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Enhancing Historical Learning Outcomes: A Virtual Tour with Google Earth and YouTube in Indonesian Vocational Schools

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ABSTRACT

This quasi-experimental study investigates the impact of a digital virtual tour, integrating Google Earth and YouTube, on the history learning outcomes of vocational high school (SMK) students in Indonesia. Addressing the common challenges of low student interest and abstract historical concepts, the intervention provided an immersive, context-rich learning experience. The research involved an experimental group (n=32) using the virtual tour and a control group (n=32) with conventional instruction. Results from pretest-posttest analyses show a significantly higher improvement in the experimental group, with an N-Gain score of 0.69 (moderate effectiveness) compared to 0.22 (low effectiveness) in the control group. Simple linear regression analysis confirmed a positive and significant influence (sig. <0.001), with the model explaining 81.2% of the variance in learning outcomes. The findings demonstrate that this integrated digital media approach is an effective and innovative pedagogical tool for making history more tangible and improving student achievement in vocational education contexts.

KEYWORDS

Virtual Tour; History Education; Digital Media; Learning Outcomes; Vocational School

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ABSTRAK

Penelitian kuasi-eksperimen ini menguji dampak tur virtual digital yang mengintegrasikan Google Earth dan YouTube terhadap hasil belajar sejarah siswa Sekolah Menengah Kejuruan (SMK) di Indonesia. Menjawab tantangan umum berupa rendahnya minat siswa dan konsep sejarah yang abstrak, intervensi ini menyediakan pengalaman belajar imersif dan kaya konteks. Penelitian melibatkan kelompok eksperimen (n=32) yang menggunakan tur virtual dan kelompok kontrol (n=32) dengan pembelajaran konvensional. Hasil analisis pretest-posttest menunjukkan peningkatan yang jauh lebih tinggi pada kelompok eksperimen, dengan skor N-Gain 0,69 (efektivitas sedang) dibandingkan 0,22 (efektivitas rendah) pada kelompok kontrol. Analisis regresi linier sederhana mengonfirmasi pengaruh positif dan signifikan (sig. <0,001), dengan model menjelaskan 81,2% varians hasil belajar. Temuan ini membuktikan bahwa pendekatan media digital terintegrasi merupakan alat pedagogis inovatif yang efektif untuk membuat sejarah lebih nyata dan meningkatkan prestasi siswa dalam konteks pendidikan kejuruan.

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Introduction

Contemporary adolescents are ubiquitously immersed in digital technology, with smartphones becoming an inextricable part of daily life due to globalization (Haddock et al., 2022). This technological shift offers unparalleled convenience and rapid access to information. In educational contexts, this presents a significant opportunity; when used judiciously, technology can greatly benefit students' learning processes. The rapid advancement of digital tools has led to the widespread adoption of technology-based learning media, which are crucial for supporting successful instructional delivery (Bernacki et al., 2020). Educators have begun to harness this sophistication, notably through the integration of smartphones into pedagogy (Ubben et al., 2023). These devices allow students to easily and quickly access various educational applications and content, including via social media platforms. Such technological capabilities can broaden students' perspectives, freeing them from an over-reliance on traditional textbooks (Hartley et al., 2023).

History education in schools serves a vital function in fostering nationalism and character development. Cultivating a sense of nationalism is essential, as the values taught through history can help prevent national disintegration (Gómez-Carrasco et al., 2022). Furthermore, history learning contributes to character building, aiming to create a younger generation that loves its homeland and possesses noble personalities (Luís & Rapanta, 2020). Character is a critical element that must be instilled in every student, enabling them to become active participants in societal life and national development (Gómez-Carrasco et al., 2022). As noted (Durrani et al., 2021)), national character formation is an alternative strategy for realizing a generation capable of fully understanding its national identity. Consequently, history is an important and compulsory subject in senior high schools (SMA/SMK).

Despite its importance, in practice, students often demonstrate low interest in learning history, resulting in poor mastery of historical material. Preliminary interviews conducted by the researcher with several Grade XI students at SMK Negeri 1 Kedung on October 2nd revealed that vocational (SMK) students find history difficult and unengaging. This lack of interest necessitates pedagogical solutions. One established method to foster enthusiasm and improve competency is conducting visits to historical sites. (Badger, 2021) assert that direct visits to historical locations are highly effective for understanding historical material. While effective for boosting interest, such field trips require substantial funding and time, often making them logistically impractical for effective and frequent classroom implementation.

