Unity-Based History Hunt: Development and Quasi-Experimental Effects on Elementary Students' Knowledge and Interest

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Abstract: This study employed a Research and Development (R&D) approach using the ADDIE model to develop the History Hunt game and then examined its effectiveness using a quasi-experimental pretest-posttest control-group design. Participants were 87 fourth- and fifth-grade elementary students, assigned to an experimental group (n=44) and a control group (n=43). Data were collected with a 10-item historical knowledge test, a 15-item learning-interest questionnaire, a 10-item usability scale, interviews, and classroom observations. The product achieved 82.04% usability, indicating it is suitable for classroom use. Learning outcomes favored the experimental group: N-Gain=0.725 versus 0.566 in the control ($t(85)=2.39$, $p=0.019$, Cohen's $d=0.513$). Learning interest also rose markedly in the experimental group ($M=60.36$) compared with the control ($M=46.23$; $p<0.001$, Cohen's $d=2.81$). These findings indicate that a Unity-based, location-enabled, game-based learning tool can meaningfully strengthen both historical knowledge and interest in elementary history. Pedagogically, combining game-based learning, location-based tasks, and joyful learning principles offers a feasible, engaging approach for teachers and a replicable development workflow for designers using the ADDIE model.

Abstrak: Penelitian ini menggunakan pendekatan Research and Development (R&D) dengan model ADDIE untuk mengembangkan gim *History Hunt* dan menguji efektivitasnya melalui desain quasi-eksperimen pretest-posttest dengan kelompok kontrol. Partisipan terdiri atas 87 siswa SD kelas 4-5, dibagi menjadi kelompok eksperimen (n=44) dan kontrol (n=43). Data dikumpulkan menggunakan tes pengetahuan sejarah 10 butir, angket minat belajar 15 pernyataan, angket kelayakan/usability 10 butir, wawancara, dan observasi kelas. Produk mencapai rating kelayakan 82,04% (kategori "layak"). Hasil belajar lebih baik pada kelompok eksperimen: N-Gain=0,725 dibanding 0,566 pada kontrol ($t(85)=2,39$; $p=0,019$; Cohen's $d=0,513$). Minat belajar juga meningkat tajam (Rerata=60,36) dibanding kontrol (Rerata=46,23; $p<0,001$; Cohen's $d=2,81$). Temuan ini menunjukkan media pembelajaran berbasis Unity dengan dukungan aktivitas berbasis lokasi efektif memperkuat pengetahuan sekaligus minat belajar sejarah di sekolah dasar. Secara pedagogis, integrasi *game-based learning*, *location-based tasks*, dan prinsip *joyful learning* menawarkan pendekatan yang layak dan menarik bagi guru, serta alur kerja pengembangan yang dapat direplikasi bagi desainer menggunakan model ADDIE.

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A. Introduction

History education occupies a fundamental position in the elementary curriculum as a bridge between past events and students' understanding of cultural heritage and national identity. However, recent studies report a persistent decline in pupils' interest in history and social studies (Balante et al., 2023). Instruction is still dominated by lecture and textbook-based approaches that require memorizing dates and names rather than exploring meanings, which is poorly aligned with the cognitive characteristics of elementary students (Rahmawati et al., 2022). Learners at the concrete operational stage need hands-on, multisensory experiences that connect abstract historical concepts to tangible contexts, but many classrooms remain monotonous and teacher-centred. This situation contrasts with the mandate of the Indonesian National Education System Law No. 20 of 2003 for joyful and meaningful learning. It helps explain why pupils often perceive history as a boring obligation rather than an engaging exploration of human experience (Ryan & Deci, 2020).

Digital technologies, particularly game-based learning, offer promising alternatives for transforming passive history lessons into interactive experiences. Empirical studies show that educational games can increase engagement, motivation, and academic achievement in primary education (Rahmawati et al., 2022; Kalogiannakis et al., 2021; Wardani et al., 2022; Mikrouli et al., 2024). For example, game-based history learning has been found to make instruction more enjoyable, interactive, and collaborative, while augmented-reality games integrated with inquiry-based learning can strengthen pupils' higher-order thinking and self-directed learning (Wen et al., 2023; Sabirli & Coklar, 2020).

Location-based games extend these benefits by combining physical movement with digital interaction. Using GPS technology, these games link virtual content to real-world locations, allowing students to explore their surroundings while completing location-specific tasks. Outdoor educational treasure hunts with smartphones have been shown to improve perceptions, performance, and skill development (Michalakis et al., 2020), and location-based augmented-reality games in primary classrooms can foster key 21st-century competences while keeping pupils actively engaged (Tzortzoglou et al, 2023). In the context of history learning, Balaskas et al (2024) showed that a location-based treasure-hunt game effectively supported exploration of historical points of interest. These designs leverage children's need for movement and concrete experiences while sustaining digital engagement through challenges and immediate feedback.

. Despite this growing body of work, there is still limited Research on the design and evaluation of integrated models that combine game-based learning, location-based experiences, and joyful learning within a single intervention for elementary history. Many previous studies examine these approaches separately and emphasize cognitive outcomes, such as test scores, while paying less attention to affective constructs, including interest and motivation. This gap is critical because pupils' early emotional responses to history strongly shape their long-term engagement with the subject (Ratinho et al., 2025; Balante et al., 2023).

