-world environment. In the context of cultural education, AR can facilitate more engaging learning experiences by virtually visualizing cultural artifacts without the need to move the original objects (Maesarah et al., 2026). This technology enables young people to discover, understand, and interact with cultural artifacts using digital devices like smartphones or tablets.

Implementing Augmented Reality as an educational tool for cultural artifact preservation holds significant potential to boost interest among the youth. The use of interactive technology can create more compelling learning experiences, enhance user engagement, and facilitate the effective communication of historical information and cultural values (Rusnandi et al., 2016). Several previous studies indicate that AR-based learning media can enhance understanding and learning motivation, as users gain visual experiences and interact directly with learning objects.

Nevertheless, the application of AR in cultural education still faces various challenges. Potential obstacles include limited technological infrastructure, the need for devices with specific technical specifications, application development costs, a shortage of personnel skilled in AR technology, and suboptimal integration between digital technology and cultural preservation institutions (Aditia, 2024). Furthermore, the successful implementation of AR is not determined solely by technological aspects but is also influenced by social, cultural, and economic factors, as well as user readiness.

Given these conditions, a comprehensive analysis is required to identify the internal and external factors involved in applying Augmented Reality as an educational medium for the preservation of local cultural artifacts. One applicable method is SWOT analysis (Strengths, Weaknesses, Opportunities, Threats). SWOT analysis enables the identification of strengths, weaknesses, opportunities, and threats associated with a strategy's implementation, thereby serving as a foundation for determining more effective and sustainable AR technology development.

The study titled "SWOT Analysis of Augmented Reality (AR) Implementation as an Educational Medium for Local Cultural Artifact Preservation among the Younger Generation" aims to analyze the potential of AR technology to support local cultural education and preservation. The analysis results are expected to provide strategic recommendations on utilizing AR technology as an innovative learning medium capable of enhancing young people's engagement in recognizing and preserving local cultural artifacts in the digital era.

METHODS

This study employs a literature review method utilizing a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis approach. The literature review method was selected because the study aims to analyze the implementation of Augmented Reality (AR) as an educational tool for the preservation of local cultural artifacts among the younger generation, drawing upon existing research findings, theories, and scientific publications. The SWOT approach serves as the primary tool for identifying the strengths, weaknesses, opportunities, and threats involved, as well as for formulating appropriate strategies based on these findings (Ali & Saputra, 2025).

This approach enables the researcher to gain a comprehensive understanding of the evolution of AR technology implementation, identify the factors influencing its success, and formulate development strategies based on the synthesis of the literature.

RESULTS AND DISCUSSION

Augmented Reality (AR)

According to Azuma, Augmented Reality is defined as the combination of real and virtual objects within a real environment, operating interactively in real-time; this integration is enabled by suitable display technology, interactivity is facilitated through specific input devices, and effective integration requires proper implementation (Sari et al., 2022).

The use of Augmented Reality technology in an educational context offers various new opportunities within the learning process. Interactive learning which emphasizes active engagement, becomes more compelling and meaningful through the inclusion of AR elements. Through realistic visualization, interactive simulations, and the hands-on experiences provided by AR, we can gain a better understanding of complex concepts (Indahsari & Sumirat, 2023).

Based on this description, Augmented Reality (AR) is a technology that combines virtual objects with the real environment in real-time, thereby providing users with a more interactive and immersive experience. In the contexts of education and cultural preservation, AR has the potential to serve as an effective learning medium, as it can present cultural artifacts in three-dimensional visual forms, enhance user engagement, and facilitate the understanding of cultural values.

Implementation of Augmented Reality (AR) as an Educational Medium for Preserving Local Cultural Artifacts Among the Younger Generation

Advancements in digital technology have spurred various innovations in the fields of education and cultural preservation. One technology seeing significant development is Augmented Reality (AR), which combines virtual objects with the real-world environment in real-time, offering users a more interactive learning experience. In the context of cultural preservation, AR is utilized to present cultural artifacts through three-dimensional (3D) models, animations, audio, and textual information accessible via mobile devices such as smartphones and tablets.

Using AR as an educational medium offers a novel approach to introducing local cultural artifacts to the younger generation. Through digital visualization, users can not only view the physical form of an artifact but also access information regarding its history, function, symbolic meaning, and inherent cultural values. This approach is considered more engaging than conventional learning media because it provides an interactive and contextual learning experience.

The implementation of AR for cultural artifact preservation typically begins with the digitization of cultural collections using 3D modeling. These models are then integrated into an AR application designed for mobile devices. Users simply point their camera at a specific marker or object, prompting the system to display the digital model alongside supporting information. This method offers greater flexibility in the learning process, as it can take place in museums, schools, or locations away from where the artifacts are actually housed.

For the younger generation raised in a digital environment, the use of Augmented Reality (AR) is considered capable of enhancing learning motivation, user engagement, and understanding of cultural material. This technology also supports preservation efforts, as information regarding artifacts can be digitally documented, thereby reducing reliance on direct interaction with original objects that are susceptible to damage.

