

Developing a Virtual Museum Tour as a History Learning Medium for Junior High Schools

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ABSTRACT

History instruction at the junior secondary school level remains predominantly teacher-centered and expository, limiting students' active engagement and conceptual understanding. This study aims to develop a Virtual Museum Tour-based learning media using the Lapentor platform for seventh-grade prehistory materials and to examine its feasibility through expert validation. The research employed a Research and Development (R&D) approach based on the Alessi & Trollip development model, which consists of planning, design, and development stages. The research participants were seventh-grade students of SMP Widya Wacana 1 Surakarta. Data were collected through observation, interviews, documentation, and validation questionnaires administered to media and subject-matter experts. The results indicate that the Virtual Museum Tour media, designed in accordance with the Cognitive Theory of Multimedia Learning proposed by Richard E. Mayer, meets the feasibility criteria in terms of content accuracy, visual design, navigation, and multimedia integration. The developed product was deemed valid and suitable for use as a visual-interactive alternative in history instruction.

Keywords: *Virtual Museum Tour, History Learning, Multimedia, Lapentor, Media Development.*



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INTRODUCTION

History education at the Junior High School (SMP) level plays a strategic role in shaping historical consciousness, national identity, and students' critical thinking skills. History does not merely present a chronology of past events; it builds interpretative and reflective capabilities regarding social and cultural dynamics. Effective history education should develop conceptual understanding, analytical skills, and a sense of values relevant to contemporary life (Karlsson, 2020; Oppong et al., 2022).

However, the practice of history education in schools still faces several structural problems. Learning tends to be oriented toward delivering factual information through lectures and textbooks, failing to provide contextual and exploratory learning experiences. This condition results in low learning motivation and passive student participation (Simbolon, 2023; Sugiarto & Musyafa, 2024). Preliminary observations conducted through interviews with a history teacher and questionnaires administered to 50 seventh-grade students at SMP Widya Wacana 1 Surakarta further confirmed these challenges. Although 84% of students expressed positive attitudes toward history (22% strongly liked and 62% liked the subject), classroom instruction was still dominated by conventional media, particularly textbooks (78%) and PowerPoint presentations (86%). Moreover, 74% of students perceived history learning as primarily

memorization-oriented, while 20% reported that the limited availability of supporting learning media hindered their understanding of the material. Although 76% of students reported being interested during lessons, only 6% felt highly engaged throughout the learning process. In contrast, 98% of respondents stated that they understood historical content more easily through visual and interactive media, and all students (100%) expressed a preference for virtual learning media such as a Virtual Museum Tour. These findings reveal a clear mismatch between current instructional practices and students' learning preferences, highlighting the urgent need for more interactive and visually engaging learning media.

This problem becomes even more pronounced when contrasted with the characteristics of the digital generation, who are accustomed to visual interaction and multimedia-based technology. The digital transformation in education has shifted the learning paradigm from teacher-centered to student-centered learning, emphasizing interactivity, personalization, and immersive learning experiences (Karanth et al., 2024). The integration of digital technology is proven to enhance engagement and learning effectiveness when designed pedagogically and systematically (Malysheva et al., 2022).

Various studies show that the use of interactive media in history education can improve student interest and understanding. Interactive video media based on digital platforms like Edpuzzle has proven effective in helping students understand abstract historical concepts (Purmintasari & Lesmana, 2023). The use of image-based visuals and animations can also strengthen the connection between new knowledge and students' prior knowledge (Zikriyah Amaliyah & Yanto, 2022). Furthermore, digital exploration of historical sites allows students to gain contextual experiences without needing to conduct physical site visits (Nikmah & Pamungkas, 2022).

In this context, the concept of a Virtual Museum Tour emerges as a relevant innovation. A Virtual Museum Tour allows students to explore exhibition spaces digitally through 360-degree visualizations, interactive hotspot features, and the integration of text, audio, and video. This medium has the potential to provide a more concrete spatial learning experience while encouraging independent exploration and inquiry-based learning.

Theoretically, the effectiveness of multimedia-based media is supported by Richard E. Mayer's Multimedia Learning Theory (2014), which states that learning is more effective when information is presented through integrated visual and auditory channels. The principles of dual-channel, limited capacity, and active processing emphasize the importance of media design that avoids cognitive overload and optimizes information integration. Thus, the development of a Virtual Museum Tour must not only focus on visual aesthetics but must also be grounded in a strong cognitive foundation.

