Premiere Educandum: Jurnal Pendidikan Dasar dan Pembelajaran
Volume 16 (1) 1 – 24, 2026
ISSN: 2088-5350 (Print) / ISSN: 2528-5173 (Online)
Doi: 10.25273/pe.v16i1.25723
The article is published with Open Access at: http://e-journal.unipma.ac.id/index.php/PE

Integrating digital learning media for local history education: A design framework based on the story of Radin Intan II

Yulia Siska ✉, STKIP PGRI Bandar Lampung
Andri Wicaksono, STKIP PGRI Bandar Lampung
M. Yanuardi Zain, Universitas Negeri Jakarta
Ambyah Harjanto, Universitas Lampung
Kadek Dio Watara, STKIP PGRI Bandar Lampung
M. Tegar Prakoso, STKIP PGRI Bandar Lampung
M. Iqbal Rasyid, STKIP PGRI Bandar Lampung
Irfan Bayu Saputra, STKIP PGRI Bandar Lampung

✉ *yuliasiska@stkippgribl.ac.id*

Abstract: Local history learning in primary education requires resources that connect historical events with cultural meanings, visual representations, and active engagement; however, digital media for local history are often developed as separate products whose pedagogical functions are not explicitly connected. This study aimed to develop an integrated design framework for local history education by synthesizing four digital learning media development studies centered on the historical narrative of Radin Intan II, a national hero associated with the history of Lampung. Using a design-oriented approach informed by Design-Based Research principles, the study synthesized empirical findings on a Creative Wayang Story, a digital comic, a 3D flipbook, and an educational game through descriptive quantitative analysis, qualitative coding, and comparative mapping of pedagogical affordances. Expert validation ranged from 90% to 98%, and student responses ranged from 95% to 97%. The synthesis identified complementary functions: narrative-cultural grounding, visual-narrative representation, spatial-temporal elaboration, and interactive exploration, respectively. These were translated into an Integrated Design Framework in which the Radin Intan II narrative serves as the organizing core that maintains continuity across media while preserving their distinctive functions. The framework provides an empirically informed basis for subsequent classroom implementation and experimental testing, rather than a claim of causal effectiveness.

Keywords: Local history education; Digital learning media; Multimodal learning; Historical narrative; Design-based research; Radin Intan II; Integrated design framework

Received 26 August 2026; **Accepted** 30 September 2026; **Published** 02 October 2026

Citation: Siska, Y., Wicaksono, A., Zain, M. Y., Harjanto, A., Watara, K. D., Prakoso, M. T., Rasyid, M. I., & Saputra, I. B. (2026). Integrating digital learning media for local history education: A design framework based on the story of Radin Intan II. *Premiere Educandum: Jurnal Pendidikan Dasar dan Pembelajaran*, *16*(1), 1–24. https://doi.org/10.25273/pe.v16i1.25723

Published by Universitas PGRI Madiun. This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

INTRODUCTION

Local history provides an important context for helping elementary school students understand the relationship between the past, their surrounding environment, and the cultural values embedded in their communities. Learning history at the primary level is not only concerned with remembering historical facts, but also with developing an understanding of people, events, places, values, and experiences that are meaningful to students' social and cultural environments. Local historical narratives can therefore provide contextual learning experiences while strengthening students' awareness of cultural identity and historical significance. However, local history is often presented through conventional instructional materials that emphasize textual information and chronological descriptions, making historical events less accessible to young learners and limiting opportunities for students to engage with the past through diverse forms of representation.

The development of digital learning media provides opportunities to present local history through forms that are more accessible and engaging for elementary learners. Digital comics, interactive books, digital storytelling, and educational games, for example, can represent historical information through visual, narrative, performative, and interactive modes (Churchill, 2020; Karpenko & Ajtay-Horváth, 2021; Lestari et al., 2020). Multimodal learning perspectives emphasize that meaning can be constructed through the interaction of different modes rather than through verbal information alone (Mayer, 2024; Wu & Chen, 2020). In history education, the use of varied representations is particularly relevant because historical understanding involves not only factual knowledge but also the interpretation of narratives, characters, actions, contexts, and values. Nevertheless, the pedagogical value of digital media does not necessarily arise from the number of media used. The more important issue is how different media can complement one another and be organized around a coherent learning purpose.

This issue emerged from a sustained research program conducted by the authors on the development of digital learning resources for local history education centered on the historical narrative of Radin Intan II, a national hero associated with the history of Lampung. The research program developed several complementary learning resources, including a Creative Wayang Story, a digital comic, a 3D flipbook, and an educational game. Although the development activities were conducted within a closely overlapping period, the Creative Wayang Story provided an important early narrative and cultural reference for the development of the other media. The development of the story explored the historical narrative, characters, sequence of events, heroic values, and visual-cultural representation of Radin Intan II. These narrative and representational elements subsequently provided a basis for maintaining the historical and cultural coherence of the other digital learning resources.

The four development studies generated empirical evidence regarding the feasibility, learner responses, and distinctive pedagogical characteristics of the resulting media. The digital comic supported narrative accessibility, visual engagement, and simplified sequencing; the 3D flipbook provided spatial-temporal representation and conceptual elaboration; the Creative Wayang Story emphasized cultural embodiment, moral-emotional resonance, and performative dramatization; and the educational game provided interactive exploration, decision-based learning, and motivational reinforcement. Expert validation across the media ranged from 90% to 98%, while student responses ranged from 95% to 97%. These findings indicate that the media developed within the research program possessed different but potentially complementary pedagogical affordances.

The accumulated findings, however, raise a further pedagogical question. If different digital media represent different dimensions of the same historical narrative, how can these resources be organized so that they function as complementary components of a coherent local history learning experience rather than as separate instructional products? A digital comic may provide visual and narrative access to historical events, while a flipbook can elaborate spatial and temporal relationships; a wayang-based narrative can provide cultural and performative meaning, while a game can provide opportunities for interaction and decision-making. Their educational potential therefore lies not only in the quality of each individual medium but also in the relationships established among them. A framework for integration needs to preserve the historical narrative and cultural values while allowing the distinctive pedagogical functions of each medium to contribute to a unified learning experience.

Addressing this issue requires a synthesis that goes beyond describing the results of the individual media development studies. The present study therefore examines the accumulated findings of the research program comparatively to identify complementary pedagogical and multimodal functions across the four learning resources. The synthesis is used to formulate a design framework for integrating digital learning media in local history education, with the historical narrative of Radin Intan II serving as the organizing context. In this framework, integration refers not simply to combining several media, but to organizing their respective narrative, visual, cultural, performative, and interactive functions into a coherent learning experience.

Accordingly, the purpose of this study is to develop a design framework for integrating digital learning media in local history education based on the historical narrative of Radin Intan II. The study contributes a design-oriented synthesis of a coordinated series of media development studies and identifies principles for organizing complementary digital learning resources around a shared historical narrative. Rather than claiming the effectiveness of the integrated framework as a completed instructional intervention, the study provides an empirically informed basis for designing multimodal local history learning for elementary education.

METHODS

Research Design

This study employed a design-oriented research approach to synthesize empirical findings from a coordinated research program on local history education. The approach was informed by the principles of design-based research, which emphasize the development of theoretically informed educational designs through systematic engagement with problems of practice and empirical evidence (Design-Based Research Collective, 2003; Scott et al., 2020). In the present study, the focus was not to test a newly implemented instructional intervention, but to examine the accumulated findings of a series of digital learning media development studies and synthesize them into an integrated design framework.

The research program focused on the historical narrative of Radin Intan II and involved the development of four complementary learning resources: Creative Wayang Story, digital comic, 3D flipbook, and educational game. The four development studies were conducted within a closely overlapping period and shared a common historical and cultural context. Although the studies were not designed as a single sequential experiment, the Creative Wayang Story provided an important narrative and cultural reference for the representation of Radin Intan II. The development of this resource established elements of the historical storyline, characters, heroic values, and visual-cultural representation that informed the development and representation of the historical narrative in the other learning resources.

The present study therefore treated the four development studies as components of a coordinated research trajectory rather than as unrelated instructional products. The

accumulated findings were examined comparatively to identify the distinctive and complementary pedagogical affordances of each resource. The results of this cross-study synthesis were subsequently used to formulate an integrated design framework for local history education.

