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NEEDS ANALYSIS OF VIRTUAL REALITY-BASED HISTORY LEARNING MEDIA TO SUPPORT SENIOR HIGH SCHOOL STUDENTS' CULTURAL LITERACY THROUGH THE CULTURAL HERITAGE OF THE OLD CITY OF PALEMBANG

Eki Novta Imanda[1], Syarifuddin[2*], Aulia Novemy Dhita[3]

Magister Teknologi Pendidikan, Fakulitas Keguruan dan Ilmu Pendidikan, Universitas Sriwijaya, Indonesia
novtaeki@gmail.com[1], syarifuddin@fkip.unsri.ac.id[2], aulianovemydhita@unsri.ac.id[3]*
**Corresponding Author*

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ABSTRACT

History learning in senior high school requires media that provide concrete, visual, interactive, and contextual experiences to support understanding of cultural heritage. This study analyzed students' and history teachers' needs for Virtual Reality (VR)-based history learning media to support cultural literacy through the Old City of Palembang. A descriptive needs analysis was conducted at the Analysis stage of the ADDIE model. Questionnaire data were collected from 73 Grade X and XI students using 20 items across five aspects: visual-digital learning interest; device readiness and digital literacy; cognitive ability and cultural heritage awareness; media design preferences; and evaluation and feedback needs. Semi-structured interviews with four history teachers were analyzed thematically. Students' overall need for digital learning media was high (M = 4.02; reported achievement = 80.3%). All five aspects were rated high, with media design preferences receiving the highest mean (M = 4.18). The item on using images, animations, videos, and historical object visualizations received the highest score (M = 4.29; very high). Positive responses accounted for 77.3%, compared with 6.3% negative responses. Teacher interviews reinforced the need for more concrete and contextual history learning, historical object visualization, greater interactivity, simple navigation, local-context integration, and assessment and feedback features. These findings provide an empirical basis for designing VR-based history learning media that integrates the historical and cultural heritage of the Old City of Palembang to support students' cultural literacy. The results indicate identified needs, not evidence of VR effectiveness; effectiveness requires further testing.

Keywords: *Needs analysis, history learning media, virtual reality, cultural literacy, Old City of Palembang.*

INTRODUCTION

The development of digital technology has transformed the design of learning experiences, including history education (Syarifuddin et al., 2025). History learning requires students not only to understand facts, dates, figures, and events, but also to interpret historical evidence, places, social contexts, and cultural values. These characteristics require learning experiences that can connect abstract historical information with concrete objects and environments. Virtual Reality (VR) offers this possibility by creating three-dimensional and immersive environments that allow students to explore historical objects and places. Previous systematic reviews and meta-analyses indicate that VR can support learning outcomes, engagement, and experiential learning, although its effectiveness depends on instructional design and user characteristics (Asad

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et al., 2021; Coban et al., 2022; Villena-Taranilla et al., 2022).

Research on immersive VR has continued to expand. Won et al. (2023), through a systematic review, found that VR research has employed diverse learning approaches, but technological features have often received greater attention than pedagogical considerations. Marougkas et al. (2024) similarly reported that immersive VR has substantial educational potential, while challenges remain regarding personalization, research design, usability, and learning conditions. Conrad et al. (2024) emphasized that the effectiveness of immersive VR depends on the alignment between technological features, learning objectives, and instructional activities. These findings suggest that VR development should be based on pedagogical needs rather than technological capabilities alone.

The potential of VR is particularly relevant to history education because historical environments and objects are often difficult to present directly in classrooms. A recent systematic quantitative review identified growing research on VR in history education, but also showed that the field still requires stronger empirical evidence regarding learning processes and educational implementation (Bonsu et al., 2025). Villena-Taranilla & Diago, Challenges and implications of virtual reality in history education A systematic review (2025) identified technical, usability, accessibility, psychological, and pedagogical challenges in the application of VR to history education. Therefore, the development of VR-based history learning media requires careful consideration of learners' and teachers' needs before the media is designed.