This research utilizes the development model by Alessi & Trollip, which emphasizes continuous evaluation at every stage of multimedia product development. This model was chosen because it provides a systematic framework for integrating planning, design, and development aspects iteratively.

While research regarding digital media in history education is extensive, most studies still focus on interactive videos or quiz-based applications. There has been limited development of spatial exploration media utilizing structured virtual tour technology for prehistoric material at the SMP level. Additionally, research that explicitly integrates Multimedia Learning Theory principles into the design of a Virtual Museum Tour remains scarce, particularly within the context of Indonesian history education.

Based on the literature review and the preliminary needs analysis, there is a clear gap between the increasing demand for contextual, interactive history learning and the conventional instructional practices currently implemented in schools. While students demonstrate a strong interest in history and express a clear preference for visual and immersive learning experiences, the instructional media used remain predominantly text-based and teacher-centered. Furthermore, previous studies have mainly focused on interactive videos or quiz-based applications, with limited attention given to spatial exploration media utilizing Virtual Museum Tour technology for prehistoric learning at the junior high school level. In addition, studies integrating Mayer's Multimedia Learning Theory into the design of Virtual Museum Tour media

are still scarce, particularly within the context of Indonesian history education. Therefore, this study aims to develop a Lapentor-based Virtual Museum Tour for seventh-grade prehistoric history learning and to evaluate its feasibility through expert validation. The proposed learning media is expected to contribute both practically to history learning innovation and theoretically to the advancement of interactive multimedia-based educational technology.

METHODS

This study employed a Research and Development (R&D) approach using the instructional multimedia development model proposed by Alessi and Trollip (2001). The model was selected because it provides a systematic and iterative framework for designing, developing, and evaluating interactive multimedia learning products. Unlike conventional development models, Alessi and Trollip emphasize continuous evaluation and revision throughout every stage of the development process, ensuring that the resulting product aligns with instructional objectives and users' needs. Given these characteristics, the model is particularly suitable for developing a Virtual Museum Tour, which integrates various multimedia elements and user interaction within a digital learning environment.

The development process consisted of three main phases: planning, design, and development. During the planning phase, a needs analysis was conducted through classroom observations, interviews with the history teacher, and questionnaires administered to seventh-grade students to identify instructional problems and learner characteristics. The design phase involved formulating learning objectives, developing storyboards, designing the navigation structure and user interface, and organizing multimedia content based on the principles of Mayer's Multimedia Learning Theory. In the development phase, the Virtual Museum Tour was developed using the Lapentor platform by integrating various multimedia components. The completed product then underwent alpha testing through validation by subject matter experts and media experts, followed by revisions based on expert feedback. Subsequently, beta testing was conducted with students to evaluate the practicality of the learning media. Continuous evaluation throughout each phase ensured that the developed learning media met the criteria of validity and practicality before being implemented in the learning process.

Research Subjects and Location

The research was conducted at SMP Widya Wacana 1 Surakarta. The research subjects consist of:

1. Needs Analysis Subjects: Social Studies (IPS) teachers and 7th-grade students.
2. Small-scale Trial Subjects: 22 7th-grade students selected using a simple random sampling technique. Simple random sampling was utilized to provide every member of the population an equal opportunity to be sampled, thereby minimizing selection bias (Noor et al., 2022).

Validators were selected using a purposive sampling technique, considering academic qualifications (minimum Master's degree), professional experience, and relevance of expertise (Guinovart-Pedescoll & Palau, 2025). The Expert Validators consist of:

1. Two content experts (History/Social Studies Education).
2. Two media experts (Educational Technology/Information Technology and Computer Engineering).

Development Procedures

1. Planning Phase This stage aims to identify learning needs and establish product specifications. Activities include:
 - a. Curriculum analysis for Social Studies (IPS) Phase D.
 - b. Observation of the learning process.
 - c. Teacher interviews.
 - d. Distribution of student needs analysis questionnaires.