Participants and Empirical Sources

The empirical sources of this study were the findings and development documentation generated from the four media development studies. The original studies involved elementary school students and expert validators who assessed different aspects of the developed learning resources, including content, media characteristics, language, feasibility, learner responses, and learning outcomes. The distribution of participants and expert validators across the four development studies is presented in **Table 1**.

TABLE 1. *Empirical sources of the digital learning media development program*

No.	Learning Resource	Main Focus of Development	Participants	Small-Group Trial	Field Trial	Expert Validators
1	Creative Wayang Story	Historical narrative, characters, heroic values, and cultural representation	±28 Grade IV students	10	28	3
2	Digital Comic	Visualizing the historical narrative and introducing characters through sequential images	±32 Grade IV students	15	32	3
3	3D Flipbook	Spatial-temporal presentation and conceptual elaboration of historical content	Grade V students, SDN Hargo Pancuran	12	30	3
4	Educational Game	Interactive exploration, decision-making, and motivational reinforcement	Grade V students, SDN 1 Sepang Jaya	12	30	4

The Creative Wayang Story involved approximately 28 Grade IV students, with 10 students participating in a small-group trial and 28 students in a field trial, and three expert validators. The digital comic involved approximately 32 Grade IV students, with 15 students in a small-group trial and 32 students in a field trial, and three expert validators. The 3D flipbook involved Grade V students at SDN Hargo Pancuran, with 12 students in a small-group trial and 30 students in a field trial, and three expert validators. The educational game involved Grade V students at SDN 1 Sepang Jaya, with 12 students in a small-group trial and 30 students in a field trial, and four expert validators.

The four learning resources were considered complementary because they addressed different aspects of representing and learning the same historical narrative. The Creative Wayang Story emphasized historical narrative, character development, cultural representation, and heroic values. The digital comic emphasized visual narrative, character introduction, and accessible sequencing. The 3D flipbook emphasized spatial-temporal representation and conceptual elaboration, whereas the educational game emphasized interaction, decision-making, and motivational reinforcement. These distinctions provided the empirical basis for examining the potential relationships among the four resources.

Materials

The materials analyzed consisted of the empirical and design documentation generated during the four development studies. These materials included expert validation sheets, feasibility and practicality scores, student response questionnaires, learning outcome tests, qualitative feedback, and documentation of the developed media.

The analysis focused on findings that could explain the pedagogical contribution of each learning resource. Particular attention was given to the representation of historical narratives, visual engagement, narrative accessibility, sequencing, spatial-temporal elaboration, cultural representation, emotional and moral engagement, performative elements, interaction, decision-making, and learner motivation. These characteristics were treated as pedagogical affordances that could potentially complement those provided by the other resources.

The quantitative evidence consisted primarily of expert validation and student response scores, together with learning outcome data reported in the respective development studies. The qualitative evidence consisted of feedback from validators, teachers, and students concerning content accuracy, media characteristics, language clarity, learner engagement, and classroom feasibility.

Procedure

The procedure comprised four stages: compiling the empirical documentation; extracting quantitative and qualitative evidence; comparing the four resources through a cross-study synthesis matrix; and translating the identified relationships into the Integrated Design Framework, HMMLM, and ADDIIE+.

Data Analysis

Data analysis was conducted in four interconnected stages: (1) quantitative analysis of findings from the individual media development studies, (2) qualitative analysis of feedback and design evidence, (3) cross-study synthesis of the four learning resources, and (4) construction of the integrated design framework. This procedure enabled the study to retain the empirical findings of each development study while examining how their distinctive pedagogical functions could be integrated within a coherent local history learning experience.

Quantitative Analysis

Quantitative findings from the four media development studies were analyzed descriptively to establish the empirical basis for the cross-study synthesis. The analysis included feasibility and student response scores, expert validation, and learning gains reported in the respective development studies.

Feasibility and student response scores were converted into percentages using the following formula (Arikunto, 2012):

$$Percentage = \frac{f(Obtained\ Score)}{N(Maximum\ Score)} \times 100 \quad (1)$$

where $Percentage$ represents the percentage score, f represents the obtained score, and N represents the maximum possible score.

Expert validation was examined using Aiken's V (Aiken, 1985):

$$V = \frac{\sum s}{n(c-1)} \quad (2)$$

where $S = r - lo$, r is the rating assigned by an expert, lo is the lowest rating category, n is the number of experts, and c is the number of rating categories.

Learning gains were examined using N-Gain (Hake, 1999):

$$N = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \quad (3)$$

where S_{post} is the posttest score, S_{pre} is the pretest score, and S_{max} is the maximum possible score.

These quantitative analyses were used to characterize the empirical quality and learning potential of the individual learning resources. The scores were not treated as evidence of the effectiveness of the integrated framework, because the framework itself was not subjected to a new experimental intervention in the present study.

Qualitative Analysis

Qualitative evidence consisted of feedback and comments generated during the development and validation of the four learning resources. The analysis considered feedback from experts, teachers, and students concerning content, narrative clarity, visual representation, cultural representation, media design, language, learner engagement, interaction, and classroom feasibility.

The qualitative material was analyzed through iterative coding and constant comparison (Braun & Clarke, 2021). Initial codes were generated from relevant statements and observations, followed by the grouping of related codes into broader categories. The analysis subsequently identified recurring themes concerning the pedagogical functions of each learning resource.

Particular attention was given to themes related to historical narrative, visual representation, cultural embodiment, performative expression, spatial-temporal representation, emotional and moral engagement, interaction, decision-making, and learner motivation. These themes were treated as indicators of the pedagogical affordances of the respective learning resources.

The unit of analysis at this stage was therefore the pedagogical affordance of each learning resource, rather than individual participant responses. This distinction was important because the purpose of the present study was not to reanalyze individual learners but to determine how the findings from the four development studies could contribute to an integrated learning design.

Cross-Study Synthesis

The quantitative and qualitative findings were then brought together through a cross-study synthesis. This stage constituted the central analytical procedure of the present study.

First, findings from each development study were extracted and organized according to common analytical dimensions. Quantitative indicators, such as expert validation and student response scores, were retained as evidence of the feasibility and learner reception of each resource. Qualitative findings were organized according to the pedagogical themes identified during coding.

Second, the findings were compared across the four learning resources. The comparison did not aim to rank one medium against another. Instead, it examined what distinctive function each resource contributed to the representation and learning of the historical narrative of Radin Intan II.

Third, the four resources were examined for complementarity rather than simple similarity. For example, a resource that primarily supported visual-narrative accessibility was considered in relation to another resource that provided cultural embodiment,

spatial-temporal elaboration, or interactive exploration. This comparison allowed the analysis to identify relationships among different modes of representing and engaging with the same historical narrative.

A cross-study synthesis matrix was used to organize these relationships. The matrix mapped each learning resource against the common analytical dimensions and identified whether a particular function was primary, supporting, or not evident in the available empirical and design evidence. The resulting matrix provided the analytical bridge between the findings of the individual development studies and the construction of the integrated framework.

Construction of the Integrated Design Framework

The final analytical stage translated the cross-study synthesis into an integrated design framework. Framework construction followed the relationships identified through the synthesis rather than being imposed before the analysis. The historical narrative of Radin Intan II functioned as the organizing context connecting the four learning resources. The Creative Wayang Story provided an important narrative and cultural foundation through its representation of the storyline, characters, heroic values, and visual-cultural elements. The digital comic contributed visual-narrative accessibility; the 3D flipbook contributed spatial-temporal and conceptual representation; and the educational game contributed interactive exploration and decision-making.

These complementary functions were then organized into a coherent learning architecture. The purpose was not simply to place four media in one instructional sequence, but to establish meaningful relationships among their distinctive representational and pedagogical functions. Through this process, the study derived an Integrated Design Framework for local history education. The framework subsequently informed the formulation of the Hyper-Media Multimodal Learning Model (HMMLM) and the extended ADDIIE+ instructional cycle, particularly the integration of different media around a shared historical narrative.

The resulting framework is therefore presented as an empirically informed design framework, rather than as an experimentally validated instructional model. Its effectiveness as an integrated intervention requires further classroom-based implementation and iterative evaluation.

RESULTS

The results of this study are presented according to the analytical stages described in the Methods section. Rather than treating the four learning resources as separate products, the results first establish the empirical characteristics of each resource and then examine the patterns that emerge when their findings are considered together. This presentation follows the trajectory of the research program, from the development of individual resources to the identification of their complementary pedagogical functions.

