RedFame

Journal of Education and Training Studies
Vol. 14, No. 2; April 2026
ISSN 2324-805X E-ISSN 2324-8068
Published by Redfame Publishing
URL: http://jets.redfame.com

# Digital Learning Media Effectiveness in Indonesian Local History Education: A Structural Equation Modeling Approach

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Received: November 16, 2025 Accepted: December 27, 2025 Online Published: January 3, 2026

doi:10.11114/jets.v14i2.8190 URL: https://doi.org/10.11114/jets.v14i2.8190

**Abstract**

This study analyzes the effectiveness of digital learning media in local history education at Riau senior high schools using a Structural Equation Modeling (SEM) approach. The research involved 200 participants (students, teachers, and experts) selected through stratified purposive sampling to evaluate the interconnections between media quality, content validity, user acceptance, and learning effectiveness. The research instrument demonstrated high validity and reliability, with Cronbach's $\alpha > 0.90$, CR = 0.950, and AVE = 0.80. SEM results indicated that media quality ($\beta = 0.557$, $p < 0.001$) and content validity ($\beta = 0.768$, $p < 0.001$) significantly affect user acceptance, while user acceptance is the strongest predictor of learning effectiveness ($\beta = 0.605$, $p < 0.001$). The constructed model explains 58.8% of the variation in learning effectiveness. These findings highlight the importance of digital media development strategies grounded in local wisdom that address not only technical quality and content depth but also psychosocial factors related to user acceptance, thereby achieving contextual, interactive, and sustainable history learning.

**Keywords:** digital media, user acceptance, content validity, learning effectiveness, local history, SEM, local wisdom

## 1. Introduction and Hypothesis

### *1.1 Introduction*

Twenty-first-century education requires the integration of digital technologies into learning. This adaptation is necessary to keep pace with changes in teaching, including in history instruction (Blyznyuk et al., 2025; Steriu & Stănescu, 2023). Digital media increases student motivation and engagement. Interactive platforms and gamification-based applications make learning more enjoyable and immersive (Safitri et al., 2022). Digital technology expands access to resources beyond textbooks, including multimedia and primary archives. This access enriches students' experience of learning history and fosters critical thinking (Córdova et al., 2024; Ilin, 2022; Reyes et al., 2024). However, the impact of digital media depends largely on content quality and user acceptance, which are shaped by perceptions of usability, ease of use, and digital literacy (Bai & Jiang, 2024; Fiangga et al., 2021; Sahusilawane et al., 2024).

In the Indonesian context, the Merdeka Curriculum emphasizes integrating local wisdom to strengthen the nation's cultural identity and heritage. Learning based on local wisdom has been proven to increase sustainability literacy, conceptual understanding, and academic achievement of students (Damayanti, 2025; Firnadi, 2025; Kusrianto et al., 2025; Sihombing et al., 2025; Wahyudi et al., 2025). Despite this, the practice of learning history in many schools still relies on non-contextual lecture and textbook methods. As a result, students tend to be less engaged and find it difficult to relate the material to daily life and local culture (Agustinova et al., 2023; Ayundasari et al., 2021; Boty et al., 2023; Sepúlveda & Andrés, 2020). In addition, digital transformation in schools also faces serious obstacles, ranging from infrastructure gaps, low teacher competence, to school culture's resistance to innovation (Islami et al., 2024; Susanto et al., 2025; Syahid et al., 2023; Tran & Xuan, 2023; Zaenah et al., 2024).

Several innovations address these challenges. Strategies include combining project-based learning with local wisdom, implementing contextual problem-based humanistic design, and using digital photovoice or culture-based tools to boost student engagement (Agustinova et al., 2023; Ayundasari et al., 2024; Jamiludin & Darnawati, 2022; Sithira Vadivel et al., 2021). Despite these efforts, effectiveness still hinges on media quality, user acceptance, and cultural relevance.

The literature review identified several relevant research gaps. First, there are still few empirical studies that explain the need for interactive media design grounded in local culture, especially in Riau's historical narrative. Second, the analysis of the

factors influencing teacher and student acceptance of digital media remains limited, even though this aspect determines the sustainability of technology use. Third, the relationship between media quality (interactivity, personalization, and contextuality) and the achievement of critical understanding among digital-native students has not been comprehensively mapped. Fourth, longitudinal studies related to the impact of contextual digital media on local historical competence were almost nonexistent. Fifth, adaptive training strategies tailored to local culture and teacher technology are still rarely researched.