- e. Analysis of learner characteristics. Needs analysis is conducted to ensure that the developed product is based on real problems (needs-based development) rather than technology innovation without a pedagogical foundation.
2. Design Phase The design phase includes:
 - a. Developing navigation flowcharts.
 - b. Creating storyboards.
 - c. Designing the User Interface (UI).
 - d. Drafting content scripts and audio narration.
 - e. Designing evaluation instruments (quizzes). Media design refers to Richard E. Mayer's Cognitive Theory of Multimedia Learning, which emphasizes the integration of visual and auditory channels, information segmentation, and cognitive load reduction (Mayer, 2014). Principles such as the multimedia, coherence, signalling, and modality principles are applied to ensure the media is not only visually appealing but also cognitively effective.
 3. Development Phase This stage involves implementing the design into a tangible product. Activities include:
 - a. Developing the landing page using HTML and CSS.
 - b. Integrating 360° panoramas using the Lapentor platform.
 - c. Creating interactive hotspots.
 - d. Producing audio narration and videos.
 - e. Integrating all multimedia components. The resulting product is a web-based Virtual Museum Tour accessible via students' digital devices.

Data Collection Techniques

Data were collected using the following techniques:

1. Observation: Used to identify the condition of history learning prior to media development.
2. Interviews: Conducted with Social Studies teachers to gather information regarding teaching methods, constraints, and the need for innovative media.
3. Questionnaires: Used during the student needs analysis, media expert validation, and content expert validation stages. The validation instrument uses a 4-point Likert scale to avoid neutral choices and increase the decisiveness of the assessment.

Data Analysis Techniques

Data were analyzed using descriptive quantitative analysis. The validation scores were calculated using the following formula:

$$Percentage = \frac{Obtained\ Score}{Maximum\ Score} \times 100\%$$

The resulting percentages were then converted into feasibility categories categories as in table 1. The category were adapted from the instructional media feasibility conversion standards.

Table 1. Feasibility categories

Percentage	Category
81–100%	Highly Feasible
61–80%	Feasible
41–60%	Moderately Feasible
≤40%	Not Feasible

RESULTS AND DISCUSSION

Results

1. Product Development Results

The developed product is a Virtual Museum Tour based on the Lapentor platform, which includes: (a) an HTML and CSS-based landing page; (b) 10 interactive hotspots containing prehistoric material; (c) integrated 360° panoramas; (d) audio narration at specific points of interest; (e) supporting educational videos; and (f) an evaluation quiz integrated via Google Forms. The media's navigation structure was designed using a flowchart as a developmental guide. The navigation flow of the media can be seen in Figure 1.