Empirical Foundation of the Four Media Development Studies

The research program generated four digital learning resources centered on the historical narrative of Radin Intan II: Creative Wayang Story, digital comic, 3D flipbook, and educational game. Although the development activities were conducted within a closely overlapping period, they addressed different representational and pedagogical dimensions of the same local historical content. The Creative Wayang Story provided an important narrative and cultural reference through the development of the storyline, characters, heroic values, and visual-cultural representation. The other resources extended the representation of the same historical narrative through visual-narrative, spatial-temporal, and interactive forms.

The four development studies involved Grade IV and Grade V elementary school students and expert validators. The number of participants and validators varied according to the respective development context, as shown in **Table 1**. The studies therefore provide a set of related but not identical empirical observations concerning the development and use of digital learning resources for local history education.

Across the four resources, the development findings indicated positive feasibility and learner-response results. Expert validation scores ranged from 90% to 98%, while student responses ranged from 95% to 97%. The findings also indicated different characteristics across the resources: the digital comic supported narrative accessibility and visual engagement; the 3D flipbook supported spatial-temporal representation and conceptual elaboration; the Creative Wayang Story emphasized cultural embodiment and moral-emotional resonance; and the educational game supported interaction, decision-making, and motivational reinforcement.

These findings establish the empirical foundation for the subsequent cross-study analysis. Importantly, the results do not indicate that one resource uniformly outperformed the others. Instead, the pattern suggests that the resources demonstrated different areas of pedagogical contribution. This distinction provides the basis for examining their complementarity in the next stage of the analysis.

Distinctive Pedagogical Affordances of the Learning Resources

The four learning resources demonstrated different pedagogical characteristics in representing and communicating the historical narrative of Radin Intan II. The differences were identified by comparing the quantitative findings and qualitative evidence generated during the respective development studies. Rather than interpreting the differences as evidence that one medium was superior to another, the analysis examined the particular learning functions associated with each resource.

The Creative Wayang Story demonstrated a strong role in representing the historical narrative through characters, storyline, cultural elements, and heroic values. Its principal contribution was the embodiment of historical content through a culturally recognizable performative form. The development findings indicated that this resource supported the presentation of moral and emotional dimensions of the historical narrative, particularly those associated with heroism and cultural meaning. Its role within the research program was therefore closely associated with establishing the narrative and cultural representation of Radin Intan II.

The digital comic provided a predominantly visual-narrative form of representation. Its use of sequential images, characters, and simplified narrative progression supported students' access to the historical storyline. The findings indicated positive visual engagement and narrative accessibility, suggesting that the medium could function as an entry point for elementary learners to encounter historical events and characters through a more accessible visual form.

The 3D flipbook provided a different form of representation by emphasizing spatial and temporal organization. Its structure allowed historical information to be presented through page-based sequencing, visual elaboration, and animated transitions. The development findings indicated that this resource supported the elaboration of historical information beyond a linear textual presentation, particularly through spatial-temporal organization and conceptual representation.

The educational game provided the most explicitly interactive form of learning experience among the four resources. Its design incorporated interaction, decision-making, missions, and motivational elements. The findings indicated that these characteristics could encourage learners to engage with historical content through active participation rather than through observation or reading alone. Its principal contribution was therefore associated with interactive exploration and learner agency.

The quantitative findings provide additional evidence for the feasibility and learner reception of the four resources. Expert validation ranged from 90% to 98%, while reported student responses ranged from 95% to 97%. These results were not interpreted as a basis for ranking the resources. Instead, they were considered together with the qualitative characteristics of each resource to identify the functions that could contribute to a broader multimodal learning experience.

TABLE 2. *Empirical findings and distinctive pedagogical functions of the learning resources*

Learning resource	Expert validation	Student response	Dominant pedagogical characteristics	Primary contribution to local history learning
Creative Wayang Story	95–98%	96%	Cultural embodiment, moral-emotional resonance, performative dramatization	Narrative and cultural grounding
Digital Comic	90–96%	Very positive	Narrative accessibility, visual engagement, simplified sequencing	Visual-narrative access
3D Flipbook	92–98%	97%	Spatial-temporal structure, conceptual elaboration, animated transitions	Spatial-temporal representation
Educational Game	97.5%	95%	Interactivity, decision-based learning, motivational reinforcement	Interactive exploration

The percentages and pedagogical characteristics are based on the empirical findings reported in the four development studies. The table presents the characteristics as complementary functions rather than as a ranking of media effectiveness.

The comparison in **Table 2** shows that the four resources do not simply reproduce the same instructional function in different formats. Their characteristics indicate a distribution of pedagogical functions across narrative-cultural representation, visual-narrative accessibility, spatial-temporal elaboration, and interactive exploration. The pattern is particularly relevant to local history learning because a historical narrative may require learners to encounter not only information about events but also characters, cultural meanings, temporal relationships, and opportunities to engage actively with the content.

At this stage, however, these functions are still considered as distinct contributions of the individual resources. The next analysis therefore examines whether and how these functions can be connected without losing their distinctive characteristics.

Cross-Study Synthesis: Complementarity Across Media

The comparison of the four learning resources indicates that their pedagogical contributions are differentiated rather than interchangeable. Each resource provides a particular mode of representing and engaging with the historical narrative of Radin Intan II. The cross-study synthesis therefore focused on identifying how these differences could be organized as complementary functions within local history learning.

The synthesis was conducted by mapping the findings of the four development studies against common pedagogical dimensions. The analysis considered the historical narrative, visual representation, cultural representation, spatial-temporal understanding, affective and moral engagement, performative experience, and interactive participation. The purpose of the mapping was not to assign each dimension exclusively to a single medium, but to identify the dominant contribution of each resource and the supporting contributions that could be connected across media.

TABLE 3. *Cross-study synthesis of pedagogical and representational functions*

Pedagogical dimension	Creative Wayang Story	Digital Comic	3D Flipbook	Educational Game	Synthesized function
Historical narrative	Primary	Primary	Supporting	Supporting	Narrative continuity
Characters and storyline	Primary	Primary	Supporting	Supporting	Narrative understanding
Visual representation	Primary	Primary	Primary	Supporting	Visual meaning-making
Cultural representation	Primary	Supporting	Supporting	Supporting	Cultural contextualization
Spatial-temporal representation	Supporting	Supporting	Primary	Supporting	Historical contextualization
Moral and emotional engagement	Primary	Supporting	Supporting	Supporting	Value-oriented learning
Performative representation	Primary	—	—	—	Cultural/embodied experience
Interactive exploration	Limited	Limited	Limited	Primary	Learner agency
Decision-making	—	—	—	Primary	Active historical exploration
Motivation and engagement	Primary	Primary	Primary	Primary	Sustained engagement

The synthesis reveals a functional differentiation among the four resources. The Creative Wayang Story occupies a particularly important position in establishing the narrative and cultural dimensions of the learning experience. Its contribution extends beyond the presentation of historical information by connecting the story of Radin Intan II with characters, heroic values, cultural representation, and performative expression. This makes it particularly relevant as a narrative-cultural foundation for the representation of the historical content across the research program.

The digital comic provides a complementary visual-narrative function. While it shares the narrative dimension with the Creative Wayang Story, its sequential visual structure offers a more direct and accessible way of presenting characters, events, and story progression. The overlap between the two resources is therefore not necessarily redundant: both maintain narrative continuity while employing different forms of representation.

The 3D flipbook contributes a further dimension through the organization and elaboration of historical information in spatial and temporal form. Its contribution complements the narrative and visual functions of the other resources by allowing learners to encounter historical information through a more elaborated sequence and visual structure.

The educational game contributes the strongest interactive dimension. Rather than primarily presenting the historical narrative, it places learners in an active position through interaction and decision-making. Its function therefore differs from the predominantly representational roles of the other resources. This difference provides an opportunity to extend historical learning from encountering and understanding a narrative toward actively engaging with historical situations.

Taken together, the findings indicate that the four resources can be understood as providing complementary rather than competing pedagogical functions. Their relationship can be summarized as a progression from encountering the historical narrative,

visualizing and contextualizing its content, experiencing its cultural and affective dimensions, and actively engaging with historical situations. The synthesis therefore provides an empirical basis for considering the four resources as components of a connected multimodal learning experience rather than as independent digital products.

However, the synthesis does not imply that every learner must use all four media in every learning session. Rather, it indicates that the distinctive affordances identified across the research program can be deliberately orchestrated according to the learning objectives, content, and stage of learning. The next stage of the analysis translates these complementary functions into an integrated design framework.