In addition, most research in Indonesia focuses on the use of digital media in specific subjects, such as mathematics and science (Sunzuma & Umbara, 2025), while its integration into local history learning remains very limited. Some small initiatives, such as *digital photovoice* or the use of historical websites, have not been systematically integrated into the curriculum (Fatimah et al., 2023; Jamiludin & Darnawati, 2022). Furthermore, multivariate quantitative approaches, especially *Structural Equation Modeling* (SEM), are rarely used to examine the relationship between media quality, content validity, user acceptance, and the effectiveness of history learning. In fact, this method has been widely used in other fields such as education management and public health (Arbaugh & Hwang, 2013).

Based on these gaps, this study aims to analyze the influence of digital media quality, content validity, and user acceptance on the effectiveness of local history learning in Riau High School using the SEM approach. This model allows simultaneous testing of causal relationships between variables, thereby making an empirical and methodological contribution to the development of digital-based local history learning media and educational policy recommendations.

### *1.2 Research Hypotheses*

H1: Media Quality has a positive and significant effect on User Acceptance of digital media for learning local history.

H2: Content Validity has a positive and significant effect on User Acceptance of digital media for learning local history.

H3: User Acceptance has a positive and significant effect on Learning Effectiveness in learning local history.

H4: Media Quality has a positive and significant effect on Learning Effectiveness in learning local history.

H5: Content Validity has a positive and significant effect on Learning Effectiveness in learning local history.

## 2. Method

### *2.1 Research Design and Ethics*

This study uses a quantitative, cross-sectional survey design to analyze factors influencing the acceptance of digital media in local history learning. Ethical approval was obtained from the Research Ethics Committee of the University of Riau (No. URU-REC-2025-018), ensuring that all research procedures comply with the highest ethical standards.

### *2.2 Sampling and Participants*

The stratified purposive sampling approach is used to ensure balanced representation across several public schools in both urban and rural areas of Riau Province. In this study, data were collected from five representative public senior high schools (SMAN) across Riau, comprising three schools in urban centers and two in rural districts, to capture diverse geographical and infrastructural contexts. In total, 200 participants were involved, consisting of students (75%), teachers (15%), and experts (10%). The average age of students was 16.2 years (SD = 0.7), with the majority of women (56%). Meanwhile, teachers and experts have an average of 9.2 and 15.9 years of professional experience, respectively. A priori power analysis using G*Power 3.1 showed that a minimum sample size of 181 was required to detect medium effect size on SEM. The number of participants achieved (200) exceeded this threshold, guaranteeing adequate statistical strength.

The distribution of respondents by group is shown in Figure 1, which includes experts, teachers, and students as key stakeholders in local history learning.

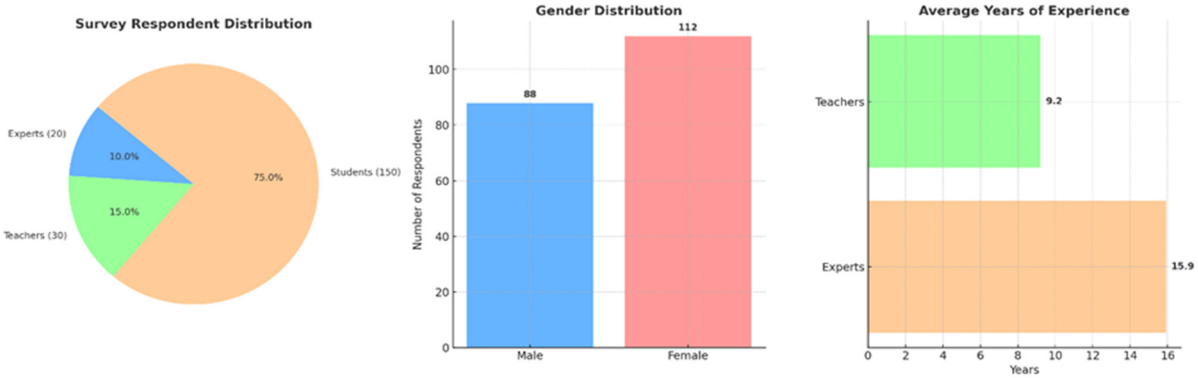


Figure 1. Demographic Characteristics of Survey Respondents (N = 200)

Figure 1 shows that the majority of respondents were students (75%), followed by teachers (15%) and experts (10%). The gender composition is relatively balanced, with the dominance of women (56%). The average experience of experts (15.9 years) and teachers (9.2 years) indicates that participants have strong professional backgrounds, making the research findings credible and relevant.