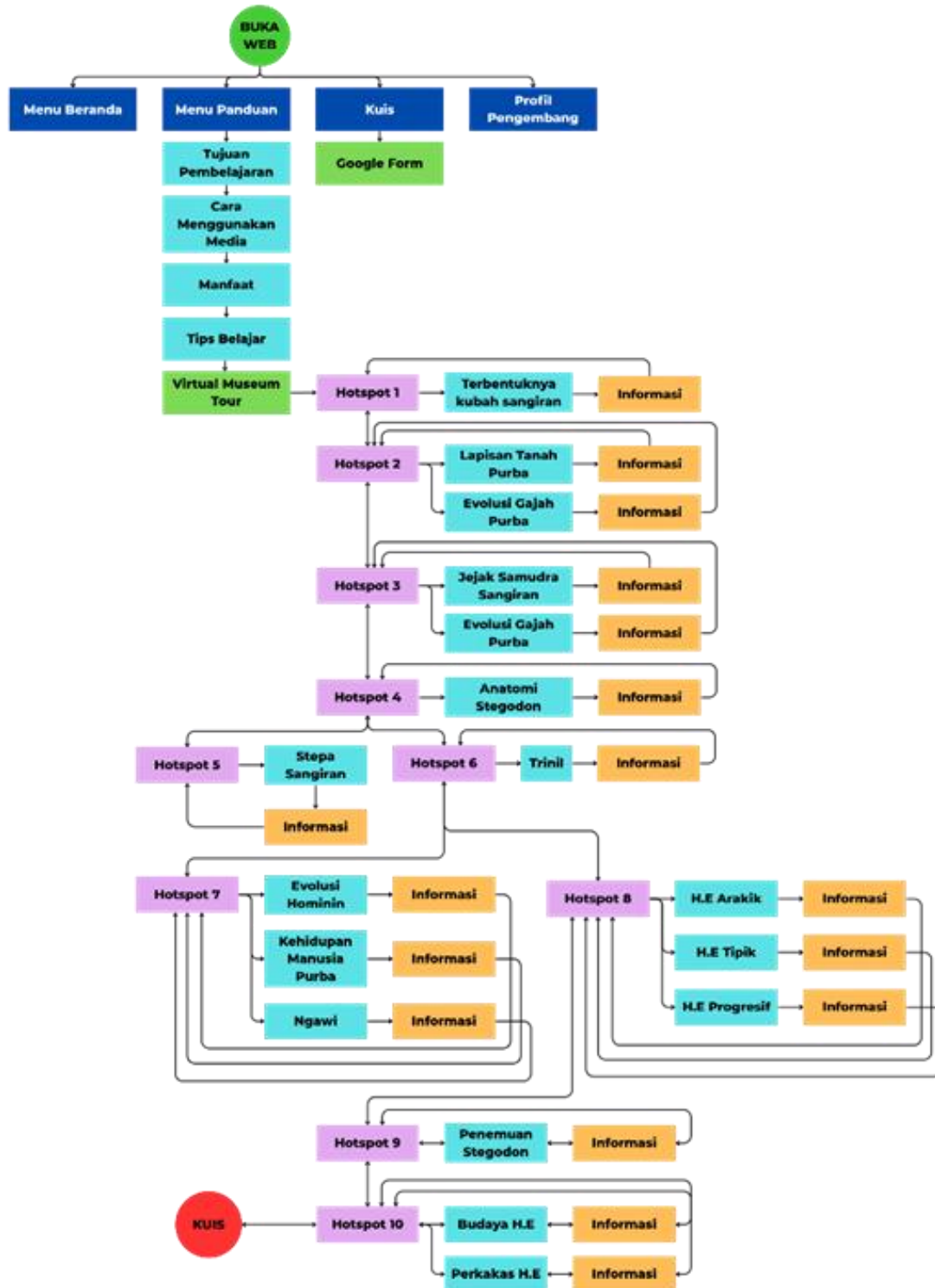


Figure 1. Flowchart

Then, as shown in Figure 2, the media flow begins with the landing page, followed by the exploration of the virtual space, and concludes with a final evaluation. Subsequently, a storyboard was developed to visualize every media interface in detail. The design of the initial landing page storyboard is shown in Figure 2.



Figure 2. Landing Page Interface

The content interface of the Virtual Museum Tour based on 360° panoramas can be seen in Figure 3. As illustrated in Figure 3, students can explore historical objects through interactive hotspot features integrated with text and audio narration.



Figure 3. Virtual Museum Tour Content

2. Expert Validation Results

a. Content Expert Validation

Content validation was conducted to assess the alignment of content with the curriculum, historical factual accuracy, depth of material, and learning benefits. The recapitulation of the content expert validation results is presented in Table 2.

Table 2. Content Expert Validation Results

No	Aspect	Evaluation Criteria	Expert	
			1	2
1.	Content	1. Is the presented material aligned with the Grade VII Social Studies Basic Competencies?	3	5
		2. Are the historical facts presented accurate and reliable?	5	5
		3. Is the depth of the material appropriate for the cognitive development of junior high school students?	4	5
		4. Is the sequence of material presentation logical and systematic, making it easy to understand?	4	5
		5. Is the material supported by visual elements that help students understand the historical content?	4	5
2.	Benefits	1. Does the Virtual Museum Tour medium provide a new and distinct learning experience for students?	5	5

No	Aspect	Evaluation Criteria	Expert	
			1	2
		2. Does the medium help students understand historical material more quickly and effectively?	5	4
		3. Does the medium have the potential to improve students' comprehension of historical material?	5	4
Total			35	38
Average			4,37	4,73

Based on Table 2, the media was declared feasible with minor revisions regarding the simplification of audio narration and the strengthening of conceptual integration.

b. Media Expert Validation

Media expert validation covered visual aspects, navigation, interactivity, audio, and technical systems. The recapitulation of the media expert validation results is presented in Table 3.