Integrated Design Framework for Local History Education

At the center of the framework is the historical narrative, which maintains continuity of characters, events, values, and cultural meaning across the different learning resources. Around this narrative core, the four resources contribute different but interconnected forms of learning experience. The Creative Wayang Story provides narrative-cultural grounding; the digital comic provides visual-narrative access; the 3D flipbook provides spatial-temporal elaboration; and the educational game provides interactive exploration. Research on immersive multimedia likewise indicates that richer visual environments can influence presence, interest, and retention when their instructional role is appropriately designed (Makransky & Mayer, 2022).

The resulting framework is therefore not conceived as a simple aggregation of four media products. Instead, it organizes their complementary functions so that each resource can contribute a distinctive dimension to the learning experience while remaining connected to the same historical content.

The framework can be represented through four interconnected functional layers. The narrative-cultural layer establishes the historical story, characters, cultural context, and heroic values. The visual-narrative layer provides accessible representation of events and characters. The spatial-temporal layer supports elaboration of historical sequences and contextual relationships. The interactive layer provides opportunities for learners to explore historical situations and make decisions. These layers are connected rather than isolated, with the historical narrative functioning as the organizing thread across them.

The framework also indicates that integration should occur at the level of pedagogical function, not merely at the level of technology. A learning sequence may therefore begin with narrative and cultural grounding, proceed to visual and contextual exploration, and extend toward interactive engagement. The specific sequence may be adapted to the learning objectives and classroom context while maintaining the continuity of the historical narrative.

The resulting framework represents the principal synthesis of the research program. It translates the accumulated findings of four closely related development studies into a coherent design structure for multimodal local history learning. The framework subsequently provides the conceptual basis for the formulation of the Hyper-Media Multimodal Learning Model (HMMLM) and the extended ADDIIE+ instructional cycle discussed in the following section.

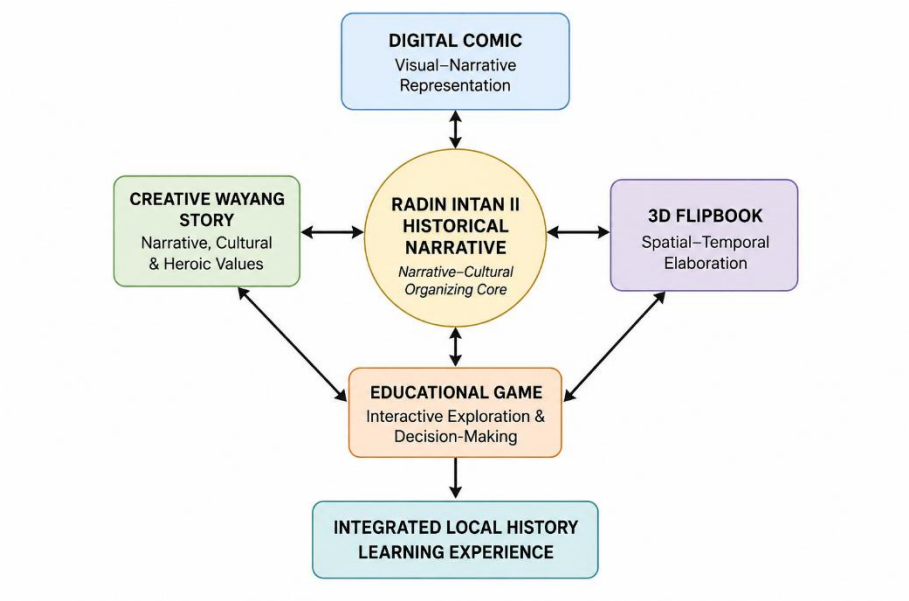


FIGURE 1. *Integrated design framework for local history education*

Figure 1 shows the integrated design framework derived from the cross-study synthesis. The historical narrative of Radin Intan II functions as the organizing core, connecting four complementary resources: Creative Wayang Story for narrative-cultural grounding, the digital comic for visual-narrative representation, the 3D flipbook for spatial-temporal elaboration, and the educational game for interactive exploration and decision-making.

The four resources are not positioned as fixed sequential or hierarchical stages. Their functions can be orchestrated according to learning objectives and instructional context while maintaining continuity of the same historical narrative.

DISCUSSION

From Separate Media Functions to Integrated Design

The findings of this study suggest that the main contribution of the four media development studies does not lie in the individual quality of each digital resource, but in the possibility of connecting their different pedagogical functions within a common historical narrative. The Creative Wayang Story, digital comic, 3D flipbook, and educational game each provided a different way of representing and engaging with the history of Radin Intan II. This finding is consistent with research on multiple representations, which shows that different representational forms can provide complementary ways of accessing and organizing knowledge, provided that learners can establish meaningful relationships among them (Ainsworth, 2006; Mayer, 2024; Kollmer et al., 2021). In this respect, the present study extends the discussion from multiple representations within a learning resource to multiple learning resources that are deliberately coordinated around one historical narrative.

Multimodality, however, does not automatically produce better learning simply by increasing the number of representational modes. Research on multimedia learning has repeatedly shown that the combination of representations needs to be designed according to their respective functions and the cognitive demands imposed on learners. Mayer (2024), for example, demonstrated the potential of combining verbal and pictorial representations when the representations provide complementary information. Similarly, Ainsworth (2006) argued that multiple representations can support learning when they allow learners to complement information, constrain interpretation, or construct deeper

understanding. Conversely, research on cognitive load has shown that poorly coordinated representations can impose additional processing demands rather than facilitate learning (Plass et al., 2003; Mutlu-Bayraktar et al., 2019; Eitel et al., 2021).

In the local-history context examined here, this principle becomes particularly visible. The four resources did not contribute the same type of representation. The Creative Wayang Story emphasized narrative, cultural representation, characters, and heroic values; the digital comic facilitated visual-narrative access; the 3D flipbook provided spatial-temporal elaboration; and the educational game introduced interactive exploration and decision-making. Thus, their relationship can be understood as functional complementarity rather than simple media accumulation. The important question is therefore not whether students should receive more media, but whether each medium performs a function that is pedagogically meaningful and sufficiently differentiated from the others.

The same concern appears in research on multimedia environments, where learners do not necessarily benefit from multiple representations simply because they are exposed to more information. Studies of multimedia environments have shown that learners must be able to recognize the relationships between representations and integrate information across them (Cromley et al., 2021; Kollmer et al., 2021). Seufert (2003), for instance, found that the integration of multiple representations is affected by the way information is externally structured and connected. Likewise, research on multimedia learning has shown that redundant or poorly coordinated representations may interfere with learning, whereas complementary representations can facilitate comprehension (Plass et al., 2003; Mayer, 2024; Lindner et al., 2021).

Taken together, these considerations shift the focus from media selection to media orchestration. The digital comic does not need to replace the wayang-based narrative, nor does the educational game need to reproduce the explanatory function of the flipbook. Their educational value emerges from the different functions they contribute to the same historical content. This is particularly relevant to local history because historical understanding involves more than the acquisition of factual information. Learners encounter historical characters and events through narratives, visual representations, cultural meanings, temporal relationships, and opportunities to engage with historical situations. Research on multimodal cultural learning similarly shows that digital storytelling can connect historical and cultural knowledge with multiple forms of expression and participation. For example, intergenerational digital storytelling with Indigenous communities has been shown to combine storytelling, images, sound, and music as a means of transmitting local knowledge while also engaging learners in digital production (Hausknecht et al., 2021).

The role of the educational game provides a useful point of comparison with recent research on history-oriented game-based learning. Studies have reported that interactive historical games can increase motivation and engagement because learners participate more actively in historical situations rather than merely receiving information. For example, Scholz et al. (2021) demonstrated the feasibility of game-based media for history learning through a digital representation of General Soedirman's guerrilla journey in Pacitan. Their development study reported high validation scores from media and material experts and favorable user responses, suggesting that historical narratives can be translated into interactive game environments without losing their contextual and local-cultural dimensions. Similarly, Rahmawati et al. (2023) found an effect of game-based learning on student engagement in history learning. More recent research on history education has likewise reported positive effects of game-based learning on engagement and learning outcomes (Yuwono et al., 2022; Darnawati et al., 2025). However, these studies primarily examine the individual contribution of game-based learning, whereas the present study places the game within a broader multimodal ecosystem. The educational game in our framework is therefore not conceptualized as the complete

solution for history learning, but as one component that contributes interactivity and learner agency alongside narrative, visual, cultural, and spatial-temporal representations.