VR is also increasingly applied to cultural heritage education. Cultural heritage provides authentic learning resources that can connect historical knowledge with local cultural contexts. A systematic review by (Rodriguez-Garcia et al., 2024) found that immersive VR has been widely used for three-dimensional reconstruction and exploration of cultural heritage. Dordio et al. (2024) further demonstrated the potential of Extended Reality as a didactic resource for cultural heritage education. Similarly, Chong et al. (2022) and Theodoropoulos & Antoniou (2022) identified VR as a technology that can support the exploration, interpretation, preservation, and dissemination of cultural heritage. Zhao et al. (2025) emphasized that VR-based heritage education should integrate educational objectives, meaningful interaction, immersive experience, and learner characteristics.

The connection between VR and cultural literacy is also important. Cultural literacy involves more than recognizing cultural objects. Students need to understand their historical context, values, meanings, and relevance to society. Digital heritage education can provide opportunities for students to interact with cultural information and develop cultural awareness through contextual learning environments (Manca et al., 2023; Tan et al., 2024). However, the effectiveness of such learning depends on the suitability of the media to students' needs and learning conditions.

The context of the Old City of Palembang provides an important opportunity for this approach. The area contains historical buildings, cultural sites, and heritage environments that can function as authentic resources for history learning and cultural

literacy. However, direct visits to historical sites may be constrained by time, accessibility, logistical conditions, and classroom limitations. VR can provide an alternative learning experience by presenting historical objects and environments in a virtual space. Nevertheless, the development of such media should begin with empirical information about what students and teachers actually need.

One relevant study is Iasha et al. (2022), which conducted a needs analysis for a VR field trip model to improve cultural literacy. The study found a need for virtual environments that could provide students with experiences of cultural objects and places. However, the research focused on primary education and did not specifically address history learning through local heritage tourism at the senior high school level. Furthermore, research examining the needs of students and history teachers for VR-based learning media within the context of the Old City of Palembang remains limited. This gap indicates the need for a context-specific needs analysis before developing VR learning media.

Based on the previous studies, three problems can be identified. First, although previous VR studies have extensively examined effectiveness and user experience after implementation, limited attention has been given to systematic needs analysis before development, particularly regarding students' visual-digital learning interests, device readiness and digital literacy, cultural heritage awareness, media design preferences, and evaluation and feedback needs, as well as teachers' perspectives on learning conditions, historical object visualization, local context, cultural literacy, and assessment. Second, VR-based history education continues to face challenges related to pedagogical design, usability, navigation, accessibility, and the representation of historical objects and environments. Therefore, this study also examines teachers' perspectives on history learning conditions, existing media use, historical object visualization, digital readiness, and the need for interactive and accessible learning media. Third, limited research has explicitly integrated Virtual Reality, history education, cultural literacy, and the local cultural heritage of the Old City of Palembang within the Indonesian senior high school context. The novelty of the present study lies in bringing these four dimensions together through a systematic needs analysis to identify the instructional and media requirements for developing VR-based history learning that enables students to explore local historical sites while understanding their cultural values and significance.

Needs analysis is therefore positioned not only as an identification of users' preferences, but also as the empirical basis for the subsequent Design stage of the ADDIE model. The findings will be translated into specific design requirements for the VR-based history learning media. Students' needs for visual and interactive learning will inform the selection of historical images, videos, three-dimensional objects, and exploration activities, while their preferences for evaluation and feedback will guide the design of quizzes, feedback mechanisms, and learning reinforcement. The findings related to cultural heritage awareness will inform the integration of historical information, cultural values, and interpretation activities. Meanwhile, teachers' needs regarding concrete history learning, historical object visualization, local context, usability, and assessment

will guide the organization of learning objectives, content structure, navigation, interaction, and teacher-oriented learning features. Thus, the Design stage will transform the identified needs into an instructional and media design specification that directly reflects the characteristics and requirements of the intended users.