The ADDIE instructional design model provides a systematic framework for addressing these needs through structured analysis, design, development, implementation,

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and evaluation. Recent studies have demonstrated ADDIE's effectiveness for technology-enhanced learning in online, blended, and face-to-face contexts (Spatioti et al., 2022; Shakeel et al., 2023; Chang & Abidin, 2024). In Indonesian primary education, the Treasure Kids Smart (TKS) game-based learning media, developed using an ADDIE-based R&D approach, has been shown to improve numeracy performance and engagement (Salmaa et al., 2024). However, little is known about how to use ADDIE to develop and test a location-enabled history game that simultaneously targets both historical knowledge and learning interest.

The present study addresses this gap by developing a history Hunt. This Unity-based, location-enabled educational game integrates game-based learning, location-based tasks, and joyful learning within a coherent pedagogical framework for elementary history. Players navigate physical or virtual spaces using GPS functionality while completing quizzes, earning points on a leaderboard, and collaborating with peers. Automatic feedback reinforces correct responses and guides misconceptions, supporting both learning effectiveness and motivational engagement.

This Research employs a mixed-methods design that combines Research and Development (R&D) with quasi-experimental evaluation. The R&D component follows the ADDIE model to guide game development from needs analysis to final evaluation. In contrast, the quasi-experimental component uses a pretest-posttest control-group design to compare History Hunt with conventional instruction on students' historical knowledge and interest in learning history. The study is novel in integrating three approaches: game-based learning, location-based learning, and joyful learning within a single Unity-based game that is experimentally evaluated in elementary history education. To the best of our knowledge, no prior work has developed and tested a location-enabled history game that simultaneously targets both knowledge and interest at this level.

Accordingly, the Research has three objectives: (1) to describe the development of the Unity-based History Hunt game using the ADDIE R&D model; (2) to evaluate its feasibility as an interactive learning medium through expert validation and user trials; and (3) to determine its effects on elementary students' historical knowledge and interest in learning history through a quasi-experimental comparison with conventional instruction. Based on these objectives, this study addresses the following research questions: (RQ1) How is the Unity-based History Hunt game developed using the ADDIE R&D model?, (RQ2) To what extent is the Unity-based History Hunt game feasible as an interactive learning medium based on expert validation and user trials?, and (RQ3) What are the effects of the Unity-based History Hunt game on elementary students' historical knowledge and interest in learning history compared to conventional instruction?. Theoretically, the study contributes to educational technology and history education by demonstrating how multiple innovative pedagogical approaches can be synthesized into a coherent design. Practically, it offers a replicable development workflow and a ready to use learning medium that can help teachers make history lessons more engaging for students.

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B. Method

This study employed a mixed-methods research and Development (R&D) design combined with a quasi-experimental pretest-posttest control group. The R&D component followed the ADDIE instructional design model (Analysis, Design, Development, Implementation, Evaluation) to guide the systematic development of the History Hunt game. In contrast, the quasi-experimental component evaluated its effectiveness relative to conventional instruction. The Research was conducted over six weeks in October-November 2025 at a public elementary school in West Java, Indonesia. ADDIE is effective for technology-enhanced learning materials in diverse contexts (Spatioti et al., 2022), and quasi-experimental designs are widely used to evaluate game-based learning interventions in elementary classrooms where random assignment is not feasible (Hodges et al., 2020; Wardani et al., 2022).

Following the ADDIE model, the development process comprises five phases, summarised in Figure 1 and Table 1. In the Analysis phase, we conducted a literature review, teacher interviews, classroom observations, and needs analysis to identify problems in elementary history learning. The Design phase specified the game mechanics (treasure hunt), narrative, user interface, navigation, reward system, historical content, and draft research instruments. During development, these designs were implemented as a Unity-based Android application with GPS-based navigation, a quiz and feedback system, and collaborative features. They underwent expert validation for content and media. The Implementation phase introduced the game in four instructional sessions, during which the experimental class used History Hunt while the control class received conventional instruction; pretests, posttests, and usability questionnaires were administered in this phase. Finally, the Evaluation phase focused on compiling expert validation results, usability data, learning outcomes, and qualitative feedback to assess the game's feasibility and effectiveness.

Table 1. Summary of the Research and Development Procedure Using the ADDIE Model

Phase	Duration	Main Activities	Key Outputs
Analysis	2 weeks	Literature review; teacher interviews (n=2); classroom observations; needs assessment	Identified learning problems and objectives
Design	3 weeks	Game mechanics & narrative; UI/UX & navigation; content selection; reward system; instrument design	Game design document; draft instruments
Development	4 weeks	Unity implementation; GPS integration; quiz & feedback system; collaborative features; expert review	Functional game prototype; expert validation
Implementation	4 weeks	Teacher training; pretest; experimental (game-based) and control (conventional) sessions; posttest; usability survey	Field trial data on knowledge, interest, and usability
Evaluation	2 weeks	Quantitative analysis; qualitative coding; mixed-methods integration; reporting	Feasibility and effectiveness findings

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The quasi-experimental component used a pretest-posttest control-group design, denoted as E: O_1 X O_2 and C: O_3 - O_4, where *E* and *C* denote the experimental and control classes, *O* the pre- and posttests, and *X* the game-based intervention. The experimental group received history instruction using the *History Hunt* game, whereas the control group followed conventional teacher-led instruction with textbooks and discussions.