Learning media are essential for facilitating and simplifying the instructional process (Detyna & Kadiri, 2020). Their use can attract and focus student attention. Among current developments in learning media is the virtual tour. Modern information technology can now visually replicate the conditions of specific locations via the internet. Applications like Google Earth allow users to view the layout and setting of desired places, including historical sites. This technological advancement enables virtual visits to historical locations (Hagge, 2021). Google Earth is an application that displays images and conditions of specific locations in three-dimensional form. Its "Street View" feature allows users to virtually explore locations, even internationally, providing a realistic sense of the environment (Hagge, 2021). Through Google Earth, students can visually examine historical sites and form a mental image of the historical events that transpired there.

Prior research by (Hamilton et al., 2021) indicates that using Google Earth-based virtual tour media can improve student learning outcomes in history. Virtual tours using Google Earth can aid students in comprehending historical material. However, a limitation is that it primarily displays images showing location conditions. To fully understand historical events, supplementary information about the events themselves is required. Therefore, innovation is needed to optimize virtual tours for history learning.

One of Google's most popular applications currently is YouTube (Shoufan & Mohamed, 2022) accessed by a wide demographic. The ease of accessing and uploading video content online contributes to its extensive user base. YouTube can be utilized as a history learning medium by creating videos that depict historical events accompanied by narrated explanations. Research by (Azor et al., 2020). demonstrates that YouTube can effectively enhance students' understanding of subject matter, aligning with desired learning objectives.

Integrating virtual tours using Google Earth and YouTube is hypothesized to increase student interest in learning history. Such an integrated virtual experience is expected to motivate students to engage more deeply with the historical learning process. Additionally, it allows for self-paced, independent exploration and review, enabling students to solidify their understanding of historical material. Consequently, research into the application of virtual tours based on Google Earth and YouTube is warranted. This specific media combination has not been extensively tested for its efficacy in improving student learning outcomes in history. This gap in the literature motivates the present study to investigate the impact of this integrated virtual tour approach on history education.

Research Questions

1. Is the implementation of a Google Earth and YouTube-based virtual tour effective in improving students' history learning outcomes compared to conventional learning methods?
2. How does the virtual tour influence student interest and attention during the history learning process?
3. What factors support or hinder the effectiveness of implementing a virtual tour in history learning at school?

Literature Review

The Digital Context and Pedagogical Challenges in History Education

Contemporary history education operates within a rapidly evolving digital landscape where students are profoundly influenced by technology and globalization (Timotheou et al., 2023). Adolescents are now deeply immersed in a digital ecosystem, with smartphones and gadgets becoming inseparable from their daily lives, shaping their social interactions and information consumption habits (Bernacki et al., 2020). This shift presents both a challenge and an opportunity for educators. While technology offers unprecedented access to information, traditional history pedagogy often struggles with student disinterest and low motivation, leading to suboptimal learning outcomes (J. Wang et al., 2023). The central challenge lies in transforming passive learning into an active, engaging process (Malysheva et al., 2022). Consequently, there is a pressing need to

leverage the very digital tools that captivate student attention—such as smartphones and popular platforms—and repurpose them for meaningful educational ends, moving beyond textbook-centric instruction to foster a more relevant and captivating learning experience (Malysheva et al., 2022).

The Centrality of Learning Media, Interest, and Motivation

Extensive research underscores the critical role of instructional media and student interest as direct determinants of learning success. Effective learning media are not merely supplementary tools but fundamental components that can attract, focus, and sustain student attention, thereby facilitating the comprehension of complex material (Abdulahman et al., 2020). The literature consistently demonstrates a strong, positive correlation between the use of engaging, well-designed media and improvements in student learning outcomes and motivation (Timotheou et al., 2023; Yorganci, 2022). When material is presented in an attractive and interactive manner, it can significantly boost intrinsic motivation, transforming student posture from passive recipients to active participants in the learning journey (Martin, 2023; Ribosa & Duran, 2022). This is particularly vital in history education, where fostering a personal connection to past narratives is essential for deep understanding and retention.