Accordingly, this study aims to analyze students' and teachers' needs for Virtual Reality-based history learning media that integrates local cultural heritage and supports senior high school students' cultural literacy through the tourism context of the Old City of Palembang. The study examines students' needs related to visual-digital learning interest, device readiness and digital literacy, cognitive abilities and cultural heritage awareness, media design preferences, and assessment and feedback. It also explores teachers' needs regarding history learning conditions, media use, historical object visualization, digital readiness, local context, cultural literacy, and assessment. The findings are expected to provide an empirical foundation for designing VR-based history learning media that is interactive, contextual, accessible, and relevant to the historical and cultural characteristics of the Old City of Palembang.

RESEARCH METHOD

This study employed a *Research and Development* (R&D) approach using the ADDIE model, consisting of *Analysis, Design, Development, Implementation,* and *Evaluation*. The study focused on the *Analysis* stage to identify user needs as the basis for developing Virtual Reality (VR)-based history learning media.

Research Participants

The participants consisted of 73 tenth- and eleventh-grade senior high school students as prospective media users and four history teachers as supporting informants. Participants were selected purposively based on predefined inclusion criteria and their relevance to the development of VR-based history learning media contextualized to the Old City of Palembang. The student participants comprised 73 Grade X and XI students who were enrolled in history learning and represented the intended users of the proposed learning media. The teacher participants comprised four history teachers who had teaching experience at the senior high school level and were directly involved in history instruction. These criteria ensured that the participants had relevant experiences and perspectives regarding history learning, digital media use, and the potential integration of local cultural heritage into learning activities.

Qualitative data from the semi-structured interviews with the four history teachers were analyzed thematically. The analysis involved five steps: (1) familiarizing the researchers with the interview data, (2) identifying and assigning initial codes to meaningful statements, (3) grouping related codes into categories, (4) developing broader themes that represented recurring patterns across the interviews, and (5) reviewing and refining the themes against the original interview responses. The resulting themes included history learning conditions, media use and limitations, historical object visualization, digital readiness, VR needs, local cultural context, cultural literacy, and

learning assessment. To verify the themes, the researchers compared the coded responses across all four teachers and reviewed whether each theme was consistently supported by the interview data. Disagreements or ambiguities in coding were discussed and resolved through researcher discussion before the final themes were established.

Data Collection Techniques

Data were collected through student needs analysis questionnaire and semi-structured interviews. The student questionnaire consisted of 20 statements measured using a five-point Likert scale and covered five aspects: visual-digital learning interest, device readiness and digital literacy, cognitive abilities and cultural heritage awareness, media design preferences, and evaluation and feedback needs. Before administration, the questionnaire was subjected to expert validation to establish its content validity. The validation focused on the relevance of each item to the intended indicator, clarity of wording, appropriateness of language for senior high school students, and alignment between the items and the objectives of the needs analysis. Following expert review, the instrument was revised based on the validators' recommendations. The reliability of the questionnaire was then examined using Cronbach's alpha to determine its internal consistency. The instrument was considered reliable when the Cronbach's alpha coefficient met the predetermined acceptance criterion. These procedures were conducted to ensure that the 20-item questionnaire was sufficiently valid and reliable for collecting data on students' needs for VR-based history learning media. Semi-structured interviews with four history teachers explored learning conditions, media use, learning limitations, digital readiness, VR needs, local context, cultural literacy, and learning assessment.

Data Analysis

Questionnaire data were analyzed descriptively using mean scores and percentages, while interview data were analyzed thematically through coding, theme categorization, and synthesis. The two data sources were subsequently integrated to determine the characteristics of VR media that correspond to the needs of history learning. The draft needs analysis questionnaire for students is presented in Table 1.