Table 3. Media Expert Validation Results

No.	Aspect	Evaluation Criteria	Expert	
			1	2
1	Visual Design	1. Does the learning media present a combination of images (360° panoramas, artifacts) and explanatory text that complement each other to facilitate students' understanding? (<i>Multimedia Principle</i>)	5	5
		2. Does the media avoid irrelevant visual elements (e.g., excessive decorations or distracting animations) that may interfere with students' learning focus? (<i>Coherence Principle</i>)	5	4
		3. Is the descriptive text positioned close to the corresponding visual objects to help students easily associate the information? (<i>Spatial Contiguity Principle</i>)	5	4
		4. Does the media include visual cues (e.g., highlights, icons, or color coding) to emphasize important information? (<i>Signaling Principle</i>)	4	5
2	Text	1. Is the textual information presented concisely without unnecessary repetition when audio narration is already provided? (<i>Redundancy Principle</i>)	5	5
		2. Is the language used conversational and learner-friendly rather than overly formal or rigid? (<i>Personalization Principle</i>)	4	5
3	Content	1. Is the historical content organized logically and sequentially according to the conceptual structure of the topic?	5	4
		2. Are students provided with introductory explanations of historical terms and concepts before beginning the exploration? (<i>Pre-training Principle</i>)	4	4
4	Audio	1. Is the learning material presented in manageable segments (rooms/topics) to reduce students' cognitive load? (<i>Segmenting Principle</i>)	4	4

No.	Aspect	Evaluation Criteria	Expert	
			1	2
		2. Is the audio narration presented simultaneously with the corresponding visual content? (<i>Temporal Contiguity Principle</i>)	5	5
		3. Does the audio (including background music) avoid interfering with students' processing of the primary instructional content? (<i>Coherence Principle</i>)	5	4
5	Navigation	1. Does the media provide learners with control over the sequence of exploration according to their learning needs? (<i>Segmenting Principle & Learner Control</i>)	5	5
		2. Does the navigation help students move clearly and systematically between learning segments or topics? (<i>Segmenting Principle</i>)	5	4
6	Interactivity	1. Do interactive features (e.g., hotspots and clickable objects) encourage students to connect visual information with explanatory content? (<i>Multimedia Principle & Active Processing</i>)	5	4
		2. Does the interactivity enable students to actively engage in learning rather than passively viewing the content? (<i>Generative Processing – Mayer's CTML</i>)	5	4
7	Technical Quality	1. Does the media operate reliably without technical issues that may disrupt students' concentration during learning? (<i>Low Cognitive Load</i>)	5	5
		2. Can the media be accessed smoothly across different devices without reducing the quality of the learning experience? (<i>Low Cognitive Load</i>)	4	4
		3. Does the system respond quickly enough to avoid interrupting students' information processing? (<i>Low Cognitive Load</i>)	5	5
Total			85	80
Average			4.72	4.40

As shown in Table 3, the media achieved a feasible category for use, with minor improvements needed to optimize the integration of text and audio.

Discussion

The development of the Lapentor-based Virtual Museum Tour by Hidayatullah et al. demonstrates a structural transformation in history education from a teacher-centered paradigm to an active, learner-centered exploration. Historically, traditional multimedia integration in classrooms was heavily constrained by technological limitations, often restricting student interaction to basic text and sound elements (Setyaningsih, 2023). However, contemporary shifts in educational technology have allowed multimedia to incorporate complete text, graphics, animation, images, and audio-visual streams that easily cross regional and national boundaries to provide rich learning resources (Setyaningsih, 2023). This rapid pedagogical evolution underpins the immersive design of the Virtual Museum Tour, where interactive variations in teaching styles, digital media, and student-teacher interactions are

deliberately deployed to break classroom monotony, overcome learning boredom, and adjust to diverse learning styles (Arifin et al., 2025).

From an instructional design perspective, the systematic planning of this virtual tour echoes the rigor found in modern Research and Development (R&D) frameworks. Multimedia systems developed through systematic instructional design models are highly effective in ensuring that interactive digital tools are delivery-capable, multimodal, and adaptive (Yasni et al., 2025). This structured approach is further optimized when digital instructional strategies emphasize organized, comprehensive learning management rather than relying on sheer content transmission alone, which significantly supports higher-order cognitive processes (Sasongko et al., 2025). Furthermore, the pedagogical impact of this digital tour is greatly augmented when educators explicitly identify and accommodate students' baseline capabilities. Integrating problem-based instructional models paired with differentiated approaches helps teachers build a more interactive and motivating environment that actively enhances student participation and independent task completion (Pawitra et al., 2025).