Technology-Enhanced Learning Media in History

In response to these pedagogical needs, educators and researchers have explored various technology-enhanced media to revitalize history instruction. The development of digital tools ranges from Android-based applications and educational games to more immersive simulation platforms (Bernacki et al., 2020; Timotheou et al., 2023). Among these, virtual tours and simulations have gained prominence for their ability to transcend physical and temporal limitations, allowing students to "visit" historical sites and contextualize events without logistical constraints (Hagge, 2021; Huang et al., 2023). Platforms like Google Earth offer powerful spatial visualization, enabling detailed exploration of geographic contexts, while YouTube serves as a vast repository for explanatory audiovisual content that can enrich narrative understanding (Hagge, 2021; Mayer, 2024). These tools align with the cognitive theory of multimedia learning, suggesting that combining visual and auditory information can enhance encoding and recall.

History Education for Character and Nationalism Building

Beyond knowledge acquisition, history education in the Indonesian context is explicitly charged with the moral and civic development of students. A substantial body of literature highlights its mandated role in cultivating nationalistic values, historical consciousness, and ethical character (Gómez-Carrasco et al., 2022). Learning history is viewed as a strategic endeavor to strengthen national identity, prevent societal disintegration, and inspire active citizenship among the younger generation (Carroll & Littlejohn, 2022; Sung, 2020). The effective communication of historical narratives, especially those concerning national struggle and founding figures, is therefore paramount. Innovative media are seen as vital for making these values tangible and resonant, moving beyond rote memorization of dates to foster genuine emotional and intellectual connection with the nation's past, thereby achieving the higher-order goals of the history curriculum.

Empirical Evidence on Efficacy and Learning Outcomes

Empirical studies provide growing evidence for the efficacy of specific digital interventions in history classrooms. Research indicates that methodologies like outdoor study and historical site visits, when feasible, positively impact learning outcomes by providing concrete, experiential encounters with the past (Arcodia et al., 2021; Hagge, 2021). In the digital realm, studies on game-based learning, Android applications, and virtual simulations report measurable improvements in student interest, engagement, and test scores (Timotheou et al., 2023). Importantly, media that incorporate audiovisual elements and allow for interactive exploration have been shown to enhance memory retention and conceptual understanding more effectively than traditional text-based methods (Lawson & Mayer, 2022). This is often linked to cognitive theories positing that multisensory engagement and repeated practice strengthen memory pathways (Fiorella & Mayer, 2016).

Methodological Frameworks and Implementation Considerations

The implementation and evaluation of these innovative teaching tools are guided by established educational research methodologies. Studies frequently employ quasi-experimental designs with control and experimental groups, utilizing pretests and posttests to isolate the effect of an intervention (Sugiyono, 2010). Robust data analysis relies on statistical tests for normality, homogeneity, and hypothesis testing (e.g., t-tests, regression analysis) to validate findings (Uhm & Yi, 2023). Furthermore, successful integration depends on several practical factors: teacher professionalism in utilizing technology, the availability of adequate digital infrastructure, and the alignment of media design with clear learning objectives (Li et al., 2025; Timotheou et al., 2023). The literature suggests that the most effective digital learning solutions are those that are pedagogically sound, user-friendly, and accessible within the existing technological constraints of the school environment.

Method

This study employed a quantitative approach utilizing a quasi-experimental design. Quasi-experimental research involves the use of a control group but does not fully control for all external variables that may influence the experiment (Sugiyono, 2010). The design was implemented using two classes assigned as control and experimental groups. Both groups were administered a pretest to establish baseline equivalence before the intervention. Following the treatment, both groups were given an identical posttest to compare outcomes between the group that received the intervention and the group that did not. This design was chosen to test the hypothesis that a Google Earth and YouTube-based virtual tour influences student learning outcomes, specifically their ability to recall historical site locations.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experimental	O ₁	X	O ₂
Control	O ₃	–	O ₄

Description: O₁ & O₃ = Pretest scores; O₂ & O₄ = Posttest scores; X = Treatment using Google Earth & YouTube-based virtual tour.

Research Location

The study was conducted at SMK Negeri 1 Kedung, Jepara Regency. This location was selected because a significant portion of students had not met the Minimum Completion Criteria (*Kriteria Ketercapaian Tujuan Pembelajaran/KKTP*) in history, indicating a need for interventions to improve learning outcomes.

Population and Sample

The population, defined as the generalization area consisting of subjects with specific qualities and characteristics (Sugiyono, 2010), comprised all 371 eleventh-grade students across 11 classes and 4 study programs at SMK Negeri 1 Kedung.