Table 1. Blueprint of the Needs Analysis Questionnaire for Students

No.	Aspect	Indicators	Item Numbers	Number of Items
1	Visual-Digital Learning Interest	Interest in learning history through digital, visual, and interactive media	1–5	5
2	Device Readiness and Digital Literacy	Availability of digital devices and ability to access and use digital learning media	6–8	3
3	Cognitive Ability and Cultural Heritage Awareness	Understanding historical objects, connecting historical evidence with the past, recognizing cultural values, and	9–12	4

		awareness of heritage preservation		
4	Media Design Preferences	Preferences for images, animation, video, visualization, and presentation of historical objects	13–15	3
5	Evaluation and Feedback Needs	Need for exercises, assessment, explanations, feedback, and learning reinforcement	16–20	5
	Total			20

Next, the semi-structured interview guide for history teachers is presented in Table 2 below.

Table 2. Blueprint of the Semi-Structured Interview for History Teachers

No.	InterviewTheme	Indicators	Focus of Questions
1	History Learning Conditions	Learning problems and contextual learning needs	Conditions, challenges, and learning experiences in history classes
2	Learning Media Use	Existing media and patterns of use	Types of media currently used and their perceived usefulness
3	Media Limitations	Limitations in presenting historical objects	Difficulties in providing direct and concrete historical experiences
4	Digital Readiness	Teachers' experience with digital media	Experience, familiarity, and ease of using digital learning technology
5	VR Needs	Potential use of virtual environments	Perceptions of VR for representing historical objects and locations
6	Local Context	Use of Palembang's historical heritage	Potential of the Old City of Palembang as a learning resource
7	Cultural Literacy	Historical meaning, cultural values, and preservation	Opportunities to develop cultural understanding through history learning
8	Learning Assessment	Assessment and feedback requirements	Need for quizzes, evaluation, explanations, and feedback

RESULTS AND DISCUSSION

Student Needs Analysis

The needs analysis involved 73 tenth- and eleventh-grade students to identify the characteristics of history learning media required before developing the proposed Virtual Reality (VR) media. The questionnaire consisted of 20 items grouped into five aspects. The questionnaire results were interpreted using predetermined score intervals based on the five-point Likert scale. The interval width was calculated as $(5 - 1) / 5 = 0.80$. Therefore, mean scores of 1.00–1.80 were classified as Very Low, 1.81–2.60 as Low, 2.61–3.40 as Moderate, 3.41–4.20 as High, and 4.21–5.00 as Very High. Based on these criteria, the overall findings showed that students' needs for digital learning media were

categorized as High, with an overall mean score of 4.02, equivalent to 80.3%. This result indicates that students generally demonstrated a strong need for learning media that supports visual, digital, interactive, contextual, and evaluative learning experiences. All five aspects were categorized as high, indicating a strong need for digital media from the perspective of prospective users as shown in Table 3 continued with Results of Student Needs Analysis in Table 4.

Table 3. Criteria for Interpreting Student Questionnaire Scores

No.	Mean Score Interval	Category	Percentage Interval
1	1.00–1.80	Very Low	20.0–36.0%
2	1.81–2.60	Low	36.1–52.0%
3	2.61–3.40	Moderate	52.1–68.0%
4	3.41–4.20	High	68.1–84.0%
5	4.21–5.00	Very High	84.1–100%

Table 4. Results of Student Needs Analysis

No.	Needs Aspect	Mean	Percentage	Category
1	Visual-digital learning interest	4.01	80.2%	High
2	Device readiness and digital literacy	4.00	80.0%	High
3	Cognitive ability and cultural heritage awareness	3.89	77.8%	High
4	Media design preferences	4.18	83.6%	High
5	Evaluation and feedback needs	4.03	80.6%	High
	Overall mean	4.02	80.3%	High

The media design preferences aspect obtained the highest mean score of 4.18. This finding indicates that students' needs concern not only the availability of digital media but also the way historical information is presented. More specifically, item 14, concerning the use of images, animations, videos, and visualizations of historical objects, obtained a mean score of 4.29, categorized as very high. Visual representation therefore emerged as one of the key characteristics that should be considered in the media design.