A similar pattern can be seen in the cultural dimension of the Creative Wayang Story. Rather than treating culture merely as decorative content added to a digital learning product, the present framework positions cultural representation within the narrative foundation of the learning experience. This position is compatible with research showing that digital storytelling can be used to connect learners with local knowledge, cultural practices, and community narratives. Del-Moral-Pérez et al. (2019), for example, reported that collaborative digital storytelling can contribute to communicative and digital competences in primary education, while research involving Indigenous communities has demonstrated the potential of multimodal storytelling to connect digital literacy with cultural knowledge and intergenerational learning.

The central thread across these findings is therefore coherence across difference. The four resources are different precisely because they provide different ways of encountering the same historical narrative. Their integration does not require making the media identical; rather, it requires maintaining continuity of historical content while allowing each medium to contribute its particular representational strength. In this sense, the present study moves beyond the question of whether digital media are useful for history learning toward a more specific design question: how can several digital resources be orchestrated so that their differences become complementary rather than fragmented?

Seen from this perspective, the position of the Radin Intan II historical narrative becomes clearer. Without a shared narrative, the four resources could remain a collection of independent digital products. With a common narrative, however, the different representations can be related to the same characters, events, values, and historical context. The contribution of the present study therefore lies less in claiming that any individual medium is novel and more in identifying a design relationship among complementary media functions. This relationship provides the conceptual basis for the Integrated Design Framework presented in the Results and, subsequently, for the formulation of the HMMLM.

Historical Narrative as Organizing Core

The cross-study synthesis indicates that the historical narrative of Radin Intan II performs a function that extends beyond providing the subject matter for the four learning resources. It operates as an organizing core that maintains continuity of characters, events, heroic values, and cultural meanings across different forms of representation. This finding is consistent with a longstanding argument in history education that historical understanding is constructed through meaningful relationships among events, actors, contexts, and interpretations rather than through the accumulation of isolated factual information (Harnes, 2025; Peñalba et al., 2020). More recent empirical research on digital storytelling similarly indicates that narrative-based activities can support students' engagement with historical significance, perspective taking, continuity, and the identification of historical values and traits (Peñalba et al., 2020).

What makes this role distinctive is that the narrative does not function simply as a storytelling technique. In the Creative Wayang Story, the narrative establishes the storyline, characters, heroic values, and cultural representation of Radin Intan II; these elements subsequently provide a common reference for the digital comic, 3D flipbook, and educational game. Thus, the narrative performs a structural function: it provides continuity while the media change. This differs from research in which digital storytelling is primarily treated as an instructional activity or a medium through which students construct and communicate their own stories. Peñalba et al. (2020), for example, examined digital storytelling as a learning activity and identified historical significance, historical imagination, perspective taking, continuity, and values and traits identification as important dimensions of students' historical understanding. The present study instead

identifies the historical narrative itself as the connective structure across several independently differentiated media functions.

The distinction becomes even clearer in the context of local-history education. Studies increasingly emphasize that local historical content can make history more contextual and culturally meaningful. A recent study of local-history learning in Indonesia, for example, reported that combining local history with digital storytelling and gamification can increase engagement and support more contextual learning, while also potentially strengthening cultural identity (Fathurrahman et al., 2025). Research on digital storytelling in local-history contexts similarly suggests that working with local historical narratives can connect students' historical learning with cultural heritage and broader competencies. These findings converge with the present study in emphasizing contextualized historical narratives, but the present framework adds another layer: rather than using local narrative as the content of one digital activity, it uses the narrative as the organizing principle for multiple learning resources.

Historical-empathy research provides another way to understand why such narrative continuity may matter. Contemporary scholarship increasingly conceptualizes historical empathy not simply as an emotional response to people in the past, but as a combination of contextual understanding, perspective-taking, and affective engagement (Harnes, 2025). Studies have shown that learners' engagement with historical actors can be influenced by how learning tasks invite them to consider perspectives and historical contexts (De Leur et al., 2017). From this perspective, a coherent historical narrative may provide a useful structure for connecting characters, actions, circumstances, and values. In the present study, however, this should be interpreted as a design implication rather than an empirical claim about increased historical empathy, because historical empathy was not directly measured in the four development studies.

Here, the distinction between narrative as content and narrative as organizing structure becomes central to the argument. In conventional digital learning development, a historical figure may simply become the topic around which text, images, animation, or questions are assembled. In the present research program, Radin Intan II functions differently: the historical narrative provides a stable reference against which different media can contribute different learning functions. The Creative Wayang Story establishes the narrative-cultural foundation; the comic makes the narrative visually accessible; the flipbook elaborates its spatial and temporal dimensions; and the game enables learners to interact with historical situations. The media consequently change, but the historical referent remains coherent.

A related concern emerges in research on technology-supported history learning: technology alone does not guarantee deeper historical understanding. Research on collaborative interactive digital storytelling has found that digital resources can help learners connect historical events with contemporary realities, compare perspectives, question sources, and construct interpretations, but also emphasizes that technology itself does not automatically produce historical understanding. The present study provides a possible explanation for this limitation. Digital resources become more pedagogically coherent when technological variation is anchored in a substantive historical structure. In other words, the organizing principle is not the technology but the historical narrative. Related work on digital history learning also shows that students' responses to historical media depend on how the digital form frames and guides engagement with historical content (Barsch, 2020).

Local history, however, should not be treated merely as additional content. A local historical narrative can indeed make learning more relevant, but relevance alone does not determine how the content is represented across media. The present findings suggest that local history can serve simultaneously as content, cultural context, narrative structure, and integrative reference. This is particularly significant for a figure such as Radin Intan II because the historical account contains not only chronological information but also

characters, conflict, struggle, values, and cultural meanings that can be represented through different modes without abandoning their historical connection.

Taken together, these arguments point toward what may be termed narrative-centered multimodal integration. Existing research has established the value of narrative for historical understanding and the value of digital and multimodal resources for engagement and representation. The present study connects these two strands by proposing that a shared historical narrative can function as the organizing core through which heterogeneous media remain pedagogically and conceptually connected. The contribution is consequently not the claim that narrative is inherently superior to other forms of historical representation, but that narrative continuity can provide a mechanism for maintaining coherence when multiple digital media are orchestrated within the same local history learning experience.

The Integrated Design Framework follows directly from this position. The framework does not begin with technology and then search for historical content to populate it. Instead, it begins with a historically grounded narrative and asks how different media can represent, elaborate, and extend that narrative according to their respective pedagogical affordances. In this sense, Radin Intan II is not merely the subject of the learning materials; the historical narrative becomes the connective tissue that transforms four media resources into an integrated learning design.

Multimodal Orchestration and Complementarity

The findings of this study suggest that the educational value of the four learning resources lies not simply in their multimodality, but in the way their different representational functions can be orchestrated around a common learning purpose. The cross-study synthesis showed that the Creative Wayang Story, digital comic, 3D flipbook, and educational game do not provide equivalent forms of representation. Instead, they contribute different affordances to the same historical narrative. This interpretation is consistent with research on multiple representations, which argues that representations become pedagogically useful when their differences enable learners to access complementary information, constrain interpretation, or develop a deeper understanding of the underlying domain (Ainsworth, 2006). More recent work likewise suggests that multiple representations are not inherently beneficial; their value depends on how they are selected, related, and used within the learning task.

The distinction matters because multimodality should not be equated with simply providing learners with several types of media. In the present study, the four resources form a multimodal environment because they represent the same historical content through different modes, while their pedagogical functions remain deliberately differentiated. The Creative Wayang Story establishes narrative and cultural meaning; the digital comic supports visual-narrative access; the 3D flipbook elaborates spatial-temporal relationships; and the educational game enables interactive exploration and decision-making. Integration consequently occurs not because the media reproduce the same information, but because each contributes a form of access that is less strongly provided by the others.

The role of the educational game illustrates this principle particularly well. Scholz et al. (2021), for example, developed game-based learning media around General Soedirman's guerrilla journey in Pacitan and reported strong expert validation and favorable user responses. Their study focused on a single game-based historical medium, whereas the present study positions game-based interaction as one component within a broader multimodal configuration. Interactive exploration and decision-making are thus differentiated from the visual, narrative, and spatial-temporal functions performed by the other resources. The pedagogical value of game-based media in this configuration consequently rests not only on interactivity itself, but also on how that interactivity is coordinated with other forms of historical representation.