Participants were 87 fourth and fifth-grade students from a public elementary school in West Java, Indonesia. Using purposive sampling based on intact classes, 44 students were assigned to the experimental group and 43 to the control group. All students were studying Indonesian historical buildings as part of the social studies curriculum and had basic digital literacy skills, as well as access to Android devices and school Wi-Fi, which enabled them to engage meaningfully with the digital game.

Data were collected using three quantitative instruments. A 10-item multiple-choice test of historical knowledge assessed students' understanding of Indonesian historical buildings (architectural features, construction periods, and historical significance). A 15-item15-item learning-interest questionnaire, adapted from Slameto's dimensions of interest (enjoyment, attraction, attention, involvement), measured students' affective orientations toward history on a five-point5-point Likert scale. A 10-item usability questionnaire captured students' perceptions of the game's ease of use, visual appeal, content clarity, and learning value. Content validity for all instruments was reviewed by history and educational technology experts, and internal consistency was examined using KR-20 for the knowledge test and Cronbach's alpha for the questionnaires; detailed reliability results are reported in the Results section.

Qualitative data were gathered through semi-structured interviews and classroom observations. We interviewed two history teachers before and after implementation to explore their experiences with conventional and game-based instruction. In addition, ten students from the experimental group were selected using maximum variation sampling (high, moderate, and low N-Gain profiles) to capture diverse perspectives on game use. Structured observation sheets were used in all sessions for both groups to document teacher activities, student participation, peer interaction, and classroom atmosphere, providing contextual information beyond test and questionnaire scores.

Quantitative data analysis included descriptive statistics (means, standard deviations, minimum and maximum scores) and measures of learning gain. Normalised gain (N-Gain) was calculated using Hake (1998) formula and categorised as low (<0.30), moderate (0.30-0.70), or high (>0.70). Prior to hypothesis testing, we examined normality (Shapiro-Wilk) and homogeneity of variances (Levene's test). When assumptions were met, independent-samples *t*-tests were used to compare knowledge gains and total interest scores between the experimental and control groups at $\alpha = 0.05$.

To complement statistical significance, effect sizes were calculated using Cohen's *d* and interpreted as small (<0.30), medium (0.30-0.80), or large (>0.80). The feasibility of the *History Hunt* game was evaluated by converting mean usability ratings into percentage

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scores relative to the maximum possible score, which were then classified as unsuitable (<50%), moderately suitable (50-70%), suitable (70-85%), or highly suitable (>85%).

Interview transcripts and observation notes were analyzed thematically following Braun & Clarke (2021) reflexive thematic analysis approach. This six-phase process, familiarisation with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report, was applied inductively to identify themes related to student engagement, learning experiences, and perceptions of the game.

All quantitative analyses were conducted using PSPP (GNU Project Statistical Package). A 95% confidence level ($\alpha = 0.05$) was applied in all hypothesis tests. The study unfolded over six weeks: week 1 for preparation and pretests, weeks 2-5 for four instructional sessions in each group, and week 6 for posttests and questionnaires, integrated into the regular social studies schedule.

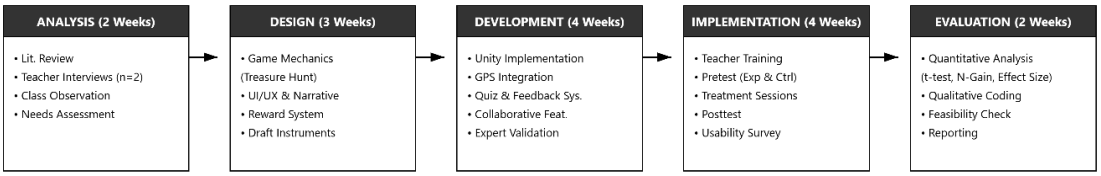

Figure 1. Research & Development flow of the History Hunt Location-Based History Educational Game (ADDIE model)

C. Result

The Development of History Hunt Game Using the ADDIE Model

The Research produced an educational game titled History Hunt, developed using the Unity game engine with integrated joyful learning approaches. Development followed the ADDIE instructional design model systematically through five distinct phases. The Analysis phase identified low student interest in history learning as the primary problem, attributed to monotonous conventional teaching methods. Pre-implementation interviews with two fourth-grade history teachers revealed consistent patterns in student disengagement. One teacher explained, "*Children tend to get bored when lessons only involve lectures and textbooks. They prefer learning activities that include physical movement.*" This finding confirmed that students perceived history lessons as mere memorisation exercises focused on memorising names and construction dates, without opportunities for direct experience or meaningful engagement.

The Design phase produced a comprehensive game blueprint incorporating location-based mechanics and treasure-hunt concepts. The design integrated historical content about four Indonesian heritage buildings: Borobudur Temple, Prambanan Temple, Gedung Sate Bandung, and Museum Fatahillah Jakarta. Design outputs included detailed game storyboards, user-friendly interface mockups, reward systems with points and badges, and collaborative features to support group learning. The Development phase transformed these designs into a functional Android application with five core features: GPS-based navigation enabling treasure-hunt mechanics, interactive quizzes presenting

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historical information and comprehension questions, a leaderboard system displaying player rankings, collaborative functionality allowing group gameplay, and automatic feedback mechanisms providing immediate responses to student answers. Before implementation, the completed product underwent validation by subject-matter experts specializing in history content and by educational media specialists focusing on pedagogical appropriateness.