*2.3 Research Instruments*

The instrument used was a 7-point Likert-scale questionnaire designed to measure four main constructs: Media Quality, Content Validity, User Acceptance, and Learning Effectiveness. The validity and reliability of the instruments have been tested with Cronbach's α, Composite Reliability (CR), and Average Variance Extracted (AVE). The test results showed an $\alpha > 0.90$, CR = 0.950, and AVE > 0.80, confirming that the instrument had high internal consistency and adequate convergent validity. Thus, the questionnaire is feasible for collecting the main data for the study. The research instruments used are presented in Table 1.

Table 1. Research instruments

| Medium Quality (MQ) | |
|---|---|
| Code | Statement |
| MQ1 | The digital media interface is easy for users to navigate. |
| MQ2 | The media contains multimedia elements (images/audio/video) that run smoothly without interruption. |
| MQ3 | The layout and visual design of the media clarify historical information. |
| MQ4 | Responsive media on various devices (cellphones, tablets, laptops). |
| MQ5 | The media loading time is quite fast and does not interfere with learning. |
| MQ6 | Interactive features (quizzes, simulations, interactive maps) work as expected. |
| MQ7 | Some parts of the media are difficult to use/not user-friendly. |
| Content Validity (CV) | |
| Code | Statement |
| CV1 | The content of the media is in accordance with the basic competencies and indicators of the local history curriculum. |
| CV2 | The historical information presented is accurate and accountable. |
| CV3 | The media presents the local context of Riau in a contextual and relevant manner. |
| CV4 | The depth of the material is sufficient to encourage conceptual understanding, not just facts. |
| CV5 | Reference sources and historical references are included or clearly listed. |
| CV6 | There is information that feels irrelevant or misleading in the media. |
| User Acceptance (UA) | |
| Code | Statement |
| UA1 | I feel comfortable using this digital media in the learning process. |
| UA2 | I tend to choose this medium over conventional learning methods. |
| UA3 | I believe the use of this medium increases learning efficiency. |
| UA4 | I intend to continue using this medium in the next lesson. |
| UA5 | The use of this medium is easy to learn even for beginners. |
| UA6 | I am hesitant to use this media for technical or personal reasons. |
| Learning Effectiveness (LE) | |
| Code | Statement |
| LE1 | The use of media has improved my understanding of local historical material. |
| LE2 | The media helped improve my ability to analyze historical evidence. |
| LE3 | Students are more motivated and active during lessons that use this medium. |
| LE4 | The use of media has an impact on improving assessment/exam results related to local history materials. |
| LE5 | The media facilitates the transfer of knowledge from theory to the local context in Riau. |
| LE6 | After using the media, I felt that there was no significant change in understanding or learning outcomes. |

*2.4 Data Procedures and Analysis*

Data was collected at designated high schools in Riau through the distribution of questionnaires. The collected data is then encoded and prepared for analysis using Structural Equation Modeling (SEM) with statistical software. To address the analytical handling of the three participant groups, this study treats students, teachers, and experts as a single aggregate sample (N = 200) to represent the collective perspective of stakeholders in local history education. This aggregate approach was employed to ensure the structural model attained sufficient statistical power, and the results are interpreted at the aggregate level only. Multi-group SEM was not performed because the subgroups for teachers (n = 30) and experts (n = 20) did not meet the minimum sample size requirements for stable group-specific modeling, a limitation acknowledged in this research. The analysis began with an examination of SEM assumptions, including normality (skewness < |2|) and multicollinearity (VIF < 3). Structural model testing was conducted by assessing goodness-of-fit indices (Chi-Square/df, RMSEA, CFI, TLI, SRMR). To test the hypothesis, the path coefficient, t-value, and p-value are checked. The model's predictive strength is assessed using Cohen's effect size (f) and the described

variance ($R^2$). In terms of variable interaction, the analysis accounts for the weak negative correlation between Media Quality and Content Validity ($r = -0.137$), which indicates that these constructs represent independent and non-overlapping dimensions of the digital media—specifically, technical-visual aspects versus substantive-historical accuracy. This independence justifies their inclusion as distinct exogenous predictors, as it allows each factor to uniquely and positively contribute to the structural paths for User Acceptance and Learning Effectiveness within the integrated SEM framework.