Ainsworth's (2006) Multiple Representations framework provides a useful theoretical lens for interpreting this arrangement. Representations can serve complementary roles when learners are able to exploit their differences and establish connections among them according to the learning task. The present study extends this principle in two respects. First, the representations are not merely different forms contained within a single instructional object; they are four independently developed learning resources. Second, their integration is organized around a culturally and historically specific narrative rather than around an abstract disciplinary concept. The emphasis therefore shifts from multiple representations within a medium toward orchestrated relationships among multiple media.

History-education research offers a further illustration of why these relationships matter. Prangsma et al. (2008), for instance, found that students who worked with visual-textual representations integrated into a timeline achieved better short-term learning outcomes than students working with textual representations alone. The significance of their finding lies not simply in the addition of a visual representation, but in the way the timeline helped students establish relationships among historical phenomena and their temporal organization. The present study converges with this perspective while extending it to a different design problem: rather than integrating representations within one history-learning task, it addresses the orchestration of several digital resources that were initially developed as distinct media.

The question of cognitive load adds an important qualification. A systematic review of 94 multimedia-learning studies by Mutlu-Bayraktar et al. (2019) showed that cognitive-load research has frequently examined design and presentation features such as modality, signaling, and seductive details. More recent synthesis has likewise indicated that adding more than two external representations does not produce a uniform learning advantage; effects vary according to the conditions under which the representations are presented. The four-media configuration proposed here should therefore not be interpreted as a claim that more media necessarily produce better learning. Its contribution lies instead in assigning differentiated functions to the media and connecting them through a shared narrative and instructional purpose. Recent work also cautions against assuming that adding sensory channels or representations automatically improves learning (Eitel et al., 2021).

This caution is especially relevant because the four resources in the present research program were developed separately rather than as components of a single experimental treatment. Their subsequent integration is therefore a design synthesis, not evidence that simultaneous exposure to all four resources produces superior learning outcomes. The empirical evidence establishes the positive feasibility, learner responses, and, where available, learning gains of the individual resources; the cross-study analysis then identifies how their distinctive functions can be combined conceptually. Whether this integrated configuration produces additional learning benefits compared with individual media remains to be established through subsequent classroom-based testing. This caution is consistent with evidence that multimedia effects can vary across learning and testing conditions rather than producing uniform gains (Lindner et al., 2021).

The issue is not only whether representations are available, but whether learners can recognize the relationships among them. Prangsma et al. (2008) showed that multimodal representations could help students construct a more coherent "big picture" of historical phenomena, while also demonstrating differences in the extent to which students verbally integrated visual and textual information. For the present framework, this suggests that simply providing different media does not guarantee that learners will establish the intended connections. Such connections need to be made pedagogically visible through instructional sequencing, prompts, narrative continuity, and appropriate transitions between resources.

Recent work on multimodal history learning offers a related perspective. A history-courseware study integrating 360-degree virtual reality with paintings, maps,

infographics, text, audio, and video reported improved learning outcomes compared with traditional courseware. Although that system differs substantially from the present research program, it illustrates how different media can provide distinct forms of access to historical information when incorporated into a coherent instructional environment. The present framework differs in its point of departure: it does not begin with a single technological platform into which multiple media are inserted, but with four already-developed resources whose pedagogical relationships are subsequently identified and organized.

The comparison also raises a broader issue in instructional design: multimodal orchestration is not synonymous with technological integration. Technological integration concerns whether different resources can technically coexist or be accessed within one environment. Pedagogical orchestration concerns whether learners encounter each resource for a meaningful reason and whether movement from one representational mode to another contributes to the construction of understanding. Mayer's formulation of the Cognitive Theory of Multimedia Learning similarly emphasizes the processes through which learners select relevant information, organize it into coherent verbal and visual structures, and integrate it with prior knowledge. From this perspective, the present framework provides an external instructional structure within which connections among representations can be deliberately supported.

Within this structure, complementarity can be identified across several dimensions. The Creative Wayang Story contributes cultural and narrative grounding; the digital comic provides visual accessibility and narrative sequencing; the 3D flipbook offers spatial-temporal elaboration; and the educational game supports interaction and decision-making. These functions inevitably overlap at certain points, but they are not identical. Their overlap helps maintain continuity, while their differences allow learners to encounter the historical narrative from different representational perspectives. The design challenge is consequently one of balance: enough continuity to prevent fragmentation, but enough differentiation to avoid redundant representation.

Seen in this way, the contribution of the present study is more specific than the general proposition that multimodal learning is effective. The literature already provides substantial evidence that multimodal representations can support learning under appropriate conditions. What the present study adds is the proposition that complementarity can serve as a design principle for integrating independently developed digital resources around a shared local-history narrative. Each medium is retained because of the particular pedagogical function it contributes, while the historical narrative provides the continuity needed to relate those functions.

This understanding of orchestration links the four development studies to the Integrated Design Framework. Integration becomes meaningful when transitions among resources are guided by the historical narrative, learning objective, and distinctive affordance of each medium.

Contribution, Implications, and Future Directions of the Integrated Design Framework

The cross-study synthesis contributes a design perspective that differs from approaches in which individual digital media are developed and evaluated independently. The central contribution of the present study is the identification of a relationship among historical narrative, differentiated media functions, and multimodal integration. The resulting framework does not propose that one medium should replace another or that the simultaneous use of several media automatically improves learning. Rather, it suggests that independently developed resources can be brought into a coherent learning design when each resource is assigned a distinctive pedagogical function and remains connected to a shared historical narrative.

The argument is consistent with research emphasizing that multimodal learning depends on the relationship among representations rather than on the mere presence of multiple modes. Ainsworth (2006) conceptualized multiple representations as potentially complementary when they provide different information, constrain interpretation, or support deeper understanding. Research in history education has similarly shown that the integration of visual and textual representations can support students' construction of relationships among historical phenomena, although the benefits depend on how learners connect the representations (Prangsma et al., 2008). The present framework extends these principles from multiple representations within a learning activity to multiple independently developed learning resources organized through a common historical narrative.

A similar direction can be seen in emerging work on multimodal approaches to history education. Historical games, for example, have increasingly been examined not merely as entertaining technologies but as multimodal environments in which historical knowledge, visual representation, gameplay, and interaction can be combined to support new forms of engagement with the past (de Vero & Barr, 2023; Scholz et al., 2021). Similarly, interactive digital storytelling has been investigated as a means of combining narrative, decision-making, dialogue, and historical reflection; one recent study found that interactive storytelling could support engagement, affective response, and reflection on historical content (Petousi et al., 2022). These studies converge with the present framework in recognizing that historical learning can benefit from moving beyond passive information delivery. The difference is that the present study does not place all multimodal functions inside a single game or storytelling environment. Instead, it identifies complementary functions across four different resources and connects them through one local historical narrative.

At the conceptual level, the framework can be understood as a narrative-centered multimodal design structure in which the historical narrative provides continuity, while the media provide differentiated modes of access to that narrative. The Creative Wayang Story establishes the narrative-cultural foundation; the digital comic provides visual-narrative accessibility; the 3D flipbook provides spatial-temporal elaboration; and the educational game provides interactive exploration and decision-making. The framework consequently treats difference among media as an instructional resource, rather than attempting to make every medium perform the same pedagogical function. This position is also consistent with contemporary formulations of multimedia learning that emphasize active selection, organization, and integration rather than technology itself (Mayer, 2024). Research on immersive multimedia likewise indicates that richer visual environments can influence presence, interest, and retention when their instructional role is appropriately designed (Makransky & Mayer, 2022).

The framework also has implications for instructional design. Conventional applications of ADDIE provide a systematic sequence of analysis, design, development, implementation, and evaluation and remain widely used for multimedia development. Recent studies continue to employ ADDIE for integrating text, images, animation, audio, and interactive activities within individual multimedia products. For example, multimedia development studies using ADDIE commonly organize the development of heterogeneous media elements within a single instructional product and subsequently evaluate its feasibility and learning outcomes. The present research suggests a somewhat different design problem: what happens when several already-developed learning resources need to function as parts of one instructional ecosystem? In this context, the issue is not merely the integration of media elements during product development but the integration of independently developed resources at the instructional level.