To complement this narrative description, the main objectives, outputs, expert validation, and revisions in each ADDIE phase are summarised in Table 2.

Table 2. Summary of the ADDIE-Based Development of the History Hunt Game

Phase	Duration	Main Activities	Key Outputs
Analysis	2 weeks	Literature review; teacher interviews (n=2); classroom observations; needs assessment	Identified learning problems and objectives
Design	3 weeks	Game mechanics & narrative; UI/UX & navigation; content selection; reward system; instrument design	Game design document; draft instruments
Development	4 weeks	Unity implementation; GPS integration; quiz & feedback system; collaborative features; expert review	Functional game prototype; expert validation
Implementation	4 weeks	Teacher training; pretest; experimental (game-based) and control (conventional) sessions; posttest; usability survey	Field trial data on knowledge, interest, and usability
Evaluation	2 weeks	Quantitative analysis; qualitative coding; mixed-methods integration; reporting	Feasibility and effectiveness findings

Prior to classroom implementation, the prototype was evaluated by content and media experts using a 4-point rubric. Their ratings indicated that both the historical content and the technical-pedagogical quality of the game met the minimum criteria for classroom use, as summarised in Table 3.

Table 3. Expert Validation of the History Hunt Game

Expert Group / Aspect	Number of Items	Number of Experts	Mean Score (1-5)	Percentage of Maximum	Category
Media (Visual & Technical)	8	3	4.50	90.0%	Highly Feasible
Content (Historical)	7	3	4.48	89.6%	Highly Feasible
Pedagogical / Learning	7	3	4.57	91.4%	Highly Feasible

Feasibility of History Hunt as Learning Media

Game feasibility was measured through usability questionnaires completed by 44 students in the experimental group after instructional implementation. The questionnaire contained 10 statements assessing ease of use, visual appeal, content clarity, and educational

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value, each rated on a five-point Likert scale, yielding a maximum possible score of 50. Table 4 presents feasibility assessment results.

Table 4. Feasibility Assessment Results for History Hunt Game

Assessment Aspect	N	Mean	SD	Min	Max	Percentage	Category
Total Game Score	44	41.02	3.64	34	49	82.04%	Suitable

Table 4 shows that History Hunt obtained a mean score of 41.02 out of 50, with a standard deviation of 3.64. Feasibility percentage calculations using equation (3) yielded 82.04%, which falls within the suitable range (70-85%). The relatively small standard deviation (3.64) indicates high consistency in student ratings, suggesting that most students held uniformly positive perceptions of the game. The minimum and maximum scores of 34 and 49, respectively, demonstrate that no students provided negative assessments, and the narrow score range indicates stable game quality in delivering positive learning experiences across diverse student characteristics.

Table 5. Usability Ratings of History Hunt by Aspect (n = 44)

Aspect	Mean (1-5)	SD	Percentage	Category
Ease of use	4.20	0.55	84.0%	Very Feasible
Visual appearance	4.18	0.61	83.6%	Very Feasible
Content clarity	4.05	0.58	81.0%	Feasible
Learning value	4.02	0.65	80.4%	Feasible
Engagement/enjoyment	4.06	0.60	81.2%	Feasible
Overall	4.10	0.36	82.04%	Very Feasible

These results indicate that students perceived the game as easy to use and visually appealing, with explicit content and good learning value; all usability aspects were rated in the "feasible" to "very feasible" range, with overall usability reaching 82.04%.

Instrument Validity and Reliability

Content validity of all instruments was established through expert judgment. History and educational technology experts confirmed that each test and questionnaire item was aligned with the learning objectives and appropriate for fourth and fifth-grade students, so all items were retained for data collection. Item-total correlation analysis showed that every item exceeded the minimum validity coefficient specified by the researchers.

Internal consistency reliability was adequate to strong for all instruments (Table 6). The historical knowledge test achieved a KR-20 coefficient of 0.78, indicating acceptable reliability for group comparisons. The learning interest questionnaire and the usability scale had Cronbach's alpha values of 0.86 and 0.82, respectively, both within the good reliability range.

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Table 6. Reliability Coefficients of the Study Instruments

Instrument	Number of items	Reliability index	Coefficient	Category
Historical knowledge test	10	KR-20	0.78	Acceptable
Learning-interest questionnaire	15	Cronbach's alpha	0.86	Good
Usability questionnaire	10	Cronbach's alpha	0.82	Good

Game Effectiveness on Historical Knowledge Enhancement

History Hunt's effectiveness in improving students' historical knowledge was analyzed by comparing gain scores between experimental and control groups. Gain scores represented the difference between posttest and pretest scores, indicating the magnitude of knowledge improvement following instruction. Table 7 presents descriptive statistics for the gain scores of both groups.

Table 7. Descriptive Statistics for Gain Scores and N-Gain Values

Variable	Group	N	Mean	SD	Min	Max
Gain Score	Experimental	44	50.45	16.13	20	80
	Control	43	41.63	18.25	0	70
N-Gain	Experimental	44	0.725	0.172	-	-
	Control	43	0.566	0.223	-	-

Table 7 shows that the experimental group achieved a mean gain score of 50.45 (SD = 16.13), while the control group achieved a mean of 41.63 (SD = 18.25). The mean difference of 8.83 points indicates that the experimental group achieved greater improvement in knowledge than the control group. The experimental group's lower standard deviation indicates that History Hunt enhanced knowledge more consistently across all students than conventional instruction, which produced greater outcome variability.