The integration of 360-degree interactive panoramas in this study also functions as a vital extension of educational technology's role in establishing adaptive learning spaces. The modern turn toward digital-centric instruction, accelerated by systemic transitions from face-to-face settings to screen-to-screen modalities, places a high demand on educators to master technology, select suitable platforms, and design media that match the precise needs and characters of digital learners (Peramtasari, 2023). This technological shift is visible across multiple educational domains. For example, the application of cloud-computing platforms to manage student responses and evaluations has markedly increased classroom efficiency and the quality of learning outcomes (Purnama et al., 2024). Similarly, the utilization of direct, hands-on media within structured collaborative frameworks has proven successful in increasing student understanding and improving classical learning completeness (Fitriani & Ridhani, 2025). Furthermore, directing students to engage effectively with digital technology, understand software functions, and solve technical problems ensures that learners build necessary proficiencies aligned with the demands of the modern digital era (Vitariyanti et al., 2024).

The effectiveness of this Virtual Museum Tour is deeply anchored in Cognitive Theory of Multimedia Learning (CTML), where principles such as the segmenting, signaling, and spatial contiguity principles are applied to ensure the media is cognitively effective. This deliberate cognitive balancing is essential because contemporary educational research warns that while immersive, 3D digital environments offer revolutionary communication and training opportunities, they carry an inherent risk of cognitive overload if the emerging technology is not designed with a strong pedagogical foundation (Alhakimi, 2023). To prevent such overload and truly optimize learning outcomes, digital media must be paired with explicit metacognitive support. True metacognition requires students to maintain active awareness and control over their cognitive regulation, including planning, monitoring, and evaluation (Buwono et al., 2025). When digital environments are designed systematically around authentic, interactive elements, they successfully drive student motivation, build logical thinking, and reinforce active problem-solving skills (Raziana & Wibawanto, 2025).

Crucially, the success of these interactive digital spaces depends on the holistic integration of cognitive, social, and emotional development. Structured multimedia strategies are vital to increasing learner involvement, improving cognitive and emotional abilities, and creating a pleasant learning atmosphere (Nongko et al., 2025). These digital-age educational practices must also recognize that informal paths given throughout a learner's environment form the essential foundation that shapes lifelong habits, character, and behavior (Pinilih, 2023). Therefore, classroom teachers must continue this trajectory by serving as critical emotional anchors and positive role models (Septyventia et al., 2024). By creating a safe, supportive classroom environment and integrating character values directly into the curriculum, educators can help students build healthy relationships, increase empathy, and manage conflict well during digital exploration (Septyventia et al., 2024).

Theoretical implications indicate that incorporating the Cognitive Theory of Multimedia Learning into digital exploration media can mitigate text-heavy cognitive load. Practically,

shifting from conventional teacher-centered expository methods to interactive visual technologies can significantly increase students' situational interest, engagement, and motivation to learn abstract historical concepts.

CONCLUSION

This research successfully developed a Virtual Museum Tour learning medium that is declared feasible for use based on expert validation in both content and media. Developed from a needs analysis highlighting the demand for more visual, interactive, and contextual history education, the media integrates 360° panoramas, interactive hotspots, and audio narration in alignment with Richard E. Mayer's multimedia learning principles. However, as this study was limited to the development and feasibility stages, the empirical impact on learning outcomes remains untested. Consequently, future research should employ robust experimental designs to evaluate its effects on conceptual understanding and cognitive load, while teachers are encouraged to practically integrate this tool into guided pedagogical strategies to ensure meaningful student exploration. It is highly recommended to transition from the feasibility validation phase into robust experimental research designs to empirically measure the media's direct impact on students' conceptual understanding, spatial retention, creative thinking indicators.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research. This study was conducted independently, and the author have no financial or personal relationships with individuals or organizations that could inappropriately influence or bias the content of this work.

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