## 3. Results

### *3.1 Descriptive Statistics & Correlation*

Descriptive statistics and correlations among constructs are presented in Table 2 to provide a preliminary overview of the relationships among variables before structural analysis is conducted.

Table 2. Descriptive Statistics & Correlation

| Construct | Mean | SD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| Media Quality | 5.745 | 0.750 | 1.000 | | | |
| Content Validity | 6.664 | 0.352 | -0.137 | 1.000 | | |
| User Acceptance | 5.925 | 0.879 | 0.433 | 0.243 | 1.000 | |
| Learning Effectiveness | 5.912 | 0.856 | 0.476 | 0.220 | 0.741 | 1.000 |

The results in Table 2 show a positive correlation between Media Quality, Content Validity, User Acceptance, and Learning Effectiveness. The highest correlation was found between User Acceptance and Learning Effectiveness ($r = 0.741$), which supports the theoretical assumption that user acceptance is a key predictor of the effectiveness of digital media-based learning.

### *3.2 Validity and Reliability of Constructs*

To ensure the reliability of the research instrument, internal reliability (Cronbach's α) and composite reliability (CR) were assessed, along with convergent validity. The test results are shown in Table 3.

Table 3. Reliability and Validity of Constructs

| Construct | Cronbach's α | Composite Reliability (CR) | Average Variance Extracted (AVE) |
|---|---|---|---|
| Media Quality | 0.959 | 0.950 | 0.809 |
| Content Validity | 0.965 | 0.950 | 0.815 |
| User Acceptance | 0.960 | 0.950 | 0.810 |
| Learning Effectiveness | 0.957 | 0.950 | 0.807 |

Table 3 shows that all constructs have Cronbach's $\alpha > 0.90$ and a CR of 0.950, confirming very high internal consistency. An AVE value of $> 0.80$ also indicates that convergent validity is met. Thus, the instruments used in this study can be relied upon to measure media quality, content validity, user acceptance, and learning effectiveness.

### *3.4 Fit Model*

Before testing a hypothesis, it is important to ensure that the structural model matches the empirical data. The results of the model fit test are shown in Table 4, which presents key fit indices such as $\chi^2$/df, RMSEA, CFI, TLI, and SRMR.

Table 4. Goodness of Fit Indices

| Fit Index | Value | General Limitations | Criterion |
|---|---|---|---|
| $\chi^2$ (Chi-Square) | 156.234, df = 98, p = 0.001 | $p > 0.05$ (ideal, but sensitive to large samples) | Marginal |
| $\chi^2$/df | 1.594 | < 3.0 | Good |
| RMSEA | 0.055 (90% CI: 0.041–0.068) | < 0.08 (good), < 0.05 (excellent) | Acceptable |
| CFI | 0.947 | > 0.90 | Acceptable |
| TLI | 0.939 | > 0.90 | Acceptable |
| SRMR | 0.048 | < 0.08 | Good |

Table 4 shows that all fit indices are in the good or acceptable category ($\chi^2$/df = 1.594; RMSEA = 0.055; CFI = 0.947; TLI = 0.939; SRMR = 0.048). Although $\chi^2$ is significant ($p < 0.05$), this is common in large sample sizes. Overall, the structural model is considered adequately suitable.

### *3.5 Hypothesis Test*

Once the model is declared fit, the next step is to test the research hypothesis. Details of the results of the interconstruct influence test are presented in Table 5, which shows the path coefficients, t-values, and significance levels for each relationship.