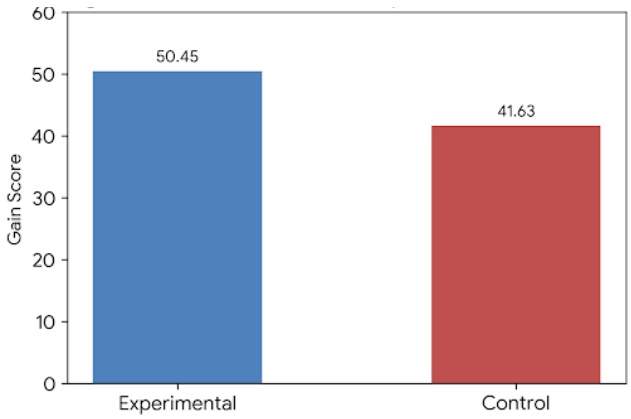

Figure 2. Mean Gain Scores

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Normalized gain (N-Gain) analysis showed the experimental group reached an N-Gain of 0.725, classified as high (N-Gain > 0.7), whereas the control group achieved only 0.566, classified as moderate (0.3 ≤ N-Gain ≤ 0.7). The experimental group's high N-Gain value demonstrates that History Hunt effectively maximized students' potential for knowledge improvement, with 72.5% of the maximum possible improvement achieved. The superiority of the experimental group is also evident in the graphical comparisons. Figure 2 shows that the experimental class obtained a higher mean gain score (50.45) than the control class (41.63).

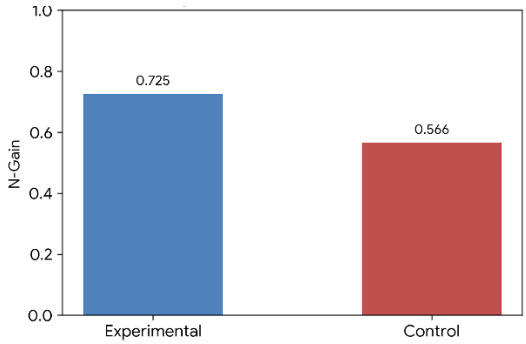

Figure 3. Mean N-Gain Values

Similarly, Figure 3 illustrates that the mean N-Gain of the experimental group (0.725, high category) clearly exceeds that of the control group (0.566, moderate category). To provide a more detailed picture of learning gains, Table 8 presents the distribution of students across the Hake N-Gain categories (low, moderate, high).

Table 8. Descriptive Statistics for Gain Scores and N-Gain Values

Group	High (N-Gain > 0.70)	Moderate (0.30-0.70)	Low (N-Gain < 0.30)
Experimental (n = 44)	26 students (59.1%)	18 students (40.9%)	0 students (0.0%)
Control (n = 43)	8 students (18.6%)	32 students (74.4%)	3 students (7.0%)

Most students in the experimental group fell into the high and moderate N-Gain categories. In contrast, the control group had a larger proportion of students with only moderate or low N-Gain. This pattern confirms that the game helped more students achieve greater improvement than conventional instruction.

Before hypothesis testing, prerequisite analyses, including normality and homogeneity tests, were conducted. Table 9 presents the results of Levene's Test for homogeneity of variances.

Table 9. Variance Homogeneity Test Results

Variable	F	Sig.	Conclusion
Gain Score	0.66	0.418	Homogeneous
Total Interest	0.84	0.362	Homogeneous

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Table 9 shows all variables with significance values exceeding 0.05, indicating homogeneous data variance between the two groups and meeting the assumptions for Independent Samples t-test procedures. Table 10 presents the results of the independent-samples t-test for gain scores.

Table 10. Hypothesis Test Results for Gain Scores

Variable	t	df	Sig.(2-tailed)	Mean Diff	95% CI	Conclusion
Gain Score	2.39	85	0.019	8.83	[1.49- 16.16]	H_0 rejected

Based on Table 10, the analysis yielded t(85) = 2.39, p = 0.019 (< 0.05), indicating significant differences in gain scores between the experimental and control groups. This result indicates that H_0 was rejected and H_1 accepted, suggesting that History Hunt usage significantly influenced elementary students' improvement in historical knowledge. The mean difference of 8.83 points, with a 95% confidence interval of 1.49 to 16.16, indicates that knowledge improvement in the experimental group consistently exceeded that in the control group. Cohen's d effect size calculation yielded a value of 0.513, classified as medium ($0.3 \leq d \leq 0.8$), indicating that History Hunt had a substantial practical impact on student knowledge enhancement.

Observational data revealed that students in the experimental group demonstrated high enthusiasm when using the game, with active participation rates reaching 94.8% across four instructional sessions. Interview data showed that students retained the historical building information learned through the game effectively, including locations, construction periods, and the historical functions of each building.

Game Effectiveness on Learning Interest Enhancement

History Hunt's effectiveness in increasing students' learning interest was analyzed by comparing interest questionnaire scores between the experimental and control groups. The interest questionnaire comprised 15 statements on a five-point Likert scale, yielding a maximum possible score of 75. Table 5 presents descriptive statistics for the learning interests of both groups.