This finding addresses an important issue raised in the Introduction. Historical content includes many objects and environments that cannot always be observed directly. Therefore, the high demand for visualization provides empirical support for using VR to represent historical objects and environments more concretely. This finding is consistent with research on VR in cultural heritage education, which identifies immersive technology as a means of representing buildings, sites, landscapes, and historical objects in virtual environments (Rodriguez-Garcia et al., 2024).

The evaluation and feedback aspect also showed a high level of need, with a mean score of 4.03. Item 19 obtained a mean of 4.19, indicating students' need for explanations or feedback after answering questions. This finding suggests that the required media should not function merely as a tool for viewing historical objects. It should provide

learning activities that allow students to assess their understanding. Therefore, assessment, answer explanations, and feedback should be integrated into the VR learning experience.

The cognitive ability and cultural heritage awareness aspect obtained the lowest mean score, at 3.89, although it remained in the high category. The two lowest-scoring items concerned students' ability to connect historical heritage with past life (3.70) and recognize cultural values in historical heritage (3.75). These findings are important because they indicate that students need more than visual access to historical objects. They also need support in interpreting those objects.

Therefore, VR in this study should not be developed merely as a *virtual tour*. It should connect visual objects with historical narratives, cultural values, interpretive questions, and reflective activities. This interpretation is consistent with (Zhao et al., 2025), who emphasized that VR-based heritage education should consider user interaction, learning objectives, and the relationship between virtual experiences and cultural heritage understanding (Zhao et al., 2025).

Distribution of Student Responses

In addition to mean scores, the response distribution provides information about students' general perceptions of digital learning media. A total of 77.3% of responses were positive, consisting of 43.3% *Agree* and 34.0% *Strongly Agree*. In contrast, only 6.3% of responses indicated rejection, as presented in Table 5.

Table 5. Distribution of Student Responses

Response	Percentage
Strongly Agree	34.0%
Agree	43.3%
Positive responses	77.3%
Negative responses	6.3%

The dominance of positive responses supports the overall mean score of 4.02. However, these findings should be interpreted as evidence of students' and teachers' identified needs and initial acceptance of VR-based learning media, rather than as evidence that VR improves learning outcomes or cultural literacy. The effectiveness of the developed VR media requires further investigation through subsequent validation and field testing. They indicate needs and initial acceptance of digital media characteristics. Since this study represents the needs analysis stage, the effectiveness of VR should be examined during subsequent implementation and evaluation stages.

This finding is consistent with recent systematic research on VR in history education and cultural heritage learning, which highlights the potential of immersive technologies to provide contextualized experiences, visualize historical environments and objects, and support students' engagement with cultural heritage (Won et al., 2023). Thus, high demand for digital media needs to be translated into appropriate instructional design rather than simply into the adoption of VR technology.

History Teachers' Interview Findings

To strengthen the quantitative findings, semi-structured interviews were conducted with four history teachers. Thematic analysis identified several major needs related to history learning conditions, media use, historical object visualization, limitations of direct visits, digital readiness, local context, cultural literacy, and assessment as shown in Table 6.

Table 6. Results of History Teacher Needs Analysis

Aspect	Interview Finding	Development Implication
History learning conditions	Teachers identified the need for more engaging, concrete, and contextual learning experiences	The media should provide concrete and contextual history learning experiences
Media use	Digital and visual media are already used	The new media should provide higher interactivity
Historical object visualization	Historical objects cannot always be observed directly	Historical objects and locations should be represented virtually
Limitations of direct visits	Visits may be constrained by time and accessibility	Virtual tours or VR can provide alternative exploration
Teacher digital readiness	Teachers have different levels of experience with digital media	Navigation should be simple and easy to use
Local context	The Old City of Palembang contains historical resources suitable for learning	Local historical objects should be integrated into the content
Cultural literacy	History learning should address facts as well as cultural values and meanings	The media should include information, cultural values, and interpretation activities
Learning assessment	Teachers need information about students' understanding	The media should provide quizzes and feedback

The teacher interviews reinforce the student findings, particularly regarding the need for visualization and concrete learning experiences. Teachers identified difficulties in bringing historical objects directly into the classroom. This provides contextual support for the very high student demand for historical visualization.