Previous studies such as those by Yudiantika et al. (2016), Kurniawan et al. (2016), Pratama & Hidayat (2020), Sari et al. (2022), and Rahman et al. (2024) demonstrate the

significant potential of Augmented Reality technology in supporting cultural education and artifact preservation.

Based on these studies, it can be concluded that Augmented Reality offers advantages as an educational medium by enhancing interactivity, learning motivation, and user understanding of cultural artifacts. However, most research has focused primarily on application development or the testing of learning media. Studies regarding strategies for implementing AR technology in cultural artifact preservation specifically from the perspective of internal and external factors remain relatively limited. Therefore, this study proposes a SWOT analysis approach to identify the strengths, weaknesses, opportunities, and threats associated with AR implementation.

SWOT Analysis of Augmented Reality Implementation as an Educational Medium for Local Cultural Artifact Preservation Among the Younger Generation

1. Analysis of Internal and External Factors

The following is an analysis of internal and external factors using the SWOT approach.

Table 1. Analysis of Internal and External Factors in the Implementation of Augmented Reality as an Educational Medium for Local Cultural Artifact Preservation Among the Younger Generation

No	Internal Factors	External Factors
1	Strengths	Opportunities
a.	Presenting cultural artifacts in a three-dimensional (3D) visual format, making them more engaging than conventional media.	a. The increasing use of smartphones by the younger generation.
b.	Increasing the younger generation's interest in and motivation for learning through interactive learning experiences.	b. Opportunities for collaboration among schools, museums, higher education institutions, and the creative industries.
c.	Facilitates understanding of the form, function, history, and cultural value of local artifacts.	c. The growing need for interactive digital learning media.
d.	Supports the digitization process of cultural artifacts, thereby aiding efforts to preserve cultural heritage.	d. Increasing public attention towards the digitization of cultural heritage.
2	Weaknesses	Threats
a.	Developing AR applications entails relatively high costs.	a. Technological developments are so fast that applications easily become obsolete.
b.	Seeking an expert in 3D modeling and AR application development.	b. Competition with various forms of digital entertainment that capture the attention of the younger generation.
c.	Not all cultural artifacts have been digitized yet, so content remains limited.	c. Budget constraints for the development and maintenance of AR applications.
d.	The content update process requires significant time and resources.	d. The lack of interest among some young people in local culture.

The results of identifying these internal and external factors serve as the basis for constructing the SWOT matrix (SO, WO, ST, and WT) to formulate an effective Augmented Reality implementation strategy that supports the preservation of local cultural artifacts among the younger generation.

2. Evaluating Internal and External Factors Using the SWOT Matrix

The SWOT matrix is applied by combining specific factors to formulate strategies: SO (Strengths-Opportunities), WO (Weaknesses-Opportunities), ST (Strengths-Threats), and WT (Weaknesses-Threats). The following outlines the analysis process using the SWOT matrix to

develop strategic alternatives based on combinations of internal and external factors (SO, WO, ST, and WT).

Table 2. Matrix SWOT

SO Strategy	WO Strategy	ST Strategy	WT Strategy
Developing a smartphone based AR application to make it more accessible to the younger generation.	Leveraging government grant programs and collaborations with the creative industry to reduce application development costs.	Presenting more engaging and interactive cultural content to compete with digital entertainment media.	Develop a phased application development plan based on budget availability.
Leveraging government support to accelerate the digitization of cultural artifacts.	Conducting training on AR technology for developers, teachers, and museum managers.	Periodically update the application to keep pace with technological advancements.	Digitizing cultural artifacts in stages, based on collection priorities.
Building collaboration among museums, schools, higher education institutions, and the creative industry in the development of AR educational media.	Expanding the digitization of cultural artifacts through collaboration with museums and cultural communities.	Leveraging 3D visualization to boost the younger generation's interest in local culture.	Optimizing the application to run on devices with mid range specifications.
Integrating AR into the learning process in schools and museums.	Developing applications compatible with various types of mobile devices.	Developing innovative cultural educational content to enhance the competitiveness of learning media.	Enhancing the digital literacy of cultural managers to enable them to manage and develop AR media sustainably.

Based on the SWOT matrix, it can be concluded that the most promising approach is the SO (Strengths–Opportunities) strategy: leveraging the strengths of Augmented Reality technology, such as interactive 3D visualization and easy mobile access to capitalize on opportunities arising from the rising use of smartphones, advancements in digital technology, and support for cultural digitization. This strategy is considered the most effective for enhancing education while simultaneously preserving local cultural artifacts for the younger generation.

CONCLUSIONS

Overall, the strategy derived from the SWOT analysis indicates that implementing Augmented Reality is a viable innovation for educational media focused on the preservation of local cultural artifacts. Successful implementation requires collaboration among the government, educational institutions, cultural communities, and technology developers to ensure the resulting media is not only visually engaging but also accurate and sustainable, while effectively raising awareness among the younger generation about the importance of safeguarding cultural heritage.

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