Table 11. Descriptive Statistics for History Learning Interest

Group	N	Mean	SD	Min	Max
Eksperimental	44	60.36	3.91	53	69
Control	43	46.23	5.88	38	67

Table 11 shows that the experimental group had a mean learning interest score of 60.36 (SD = 3.91), while the control group had a mean of 46.23 (SD = 5.88). The substantial mean difference of 14.13 points indicates that students who learned with History Hunt had considerably higher interest in history learning than students receiving conventional instruction. The experimental group's much lower standard deviation (3.91) compared to

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the control group's (5.88) indicates that History Hunt consistently enhanced learning interest across all students rather than benefiting only specific student subgroups.

The difference in total interest scores is visualized in Figure 4, which shows that the experimental class achieved a much higher mean score (60.36) than the control class (46.23).

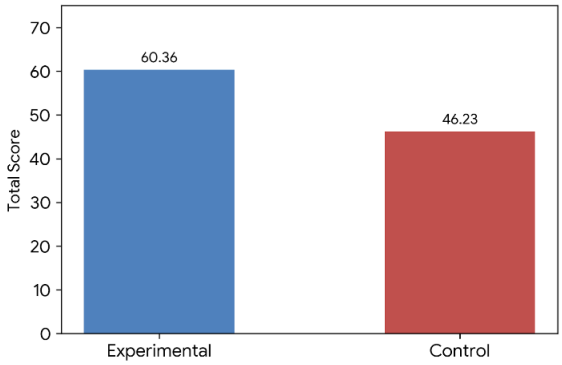

Figure 4. Total Learning Interest Scores

Following the development overview illustrated in Figure 4, the next step focuses on assessing the feasibility of the Unity-based History Hunt game as an interactive learning medium. Therefore, Table 12 presents the expert validation results, including evaluations of content accuracy, design quality, usability, and instructional relevance, which serve as an initial basis for improvement and implementation.

Table 12. History Learning Interest by Dimension

Dimension	Group	Mean	SD
Enjoyment	Experimental (n = 44)	15.80	1.20
	Control (n = 43)	11.10	1.80
Attention	Experimental (n = 44)	14.50	1.15
	Control (n = 43)	11.50	1.95
Involvement	Experimental (n = 44)	14.90	1.30
	Control (n = 43)	11.20	1.85
Attraction	Experimental (n = 44)	15.16	1.25
	Control (n = 43)	12.43	1.90

Analysis at the dimension level shows a consistent pattern. For all four dimensions, enjoyment, attention, involvement, and attraction, the experimental group obtained higher mean scores than the control group, with differences of approximately 3-4 points on each dimension. This indicates that History Hunt not only increased students' overall interest in history but also made them enjoy the lessons more, pay closer attention, participate more actively, and feel more drawn to history topics.

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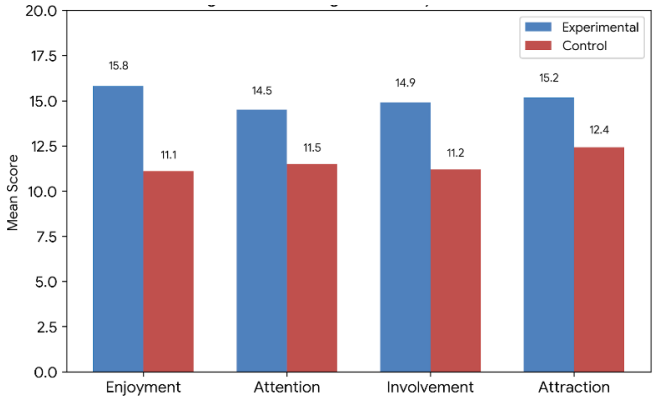

Figure 5. Learning Interest by Dimension

Following the implementation results illustrated in Figure 5, the next analysis focuses on evaluating the feasibility of the Unity-based History Hunt game through user-based trials. Therefore, Table 13 presents the trial results, highlighting students' responses, usability aspects, engagement levels, and overall practicality as an interactive learning medium in elementary history learning.

Table 13. Hypothesis Test Results for Learning Interest

Variable	t	df	Sig. (2-tailed)	Mean Diff	95% CI	Conclusion
Total Interest	13.23	85	0.000	14.13	[12.01 - 16.26]	H_0 rejected

Based on Table 13, the analysis yielded $t(85) = 13.23$, with $p < 0.001$, indicating highly significant differences in learning interest between the experimental and control groups. The minimal p-value ($p < 0.001$) indicates very high confidence that the observed differences were due to the intervention rather than chance. The mean difference of 14.13 points, with a 95% confidence interval ranging from 12.01 to 16.26, demonstrates that learning interest improvement in the experimental group consistently and substantially exceeded that in the control group.

Cohen's d effect size calculation yielded a value of 2.81, indicating a huge effect ($d > 0.8$). This large effect size represents a remarkable finding in educational Research, indicating that History Hunt had a powerful, practically significant impact on elementary students' interest in history.

Analysis of Interviews and Observations

Table 14. Qualitative Themes from Interviews and Classroom Observation

Theme	Description	Example Evidence
Increased student enthusiasm	Students demonstrated greater excitement and anticipation before history lessons when using the History Hunt game.	A teacher reported that students who previously complained about history began requesting to play the game.