The interviews also indicate that VR should be designed with usability in mind. Teachers reported different levels of experience with digital media, making complex navigation a potential barrier. This finding is consistent with a recent systematic review of VR in history education, which identified navigation difficulties, interface complexity, hardware requirements, and cognitive overload as important challenges in VR implementation (Villena-Taranilla & Diago, 2025).

Another important finding concerns the local context. Teachers identified the Old City of Palembang as a potential learning resource that can connect history learning with students' cultural environment. This strengthens the position of VR in this study. The proposed media is not a generic VR application but a context-specific learning environment representing local historical and cultural resources.

Integration of Student and Teacher Findings

The findings show consistency between the quantitative student data and qualitative teacher data. Students demonstrated high needs for visualization, media design, and assessment, while teachers provided contextual explanations for these needs through the identified problems in history learning. A detailed overview of the findings for each aspect is presented in Table 7 below.

Table 7. Integration of Student and Teacher Findings

Student Finding	Teacher Finding	Implication for VR Media
Media design preference = 4.18	Media needs greater interactivity	VR should provide exploration and interaction
Visualization item = 4.29	Historical objects are difficult to present directly	VR should represent historical objects and locations virtually
Evaluation and feedback = 4.03	Teachers need information about student understanding	VR should provide quizzes and feedback
Cultural heritage awareness = 3.89	Learning should address cultural values and meanings	VR should integrate cultural interpretation
Digital readiness = 4.00	Teachers have different levels of digital experience	Navigation should be simple and accessible

The integration of these findings addresses the central question of what characteristics should be considered before developing VR for history education and cultural literacy. The findings indicate five major characteristics: historical object visualization, interactivity, local context, assessment and feedback, and usability.

These findings are consistent with (Won et al., 2023), who found that immersive VR learning involves diverse approaches and emphasized the importance of considering pedagogical features alongside technological affordances. A similar pattern is evident in the present study, particularly in the high score for media design preferences (M = 4.18), which indicates that students do not simply require access to digital technology but expect visual, interactive, and meaningful learning experiences. The highest-rated item (M = 4.29) further shows students' strong preference for images, animation, video, and visualization of historical objects. This finding is also comparable to research on VR-based history education, which identifies immersive visualization and exploration of historical environments as important affordances for making historical content more accessible and engaging (Bonsu et al., 2025; Villena-Taranilla & Diago, 2025). However, an important difference is that these studies primarily synthesize or examine the use of VR in history education, whereas the present study investigates users' needs before the development of the learning media. The findings also correspond with cultural heritage research emphasizing virtual reconstruction and immersive visualization of heritage sites and objects (Rodriguez-Garcia et al., 2024; Dordio et al., 2024).

Limitations and Implications for Further Development

Several limitations should be considered. First, the quantitative data were obtained from 73 students in the research setting, so the findings cannot be generalized to all senior

high school students. Second, the teacher data involved only four history teachers and therefore function primarily as contextual and triangulation data rather than population-level evidence. Third, this study did not examine the effectiveness of VR in improving cultural literacy because the research was limited to the needs analysis stage.

These limitations mean that the broader question of whether VR can actually improve students' cultural literacy remains unanswered. The current findings only establish that students and teachers need media characteristics that can support this objective. Future research should therefore develop a prototype based on these findings, conduct expert validation, perform one-to-one, small-group, and field testing, and subsequently examine changes in cultural literacy using valid instruments and an appropriate research design.This direction is important because recent research indicates that VR in cultural heritage education still requires stronger empirical evidence concerning long-term learning, understanding, and cultural interpretation. Systematic research on VR-based cultural heritage reconstruction also emphasizes the importance of development standards, experience characteristics, and application evaluation in future research (Rodriguez-Garcia et al., 2024).