A simple random sampling technique was used. This technique involves selecting a sample randomly without considering strata within the population (Sugiyono, 2010). From the population, a sample of 64 students from two classes was selected: Class XI PMS 1 as the control group and Class XI AKL 2 as the experimental group. Random sampling was justified as all students were considered to have similar baseline capabilities based on their first-semester grades for the 2023/2024 academic year. The selection process involved listing all classes studying the target history material, assigning them random numbers via a random number generator application, and drawing the experimental and control classes randomly from this pool. The average report card scores for Grade XI classes are presented below, showing comparable academic levels between the selected classes.

Research Variables

Variables are aspects that vary and are defined by the researcher to be studied (Sugiyono, 2010). This study employed two variable types:

1. Independent Variable: The factor hypothesized to influence another variable. In this study, the independent variable was the Google Earth and YouTube-based virtual tour.
2. Dependent Variable: The outcome measured. In this study, the dependent variable was student learning outcomes.

Data and Data Sources

This study used quantitative data (numerical scores from tests). The primary data source was student responses to pretest and posttest instruments.

Data Collection Techniques

Data were collected through observation, documentation, and tests.

1. Observation: Direct observation of student learning activities before and during the experiment (Sugiyono, 2010).
2. Documentation: Collection of supporting documents such as school profiles, photos of the research process, student lists, and prior academic scores (Sugiyono, 2010).
3. Test: A multiple-choice test was administered as a pretest and posttest to measure knowledge (Francis et al., 2020). The pretest measured baseline knowledge, while the posttest measured outcomes after the intervention.

Data Validity and Reliability

Validity refers to the extent to which an instrument accurately measures the intended variable (Dunn, 2020). Item validity was tested using Pearson's Product Moment correlation via SPSS 27. From an initial 50 items, 40 were deemed valid ($r\text{-count} > r\text{-table}$) and used for the study.

Table 2. Validity Test Results

Criteria	Item Numbers	Total
Valid	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 18, 20, 21, 22, 23, 25, 27, 28, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	40
Invalid	2, 9, 13, 17, 19, 24, 26, 29, 30, 33	10

Reliability indicates the consistency of an instrument (Kalkbrenner, 2023). Using Cronbach's Alpha on the 40 valid items, a score of 0.952 was obtained, which exceeds the critical $r\text{-table}$ value of 0.349 ($N=32$, $\alpha=0.05$), confirming high reliability.

Item analysis was conducted to ensure a balanced test (Akveld & Kinnear, 2024). Results showed: 3 items were "difficult," 15 were "moderate," and 22 were "easy." Regarding discriminatory power, 22 items were "adequate" and 18 were "good" at distinguishing between high and low-achieving students. All 40 items were retained.

Data Analysis Techniques

1. Normality Test: Employed the Shapiro-Wilk test via SPSS 27 to check if data were normally distributed (Ag-Yi & Aidoo, 2022).
2. Homogeneity Test: Used Levene's Test via SPSS 27 to assess the equality of variances between groups before the intervention (Goldberg et al., 2022).
3. Hypothesis Testing: A simple linear regression analysis tested the influence of the independent variable (virtual tour) on the dependent variable (learning outcomes) (Hahs-Vaughn & Lomax, 2020).
4. N-Gain Score Analysis: Calculated to determine the relative improvement from pretest to posttest for both groups (Harerimana et al., 2023).

Results

This research yields a detailed description of the learning process utilizing a virtual tour based on the Google Earth and YouTube applications. Furthermore, it reveals the learning outcomes of students who were taught using conventional methods compared to those who used the Google Earth and YouTube-based virtual tour media. A detailed explanation of the research findings is as follows.

The History Learning Process

1) Control Class Learning

The learning process for the control class was conducted offline through face-to-face meetings in class XI PMS 1, in accordance with the history subject schedule. The pretest was administered on February 7, 2024, the group discussion session took place on

February 21, 2024, and the posttest was conducted on February 26, 2024. The teacher accompanied the students throughout the entire learning session. The instructional process was carried out according to the steps outlined in the teaching module, employing conventional lecture and discussion methods.