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Theme	Description	Example Evidence
History is a more enjoyable learning experience.	Pupils perceived history as easier and more enjoyable when presented through treasure-hunt mechanics and location-based exploration.	A student noted that "history became easy and fun because we walked around looking for treasure and earned points."
Consistent active participation	High levels of participation and focus were sustained throughout all four game-based sessions, whereas engagement declined in the control class.	Observation records indicated 94.8% participation in the experimental class, compared to 70.4% in the control class.

Triangulation between interview and observation data revealed three major themes regarding student learning interest enhancement through history Hunt game-based learning. Qualitative data thus corroborate the quantitative findings: History Hunt increased students' enthusiasm, made history lessons more enjoyable, and maintained consistently high levels of active participation throughout the four game-based sessions.

In summary, the findings show that the three research objectives were achieved. First, the History Hunt game was successfully developed using the ADDIE model into a Unity-based, location-enabled educational product that integrates game-based and joyful learning principles. Second, expert validation and student usability ratings (82.04% in the "suitable" to "very feasible" range) indicate that the game is feasible and appropriate for elementary classroom use. Third, the quasi-experimental analysis demonstrates that History Hunt is efficacious in improving both historical knowledge (higher gain scores and N-Gain, medium effect size d = 0.513) and learning interest (very large effect size d = 2.81) compared with conventional instruction.

D. Discussion

This section discusses the three research questions: (RQ1) how the History Hunt game was developed with the ADDIE model; (RQ2) how feasible the game is as a learning medium; and (RQ3) how effective it is in improving elementary students' historical knowledge and interest in learning history.

The findings show that the ADDIE model provided a clear structure for transforming needs analysis into a Unity-based, location-enabled game that integrates game-based and joyful learning for elementary history. The phased analysis, design, development, implementation, and evaluation align with recent work that uses ADDIE to guide the development of technology-enhanced learning materials in distance, blended, and classroom contexts (Spatioti et al., 2022; Shakeel et al., 2023; Chang & Abidin, 2024). In the Indonesian context, this systematic process is important because history learning is still dominated by lecture- and textbook-based approaches; for example, the ADDIE-based Treasure Kids Smart game successfully improved primary students' numeracy performance and engagement (Salmaa et al., 2024). History Hunt extends this line of Research by embedding content on national heritage buildings into treasure-hunt mechanics and

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location-based tasks, ensuring that learning objectives, game rules, and the concrete-operational characteristics of elementary students are aligned.

Expert validation ratings around 90% ("highly feasible") and student usability scores of 82.04% ("suitable") indicate that History Hunt meets both pedagogical and technical requirements for classroom implementation. The relatively small standard deviation in usability scores suggests that the interface is accessible for students with diverse ability and interest profiles. Similar feasibility patterns are reported in recent outdoor and location-based educational games, where intuitive navigation, simple visual design, and clear instructions lead to positive perceptions and sustained use (Michalakis et al., 2020; Tzortzoglou et al., 2023; Balaskas et al., 2024). From the perspective of cognitive load theory, the design of History Hunt appears to minimize extraneous load through uncluttered screens, short textual explanations, and straightforward controls while promoting germane load as students integrate visual information, location clues, and quiz feedback into coherent knowledge about each building (Paas & van Merriënboer, 2020). Cognitive-load-oriented guidelines emphasize this combination of reducing unnecessary demands and structuring tasks to support schema construction, particularly when digital technology is used in authentic classroom settings (Paas & van Merriënboer, 2020; Thai et al., 2020).

Quantitatively, the experimental group's N Gain of 0.725 (high category) versus 0.566 (moderate) in the control group, together with a medium effect size (d = 0.513), indicates that History Hunt produces more substantial and more consistent gains in historical knowledge than conventional instruction. This pattern is consistent with previous studies indicating that digital game-based and AR-enhanced history or social studies learning generally yields small-to-medium improvements in test performance compared with traditional approaches (Rahmawati et al., 2022; Sabirli & Coklar, 2020; Wen et al., 2023). Location-based treasure-hunt games, in particular, have helped learners explore historical points of interest by combining movement, exploration, and content review (Michalakis et al., 2020; Balaskas et al., 2024). In history, Hunt, GPS-based navigation makes abstract historical information spatially meaningful, while short challenges and immediate corrective feedback help students monitor their understanding and distribute their mental effort over manageable units. These features align with cognitive-load theory findings that chunked tasks and frequent feedback enhance learning because they allow working-memory resources to be devoted to productive (germane) rather than unproductive (extraneous) cognitive load (Paas & van Merriënboer, 2020).

The effect on learning interest is even more striking: students in the experimental group reported substantially higher total interest scores than those in the control group, with a considerable effect size (d = 2.81) and consistent gains across enjoyment, attention, involvement, and attraction. Although game-based learning is widely associated with motivational benefits, systematic reviews usually report more moderate effects (Kalogiannakis et al., 2021; Mikrouli et al., 2024). The magnitude observed in this study can be interpreted using self-determination theory and recent gamification research. According to self-determination theory, intrinsic motivation flourishes when learning environments

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support autonomy, competence, and relatedness (Ryan & Deci, 2020; Mula et al., 2025). In history Hunt, autonomy is fostered through choices of path and strategy in the treasure hunt; competence is supported by optimally challenging questions, clear goals, and visible progress via points and badges; and relatedness is nurtured through collaborative play and shared exploration. Systematic reviews of gamification in education emphasize that elements such as points, leaderboards, rewards, and challenges tend to increase learners' motivation and participation when meaningfully tied to learning activities rather than used as superficial "pointsification" (Kalogiannakis et al., 2021). The substantial, stable increases in interest observed here suggest that students perceived the reward-challenge-feedback loop in History Hunt as integral to learning history rather than an add-on.