This distinction provides the rationale for the Integration component proposed in the extended ADDIIE+ cycle. The Integration phase should not be interpreted as a replacement for the established ADDIE model or as a universally superior instructional-design procedure. Rather, it represents a design response to the specific problem

identified in this research program: coordinating several media whose pedagogical functions differ but whose historical content is shared. Its practical purpose is to determine when, why, and how learners move between resources, while maintaining narrative continuity and avoiding unnecessary duplication.

At the same time, the evidence places a clear boundary around what can be claimed about ADDIIE+. The present study provides a design rationale for an explicit integration phase, but it does not yet provide comparative experimental evidence demonstrating that ADDIIE+ produces better outcomes than conventional ADDIE. Accordingly, the contribution should be understood as a design proposition emerging from the cross-study synthesis, rather than as a conclusively validated instructional-design model. This distinction strengthens the methodological credibility of the study because it separates what is empirically established from what remains to be tested.

For teachers and learning designers, the implications are more practical. First, teachers do not necessarily need to use all four resources in every learning session. Instead, the framework can be used to select or sequence resources according to the learning objective. Narrative-cultural resources may be prioritized when introducing characters, values, and historical context; visual-narrative resources may support initial access to events and storylines; spatial-temporal representations may be useful when learners need to establish relationships among events; and interactive resources may be introduced when learners are expected to explore alternatives, make decisions, or reflect on historical situations. This principle is compatible with research showing that interactive storytelling can create opportunities for dialogue and reflection when decision points are meaningfully connected to historical content (Petousi et al., 2022).

Second, the framework provides a possible strategy for local-history education in contexts where digital resources are often developed as individual products. Rather than requiring the development of a completely new integrated platform, teachers and researchers may consider how existing resources can be connected through a common narrative, learning objective, and instructional sequence. This may be particularly useful for culturally grounded history education, where the preservation of narrative and cultural continuity is as important as the technological format used to present the content.

Third, the framework has implications for future development of historical digital learning environments. Recent research on historical games has argued for greater attention to the multimodal character of historical representations and the ways in which gameplay can become a medium for engaging with historical knowledge rather than simply an entertainment layer (de Vero & Barr, 2023; Scholz et al., 2021). The present framework extends this direction by suggesting that historical multimodality can be designed across multiple complementary resources, not only within a single game or digital platform.

These implications should nevertheless be considered alongside several limitations. First, the Integrated Design Framework was derived through cross-study synthesis, and the four development studies were not originally designed as a single controlled experiment testing the integrated framework. Consequently, the present findings provide evidence for the feasibility and characteristics of the individual resources and a theoretically and empirically informed rationale for their integration, but they do not establish the causal effectiveness of the integrated framework itself. Second, the four studies involved different development contexts and participants; therefore, direct numerical comparison across the studies should be interpreted cautiously. Third, constructs such as historical empathy, cultural identity, digital literacy, and learner autonomy were discussed as potential implications of the framework but were not uniformly measured as outcomes across the four studies. These constructs should therefore not be presented as demonstrated effects of the integrated framework.

The next step is therefore to move from design synthesis to integrated implementation. A subsequent study could test the four resources as a coordinated learning sequence and compare the integrated condition with selected single-media

conditions. Such a design would make it possible to determine whether functional complementarity produces learning benefits beyond those obtained from individual resources. Future studies could also examine how teachers actually orchestrate transitions among media and whether different learner characteristics influence the usefulness of particular representational modes. In addition, the proposed Integration phase of ADDIIE+ should be tested through iterative classroom-based Design-Based Research cycles to determine which integration strategies are most feasible and which transitions create unnecessary cognitive or instructional demands.

For this reason, the framework is best understood not as a claim that more media produce better learning, but as a proposition that different media can become pedagogically more meaningful when their functions are deliberately differentiated and connected through a coherent historical narrative. The Integrated Design Framework provides a bridge between the four empirical development studies and a broader model of multimodal local-history learning. In this sense, HMMLM represents a conceptual formulation of the relationships identified through the synthesis, while ADDIIE+ represents an instructional-design implication that requires further empirical testing. The framework consequently offers a grounded starting point for subsequent implementation studies rather than a final claim of universal effectiveness.

CONCLUSION

This study synthesized findings from four closely related digital media development studies conducted around the historical narrative of Radin Intan II. Rather than treating the Creative Wayang Story, digital comic, 3D flipbook, and educational game as independent instructional products, the study examined their distinctive pedagogical functions and the relationships among them. The cross-study synthesis identified complementary contributions in narrative-cultural grounding, visual-narrative representation, spatial-temporal elaboration, and interactive exploration.

At the center of this synthesis is the historical narrative of Radin Intan II, which can function as an organizing core for multimodal local history learning. Its role extends beyond providing historical content: it maintains continuity of characters, events, values, and cultural meanings across different media. The resulting Integrated Design Framework therefore emphasizes functional complementarity, in which different media are connected according to their particular pedagogical affordances rather than simply accumulated within one learning environment.

The principal outcome is an Integrated Design Framework for multimodal local history education, derived from the cross-study empirical evidence. The framework provides a design basis for connecting independently developed digital resources through a shared historical narrative and a coherent instructional purpose. Within this framework, the Hyper-Media Multimodal Learning Model (HMMLM) can be understood as a conceptual formulation of the relationships identified through the synthesis, while the proposed ADDIIE+ Integration phase represents an instructional-design implication of the need to coordinate different media at the instructional level.

The study should not, however, be interpreted as establishing the causal effectiveness of the integrated framework, HMMLM, or ADDIIE+ as a completed instructional intervention. The empirical evidence primarily concerns the development and evaluation of the individual learning resources, whereas the integration presented in this study is derived through cross-study synthesis. Further classroom-based implementation and comparative research are therefore required to determine whether the integrated configuration provides learning benefits beyond those achieved by individual media and to examine how teachers and learners negotiate transitions across different modes of representation.

Taken as a whole, the study suggests that integration becomes most meaningful when differences among media are deliberately organized around a coherent historical

narrative. The resulting framework offers a grounded basis for future development and testing of culturally responsive, multimodal approaches to local history learning in primary education.

ACKNOWLEDGMENTS

The authors express gratitude to STKIP PGRI Bandar Lampung, Universitas Lampung, and Universitas Negeri Jakarta for institutional support. We thank the expert validators, teachers, and elementary students whose participation in the four development studies provided the empirical foundation for this research.

DECLARATIONS

Funding

This research was funded by the Competitive Research Grant of STKIP PGRI Bandar Lampung. Publication support was provided through the article publication incentive program for reputable national and international journals by the Ministry of Higher Education, Science, and Technology of the Republic of Indonesia (Kemdiktisaintek).

Conflict of Interest

The authors declare no conflict of interest.

Ethics Approval and Consent to Participate

Not applicable.

Availability of Data and Materials

The data supporting the findings are derived from the documentation of the four development studies and are available from the corresponding author upon reasonable request, subject to applicable privacy and institutional restrictions.

Author Contributions

Conceptualization, Y.S. and A.W.; Methodology, A.W. and Y.S.; Investigation, K.D.W., M.T.P., M.I.R., and I.B.S.; Resources, K.D.W., M.T.P., M.I.R., and I.B.S.; Data curation, K.D.W., M.T.P., M.I.R., and I.B.S.; Formal analysis, A.W. and Y.S.; Validation, M.Y.Z. and A.H.; Visualization, A.W.; Writing-original draft preparation, A.W. and Y.S.; Writing-review and editing, M.Y.Z. and A.H.; Supervision, Y.S. and A.W.; Project administration, Y.S.; Funding acquisition, Y.S. and A.W. All authors have read and agreed to the published version of the manuscript.