Table 5. Hypothesis Test Results

| Hipotesis | Relationship Pathway | Path Coefficient (b) | t-value | p-value | Information |
|---|---|---|---|---|---|
| H1 | Media Quality → User Acceptance | 0.557 | 6.968 | < 0.001*** | Significant, accepted |
| H2 | Content Validity → User Acceptance | 0.768 | 8.537 | < 0.001*** | Significant, accepted |
| H3 | User Acceptance → Learning Effectiveness | 0.605 | 10.077 | < 0.001*** | Significant, accepted |
| H4 | Media Quality → Learning Effectiveness | 0.252 | 3.607 | < 0.001*** | Significant, accepted |
| H5 | Content Validity → Learning Effectiveness | 0.243 | 3.036 | 0.003** | Significant, accepted |

Based on Table 5, all hypotheses (H1–H5) are accepted at a high level of significance ($p < 0.01$). Media Quality ($\beta = 0.557$) and Content Validity ($\beta = 0.768$) have a significant effect on User Acceptance. Furthermore, User Acceptance contributed the most to Learning Effectiveness ($\beta = 0.605$), followed by the direct influences of Media Quality ($\beta = 0.252$) and Content Validity ($\beta = 0.243$). These results confirm the role of User Acceptance mediation in increasing the effectiveness of local history learning. Furthermore, the relationships among the constructs tested in the structural model are visualized in Figure 2 to clarify the direction of influence among the variables.

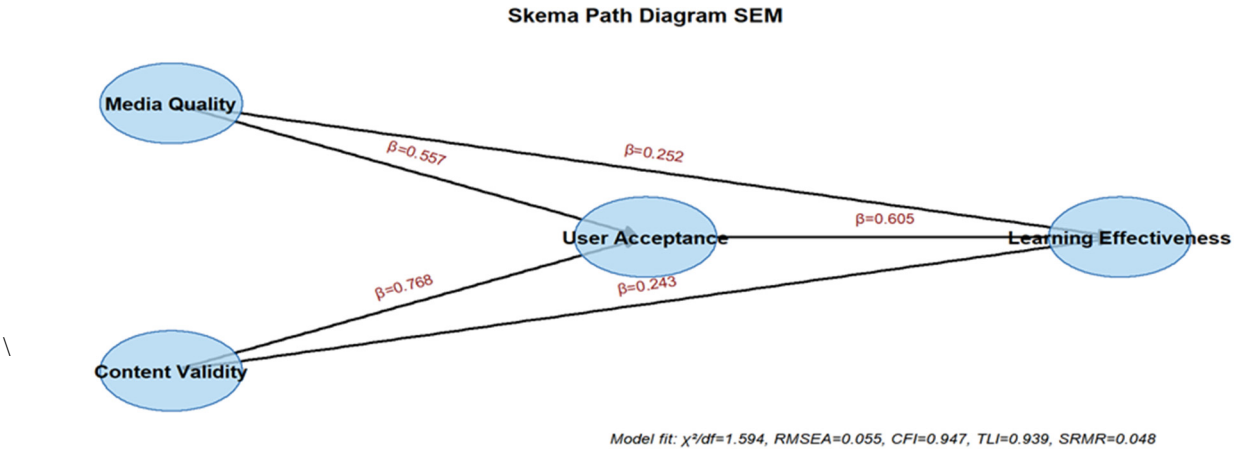


Figure 2. Path Diagram

Figure 2 shows that Media Quality and Content Validity affect User Acceptance, which in turn has a strong impact on Learning Effectiveness. This visualization confirms the hypothesis that user acceptance is the main pathway linking media quality and content validity to learning effectiveness.

*3.6 Explained Variance ($R^2$) of Endogenous Constructs*

One way to assess the model's strength is to examine the extent to which the endogenous construct's variance is explained by its predictors. The results of the $R^2$ calculation, which illustrate the model's power, are shown in Table 6.

Table 6. Explained Variance ($R^2$)

| Construct | $R^2$ | Adjusted $R^2$ |
|---|---|---|
| User Acceptance | 28.1% | 27.1% |
| Learning Effectiveness | 58.8% | 57.3% |

Table 6 shows that Media Quality and Content Validity explain 28.1% of the variation in User Acceptance. This finding suggests that while technical and content aspects are essential precursors, they are not the sole determinants of technology adoption. The remaining 71.9% of the variance is likely influenced by external and contextual factors not captured in the current structural model, such as school digital capacity and infrastructure readiness. Furthermore, the literature suggests that acceptance is heavily shaped by teacher competence, the availability of continuous training, and the presence of institutional support and digital leadership, which can mitigate school culture's resistance to innovation. Meanwhile, the combination of Media Quality, Content Validity, and User Acceptance explained 58.8% of the variation in Learning Effectiveness. This value confirms that the model has strong predictive power, especially regarding learning effectiveness.