Qualitative findings help explain how these motivational mechanisms operated in practice. Teachers reported a clear shift from complaints that history lessons were boring to enthusiastic requests to play the game. At the same time, classroom observations documented participation rates above 90% throughout the four game-based sessions. Such sustained engagement indicates that the game did not merely generate a short-term novelty effect but provided a learning experience that students found continually enjoyable and worthwhile. Prior research underlines that early affective responses to school subjects have long-term implications for persistence and achievement (Ratinho et al., 2025). By framing history learning as an adventure involving movement, discovery, and cooperation, History Hunt appears to reshape students' emotional relationship with the subject, potentially supporting future engagement.

Situated within the broader educational and cultural context, these findings show how a Unity-based, location-enabled game can make Indonesian heritage more concrete and personally meaningful for elementary students. Many pupils previously encountered historical buildings only as static images in textbooks; in History Hunt, Borobudur, Prambanan, Gedung Sate, and Museum Fatahillah become interactive "stations" that must be visited (physically or virtually), discussed, and reflected upon. International studies of outdoor and location-based learning similarly report that combining movement, real-world places, and narrative tasks can enhance students' perceptions, engagement, and skill development (Boaventura et al., 2021; Michalakis et al., 2020; Tzortzoglou et al., 2023). In this sense, History Hunt not only improves test scores and interest but also supports the Indonesian curriculum's mandate for joyful, meaningful, and culturally rooted learning experiences.

E. Implication

This Research contributes to the instructional design literature by providing empirical evidence that the ADDIE model is effective in orchestrating complex pedagogical combinations, specifically game-based, location-based, and joyful learning into a coherent history learning experience. Theoretically, this study strengthens the premise of *Joyful Learning* in elementary education; it demonstrates that when history instruction is designed to satisfy students' intrinsic need for movement and play (via location-based mechanics), it

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generates a "motivational bridge" that significantly enhances cognitive retention, as evidenced by the correlation between high interest and knowledge gains in this study.

For practitioners, particularly elementary school history teachers, *History Hunt* offers a proven alternative to lecture-based instruction. Teachers are guided to utilize this application not merely as an entertainment interlude, but as a structured outdoor inquiry activity that transforms the school environment into a learning resource. In practice, educators can replicate this approach by integrating simple GPS-based tasks to visualize abstract historical concepts, ensuring students are active navigators rather than passive listeners. The high usability score (82.04%) confirms that teachers with basic digital literacy can implement this without needing specialized technical support.

At the policy level, these findings underscore the urgency of integrating Information and Communication Technology (ICT) into the elementary school curriculum. The study provides data-driven arguments for school policymakers to support "Bring Your Own Device" (BYOD) or school-tablet initiatives for social studies, dispelling the myth that mobile devices are mere distractions for young learners. Consequently, curriculum developers should consider incorporating location-based digital activities into the national history syllabus to foster a stronger national identity and historical awareness from an early age.

F. Limitation and Suggestion for Further Research

This study has several limitations. First, the use of a quasi-experimental design with intact classes introduces potential sampling bias that randomized trials would mitigate. Second, reliance on mid-range Android devices introduces technical limitations that can affect GPS stability and the user experience. Third, the six-week intervention period provides limited evidence regarding long-term knowledge retention. Fourth, assessments focused exclusively on factual knowledge rather than higher-order historical thinking skills. Future Research should address these constraints through randomized controlled trials (RCTs) conducted across multiple schools (cross-school analysis) to enhance external validity. Additionally, future development could integrate Augmented Reality (AR) or Virtual Reality (VR) technologies to provide more immersive historical visualization. Finally, further studies should employ assessments targeting critical thinking skills and examine the cost-effectiveness of such interventions.

G. Conclusion

This study had three objectives: (1) to develop the Unity-based History Hunt game using the ADDIE model, (2) to evaluate its feasibility as an interactive learning medium, and (3) to examine its effects on elementary students' historical knowledge and interest in learning history. All three objectives were achieved. The Research successfully produced a Unity-based, location-enabled educational game that systematically integrates game-based learning, location-based tasks, and joyful learning principles. Expert validation and student usability ratings classified History Hunt in the "suitable" to "highly feasible" range for elementary classroom use. At the same time, the quasi-experimental comparison showed

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that students who used the game achieved greater improvements in historical knowledge and much higher learning interest than those who received conventional instruction.

Taken together, these findings indicate that a well-designed educational game that simultaneously targets cognitive (knowledge) and affective (interest) outcomes can effectively address persistent problems of low engagement in elementary history education. For teachers, History Hunt offers a ready-to-use platform for joyful, meaningful history learning that encourages active participation rather than rote memorization. For educational technology designers, the study demonstrates how the ADDIE framework can be used to integrate game-based, location-based, and joyful learning into a coherent product that fits real classroom constraints, providing a replicable model for developing similar interventions in other subjects and contexts.

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