However, this study differs from previous research in its primary focus and contextual integration. Recent studies have predominantly examined the implementation, learning effectiveness, user experience, or pedagogical affordances of VR in education, history learning, and cultural heritage contexts (Won et al., 2023; Marougkas et al., 2024; Bonsu et al., 2025; Villena-Taranilla & Diago, 2025). Other studies have focused on the use of immersive technologies to visualize and reconstruct cultural heritage sites and objects, emphasizing their potential for exploration, interpretation, and engagement (Chong et al., 2022; Rodriguez-Garcia et al., 2024; Dordio et al., 2024). In contrast, the present study positions systematic needs analysis as the empirical foundation for the subsequent development of VR-based history learning media. More importantly, its distinctive novelty lies in integrating the needs of both students and history teachers rather than examining the learner perspective alone. Students' needs provide information about visual-digital learning interests, device readiness, cultural heritage awareness, media design preferences, and evaluation and feedback, while teachers' perspectives provide complementary information about learning conditions, historical object visualization, digital readiness, local context, cultural literacy, and assessment. This integration is further situated within the local cultural heritage context of the Old City of Palembang, thereby connecting immersive visualization with historical interpretation and cultural literacy rather than treating VR solely as a technological representation of heritage sites. This approach is particularly relevant because previous research has emphasized the importance of aligning immersive technologies with pedagogical objectives, learning contexts, and the characteristics of cultural heritage content (Won et al., 2023; Gong et al., 2024; Zhao et al., 2025). Therefore, the contribution of this study is a context-specific needs-analysis framework that integrates student and teacher requirements with local historical and cultural heritage to inform the Design stage of ADDIE and guide the development of VR-based history learning media for senior high school students.

Therefore, this study provides an empirical foundation for defining the initial specifications of VR learning media, but it does not yet establish its effectiveness. Further development should examine whether the identified media characteristics can be translated into meaningful learning experiences and contribute to students' cultural literacy. This implication is supported by recent research showing that VR and extended reality can facilitate the visualization, exploration, and interpretation of cultural heritage by connecting digital environments with historical sites, objects, and cultural contexts (Chong et al., 2022; Dordio et al., 2024; Rodriguez-Garcia et al., 2024; Zhao et al., 2025). Beyond the Old City of Palembang, the needs analysis framework developed in this study may therefore be adapted to other local-history and cultural-heritage contexts by integrating students' learning needs and teachers' instructional perspectives with local historical characteristics, cultural values, visualization, interaction, usability, and assessment requirements. Such an approach can help ensure that VR learning media are designed not only around technological affordances but also around pedagogical objectives and the cultural meanings embedded in local heritage. This is particularly relevant to history education, where immersive visualization can provide opportunities to explore historical environments and heritage that may be difficult to access directly (Bonsu et al., 2025; Villena-Taranilla & Diago, 2025). Accordingly, local museums, heritage buildings, archaeological sites, traditional cultural practices, and historic urban areas in other regions could be examined using similar needs-analysis dimensions before VR media are developed. The framework thus offers a potential basis for context-sensitive VR learning design that connects digital immersion with local identity, historical understanding, and cultural literacy. Nevertheless, its transferability across educational levels, regions, and cultural contexts requires further empirical validation.

CONCLUSION

This study concludes that there is a strong need for VR-based history learning media that connects historical learning with cultural heritage and the local context of the Old City of Palembang. The findings from students and history teachers indicate that the required media should move beyond text-based presentation by providing accessible visualization of historical objects and sites, meaningful interaction, contextual cultural interpretation, simple navigation, and integrated assessment and feedback. These requirements provide an empirical basis for translating user needs into design specifications for the subsequent stages of the ADDIE model. The study contributes a context-specific needs-analysis perspective by integrating student and teacher requirements with local-history and cultural-heritage learning, which may inform the development of similar VR-based learning initiatives in other local contexts. However, the findings represent identified needs and initial acceptance rather than evidence of VR effectiveness in improving cultural literacy. Further research is therefore required to develop and validate the proposed VR media, examine its usability, and empirically test its contribution to students' cultural literacy.

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