Declaration of Generative Ai and AI-Assisted Technologies in the Manuscript Preparation Process

Portions of this manuscript were drafted and edited with the assistance of Claude (Anthropic). The AI tool was used solely to support language editing, including improving grammar, clarity, readability, and overall coherence of the manuscript. All AI-assisted text was thoroughly reviewed, revised, and validated by the authors, who retain full responsibility for the accuracy, originality, integrity, and final content of the manuscript. No AI tool was used for data collection, data analysis, interpretation of research findings, or the development of the research model and its conclusions. The use of AI was limited to language and editorial assistance

REFERENCES

1. Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, *45*(1), 131–142. https://doi.org/10.1177/0013164485451012

2. Ainsworth, S. (2006). DeFT: A conceptual framework for considering learning with multiple representations. *Learning and Instruction, 16*(3), 183–198. https://doi.org/10.1016/j.learninstruc.2006.03.001
3. Arikunto, S. (2012). *Prosedur penelitian: Suatu pendekatan praktik*. Rineka Cipta.
4. Barsch, S. (2020). Does experience with digital storytelling help students to critically evaluate educational videos about history? *History Education Research Journal, 17* (1), 67–80. https://doi.org/10.18546/HERJ.17.1.06
5. Braun, V., & Clarke, V. (2021). Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Counselling and Psychotherapy Research, 21*(1), 37–47. https://doi.org/10.1002/capr.12360
6. Churchill, N. (2020). Development of students' digital literacy skills through digital storytelling with mobile devices. *Educational Media International, 57* (3), 271–284. https://doi.org/10.1080/09523987.2020.1833680
7. Cromley, J. G., Kunze, A. J., & Dane, A. P. (2021). Multi-text multi-modal reading processes and comprehension. *Learning and Instruction, 71*, Article 101413. https://doi.org/10.1016/j.learninstruc.2020.101413
8. Darnawati, Sutopo, H., Sahran, L. O., & Jamiludin. (2025). Exploring the development of a game-based education: History learning for elementary school students. *International Journal of Digital Multimedia Broadcasting, 2025*, Article 3600683. https://doi.org/10.1155/ijdm/3600683
9. de Leur, T., van Boxtel, C., & Wilschut, A. (2017). "I saw angry people and broken statues": Historical empathy in secondary history education. *British Journal of Educational Studies, 65* (3), 331–352.
10. de Vero, I., & Barr, M. (2023). A historical text-based game designed to develop critical thinking skills. *International Journal of Game-Based Learning, 13*(1), Article 38. https://doi.org/10.4018/IJGBL.323138
11. Del-Moral-Pérez, M. E., Villalustre-Martínez, L., & Neira-Piñeiro, M. del R. (2019). Teachers' perception about the contribution of collaborative creation of digital storytelling to the communicative and digital competence in primary education schoolchildren. *Computer Assisted Language Learning, 32* (4), 342–365. https://doi.org/10.1080/09588221.2018.1517094
12. Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32*(1), 5–8. https://doi.org/10.3102/0013189X032001005
13. Eitel, A., Prinz, A., Kollmer, J., Niessen, L., Russow, J., Ludäscher, M., Renkl, A., & Lindner, M. A. (2021). The misconceptions about multimedia learning questionnaire: An empirical evaluation study with teachers and student teachers. *Psychology Learning & Teaching, 20* (3), 420–444. https://doi.org/10.1177/14757257211028723
14. Fathurrahman, F., Sutimin, L. A., Susanto, H., Maulana, W. I., & Wijayanti, F. (2025). Pembelajaran sejarah lokal berbasis pendekatan edutainment. *Dinamika Sosial: Jurnal Pendidikan Ilmu Pengetahuan Sosial, 4*(3). https://doi.org/10.18860/dsjpips.v4i3.17807
15. Hake, R. R. (1999). *Analyzing change/gain scores*. Indiana University.
16. Harnes, H. B. (2025). What can empirical research tell us about how to develop students' historical empathy? A scoping review. *History Education Research Journal, 22* (1), Article 18. https://doi.org/10.14324/HERJ.22.1.18
17. Hausknecht, S., Freeman, S., Martin, J., Nash, C., & Skinner, K. (2021). Sharing Indigenous knowledge through intergenerational digital storytelling: Design of a workshop engaging Elders and youth. *Educational Gerontology, 47* (7), 285–296. https://doi.org/10.1080/03601277.2021.1927484

18. Karpenko, Y. M., & Ajtay-Horváth, M. (2021). Digital storytelling as an educational technology for activating cognitive activity of primary school pupils in foreign language lessons. *Information Technologies and Learning Tools, 81*(1), 36–45. https://doi.org/10.33407/itlt.v81i1.3149
19. Kollmer, J., Hosp, T., Glogger-Frey, I., Renkl, A., & Eitel, A. (2021). Adjunct aids and signals support online learning from multiple representations. *Journal of Computer Assisted Learning, 37*(1), 172–182. https://doi.org/10.1111/jcal.12477
20. Lestari, S., Sugianto, & Setiawan, D. (2020). The effectiveness of PBL assisted by digital storytelling media towards science literacy and critical thinking skills. *Journal of Primary Education, 9*(4), 329–341. https://doi.org/10.15294/jpe.v9i4.40495
21. Lindner, M. A., Eitel, A., Barenthien, J., & Köller, O. (2021). An integrative study on learning and testing with multimedia: Effects on students' performance and metacognition. *Learning and Instruction, 71*, Article 101100. https://doi.org/10.1016/j.learninstruc.2018.01.002
22. Makransky, G., & Mayer, R. E. (2022). Benefits of taking a virtual field trip in immersive virtual reality: Evidence for the immersion principle in multimedia learning. *Educational Psychology Review, 34*, 1771–1798. https://doi.org/10.1007/s10648-022-09675-4
23. Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning. *Educational Psychology Review, 36*, Article 8. https://doi.org/10.1007/s10648-023-09842-1
24. Mutlu-Bayraktar, D., Cosgun, V., & Altan, T. (2019). Cognitive load in multimedia learning environments: A systematic review. *Computers & Education, 141*, 103618. https://doi.org/10.1016/j.compedu.2019.103618
25. Petousi, D., Katifori, A., Servi, K., Roussou, M., & Ioannidis, Y. (2022). History education done different: A collaborative interactive digital storytelling approach for remote learners. *Frontiers in Education, 7*, Article 942834. https://doi.org/10.3389/feduc.2022.942834
26. Peñalba, E. H., Samaniego, C. R. C., & Romero, S. M. A. (2020). Digital storytelling: A tool for promoting historical understanding among college students. *Research in Learning Technology, 28*, Article 2348. https://doi.org/10.25304/rlt.v28.2348
27. Plass, J. L., Chun, D. M., Mayer, R. E., & Leutner, D. (2003). Cognitive load in reading a foreign language text with multimedia aids and the influence of verbal and spatial abilities. *Computers in Human Behavior, 19*(2), 221–243. https://doi.org/10.1016/S0747-5632(02)00015-8
28. Prangsma, M. E., van Boxtel, C. A. M., & Kanselaar, G. (2008). Developing a "big picture": Effects of collaborative construction of multimodal representations in history. *Instructional Science, 36* (2), 117–136. https://doi.org/10.1007/s11251-007-9026-5
29. Rahayu, S., Sariyatun, S., Sutimin, L. A., & Ardianto, D. T. (2025). Multimodal digital learning and local Indigenous frameworks to enhance critical thinking in history learning. *Ianna Journal of Interdisciplinary Studies, 7* (2), 804–818.
30. Rahmawati, V., Umamah, N., Sumardi, & Marjono. (2023). The effect of the game-based learning model on student engagement in history learning. *Paramita: Historical Studies Journal, 33* (1), 163–173. https://doi.org/10.15294/paramita.v33i1.37748
31. Scholz, K. W., Komornicka, J. N., & Moore, A. (2021). Gamifying history: Designing and implementing a game-based learning course design framework. *Teaching & Learning Inquiry, 9* (1), 99–116. https://doi.org/10.20343/teachlearninqu.9.1.9
32. Scott, E. E., Wenderoth, M. P., & Doherty, J. H. (2020). Design-based research: A methodology to extend and enrich biology education research. *CBE—Life Sciences Education, 19* (3), Article es11. https://doi.org/10.1187/cbe.19-11-0245

33. Seufert, T. (2003). Supporting coherence formation in learning from multiple representations. *Learning and Instruction, 13*(2), 227–237. https://doi.org/10.1016/S0959-4752(02)00022-1
34. Wu, J., & Chen, D.-T. V. (2020). A systematic review of educational digital storytelling. *Computers & Education, 147*, 103786. https://doi.org/10.1016/j.compedu.2019.103786
35. Yuwono, A., Fakhruddin, M., & Ibrahim, N. (2022). Penggunaan media evaluasi pembelajaran berbasis game edukasi Kahoot pada hasil belajar sejarah di SMAN 51 Jakarta. *Historiography: Journal of Indonesian History and Education, 2*(1), 43–53. https://doi.org/10.17977/um081v2i12022p43-53