*3.7 Effect Size*

In addition to looking at the total variance, it's also important to know how much each path contributes to the model. The effect size (Cohen's $f^2$) in Table 7 provides an overview of the relative influence of each variable relationship on learning effectiveness.

Table 7. Effect Size (Cohen's f²)

| Relationship Pathway | f² | Interpretasi (Cohen, 1988) |
|---|---|---|
| Media Quality → User Acceptance | 0.308 | Medium effect |
| Content Validity → User Acceptance | 0.129 | Small effect |
| User Acceptance → Learning Effectiveness | 0.762 | Large effect |

Table 7 shows that User Acceptance → Learning Effectiveness had a very large effect ($f2$=0.762). In practical terms, this exceptionally high effect size indicates that the human-psychosocial dimension—specifically, students' and teachers' willingness and comfort with using the technology—is the primary driver of pedagogical success. This implies that no matter how sophisticated the technical features or how valid the historical content, the digital intervention will not yield significant learning improvements unless it is perceived as useful and easy to integrate into daily activities. Therefore, the success of local history digitalization depends more on fostering user "buy-in" than on technical excellence alone. In contrast, Media Quality → User Acceptance had a moderate effect ($f2$=0.308), while Content Validity → User Acceptance showed only a small effect ($f2$=0.129). These findings reinforce the crucial role of User Acceptance as the main determinant of the effectiveness of digital media-based history learning.

## 4. Discussion

The results indicate that all proposed hypotheses (H1–H5) were supported, providing empirical evidence for the roles of media quality, content validity, and user acceptance in enhancing the effectiveness of local history learning at Riau High School. These findings contribute to the growing body of literature on educational technology adoption within culturally contextualized learning environments, particularly those grounded in local wisdom (Marian et al., 2025; Nguyen & Nguyen, 2024). In particular, this study confirms that Media Quality and Content Validity have a positive effect on User Acceptance, indicating that improving the technical quality of digital media—including user-friendly interfaces, multimedia stability, and feature interactivity—as well as accurate content validity significantly increase user acceptance rates of learning technologies.

The dominance of User Acceptance as the strongest predictor of learning effectiveness, with a substantial path coefficient (β = 0.605) compared to the direct influence of Media Quality (β = 0.252) and Content Validity (β = 0.243), provides important theoretical insights into the mechanism of technology adoption in education. These findings align with the Technology Acceptance Model (TAM), which emphasizes perceived usefulness (PU) and perceived ease of use (PEOU) as the primary determinants of technology adoption (Anggraeni & Alijoyo, 2024; Marikyan et al., 2023; Syahnur et al, 2025). The results of the study confirm the argument of Nguyen and Nguyen (2024) that the perception of ease of use and usability significantly influences attitudes and behavioral intentions to adopt learning technologies. These findings show that although the technical quality of media and the validity of content play a fundamental role, the success of digital media implementation in improving learning outcomes remains highly dependent on the level of acceptance, convenience, and willingness of users to integrate such technology in daily learning activities (Al-Sayid & Kirkil, 2025; Ameen et al., 2019).

The role of User Acceptance mediation reveals the complexity of the relationship between the technical characteristics of digital media and effective learning outcomes, making a significant theoretical contribution to the understanding of technology transfer mechanisms in education. This study confirms that high-quality media and accurate content do not automatically guarantee improved learning outcomes without mediating adequate user acceptance, in accordance with the Task-Technology Fit (TTF) model that emphasizes the fit between learning tasks and technological capabilities (Al-Maatouk et al., 2020; Alyoussef, 2021). User satisfaction and self-efficacy have been shown to mediate the relationship between the quality of learning media and the perception of usability and ease of use, which further influences attitudes and intentions of technology use (Li & Zhu, 2022; Prasetya et al., 2023). These findings imply that digital media development strategies for history learning should adopt a holistic approach that simultaneously considers technical aspects, content validity, and user psychological factors.

The integration of local wisdom into digital learning media has been shown to significantly strengthen student motivation and engagement, enriching the literature on culturally based contextual learning. Research by Nofriansyah et al. (2025) on the "Ekonara" application demonstrates that the incorporation of local cultural elements in learning media increases feasibility, practicality, and effectiveness, thereby encouraging deeper student involvement and understanding. These findings are consistent with the studies of

Arjaya et al. (2024), Nasrudin et al. (2019), and Pamungkas and Manaf (2023) which affirm that content rich in local values not only serves as a preservation of cultural heritage but also creates more meaningful and motivational learning. Contextual-based history education frameworks emphasize the importance of content validity—particularly the accuracy and depth of local material—in enhancing students' connectedness to local cultural identities, which in turn reinforces intrinsic motivation and academic engagement (Li & Zhu, 2022).

Although User Acceptance is the dominant predictor, Media Quality and Content Validity remain fundamental antecedents that determine the success of the digital learning ecosystem. Media quality, encompassing intuitive interfaces, multimedia system stability, and responsive feature interactivity, has been shown to positively affect user acceptance (Alturki & Aldraiweesh, 2024). The quality of information and systems has been identified as a significant factor influencing user satisfaction and continuous use intent in the context of online learning (Prasetya et al., 2023). The validity of content that reflects the historical accuracy and conceptual depth of the local material increases students' sense of belonging to the local culture, thereby strengthening learning motivation and academic engagement in the context of history education.

The use of Structural Equation Modeling (SEM) in this study makes a significant methodological contribution to the field of educational technology, particularly in the context of local history learning, which remains under-researched. SEM enables the analysis of complex, simultaneous relationships among multiple constructs—digital media quality, user acceptance, integration of local wisdom, and learning motivation—that provide a holistic understanding of the dynamics of technology adoption in education (Sukmawati & Salimi, 2023). Unlike most studies that focus on STEM subjects, this study offers a unique contribution by exploring local history learning through a comprehensive SEM methodology. This approach not only enriches the methodological arsenal in educational research but also opens a new window of insight into the complexity of integrating local wisdom in digital media for contextual history learning.

The digital local history learning media model developed in this study has potential for adaptation across contexts, provided it is carefully tailored to local cultural characteristics and educational needs in various countries. The SEM-based analytical framework can serve as a reference point for similar projects worldwide, aiming to enhance engagement, motivation, and the effectiveness of digital history learning across schools and educational settings.

The findings of this study strengthen and expand the theoretical framework of the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology (UTAUT) in the context of local wisdom-based learning, where perceived usefulness and perceived ease of use consistently influence the attitudes, intentions, and behaviors of learning technology adoption (Marian et al., 2025; Naveed et al., 2020; Zhao et al., 2024). Habits and facilitating conditions have also been shown to contribute to intentions and actual use of personalized learning systems, confirming the complexity of the factors influencing technology adoption in education. In practice, these results imply the need for a digital media development strategy that integrates technical aspects, content validity, and user psychosocial factors within a coherent, evidence-based framework.

## 5. Conclusion

The study's results confirm that without active acceptance from students and teachers, the technical excellence and validity of digital media content will not maximize learning outcomes. Therefore, the development and implementation of learning technologies must prioritize increasing user acceptance through intensive training, intuitive interfaces, and continuous feedback. The resulting quantitative SEM model provides an adaptive evaluation framework across a variety of cultural contexts, with content and media design tailored to local characteristics. At the policy level, there is a need for guidelines for the procurement and integration of digital media that emphasize ease of use, real learning benefits, and the validity of local cultural content, so that digital interventions are more effective, sustainable, and contextual across regions.

Although it provides important insights, the sampled public high schools representing both urban and rural regions in Riau, and the cross-sectional design, cannot measure long-term impact or objective learning outcomes, such as cognitive/affective test scores. Additional data triangulation is required for more comprehensive validity. Further research should use a longitudinal design, test gamification-based media or VR/AR for immersive experiences, and apply mixed-methods at the junior high school and university levels to enrich understanding of the use of historical digital media.

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