2) Experimental Class Learning

The learning process for the experimental class was conducted offline through face-to-face meetings in class XI AKL 2, following the history subject schedule. The pretest was administered on February 16, 2024, the Google Earth and YouTube-based virtual tour intervention was implemented on February 23, 2024, and the posttest was conducted on February 26, 2024. The teacher accompanied the students throughout the learning activities. The process adhered to the steps in the teaching module, with the key difference being the integration of the virtual tour media.

This study was executed by implementing a learning process using a virtual tour. The virtual tour was accessed by scanning QR codes provided on an instructional leaflet. For each historical event, the leaflet contained three distinct QR codes: one for the route to the historical location, one for the situational view of the historical site, and one for the explanatory video of the historical event. Students followed a multi-step procedure. First, they selected the historical event to study—the Rengasdengklok Incident—and then scanned the QR code labeled "route." This code automatically connected to Google Maps, displaying the travel distance and providing a visual representation of the route from the school to Rengasdengklok, the site of the historical event.

The second step involved students scanning the "site situation" QR code. This action automatically launched the Google Earth application, presenting a three-dimensional, street-view display of the historical location. Students could visually explore the exterior and interior surroundings of the Museum Rumah Pengasingan (the house where Soekarno and Hatta were held) in Rengasdengklok, gaining a spatial understanding of the setting.

After observing the site's conditions, students proceeded to the third step: scanning the "historical event explanation" QR code. This code linked directly to a dedicated YouTube video that provided a detailed narrative explanation of the Rengasdengklok Incident. This video served to reinforce student comprehension by contextualizing the visual information within the broader story of the events leading to Indonesia's Proclamation of Independence.

Subsequently, students repeated these identical three steps for the other two core events: the drafting of the proclamation text and the reading of the proclamation. This process provided integrated information on the route, site situation, and historical explanation for each event. Following the teacher-guided session, students were instructed to repeat the entire virtual tour independently. This independent repetition aimed to solidify their memory of the procedural steps and the historical sequence, enabling them to revisit the material easily. Through this method, students could more effectively learn and relearn the history of the Proclamation of Independence, strengthening their recall of the historical sites' settings and conditions.

On the first day of the research, the teacher collected baseline data through a pretest to gauge students' initial understanding of the History of the Proclamation of Indonesian Independence material in both the control and experimental classes. Students completed a set of questions prepared by the teacher. This pretest, administered once in each class, served to assess the students' level of comprehension before any instructional intervention, as noted by (Estaji & Ameri, 2020). The results were used to establish a baseline for comparing learning outcomes before and after the virtual tour treatment.

1) Control Class Pretest Results

Analysis of the control class pretest data from 32 students showed a range of scores from 60 to 82.5. The frequency distribution indicated that 4 students scored 60, 4 scored 62.5, 2 scored 65, 5 scored 67.5, 6 scored 70, 3 scored 72.5, 4 scored 75, 1 scored 77.5, 1 scored 80, and 2 scored 82.5. Categorizing these scores based on the Minimum Mastery Criteria (KKTP) set at 75 revealed that 24 students (75%) fell into the "Low" category (score <75), 6 students (18.75%) were in the "Adequate" category ($75 \leq \text{score} < 80$), and only 2 students (6.25%) achieved the "Good" category ($80 \leq \text{score} < 90$). No students reached the "Excellent" category (score ≥ 90). The highest score was 82.5, the lowest was 60, and the mean pretest score for the control class was 69.29.

2) Experimental Class Pretest Results

The experimental class pretest data, also from 32 students, showed a similar score distribution: 4 students scored 60, 3 scored 62.5, 5 scored 65, 4 scored 67.5, 4 scored 70, 3 scored 72.5, 3 scored 75, 2 scored 77.5, 2 scored 80, and 2 scored 82.5. Categorization showed 23 students (71.88%) in the "Low" category, 7 students (21.88%) in the "Adequate" category, and 2 students (6.25%) in the "Good" category. The highest score was 82.5, the lowest was 60, and the mean pretest score was 69.53.

Comparative Analysis of Pretest Results

The pretest results for both classes were strikingly similar. The control class mean was 69.29, and the experimental class mean was 69.53. In both groups, the majority of students (28 in control, 23 in experimental) scored below the KKTP of 75. Only a small number (8 in control, 9 in experimental) met or exceeded this threshold. This indicates that, prior to the intervention, the initial understanding and learning outcomes of students in both classes were low and statistically equivalent, with no significant difference in baseline ability. This low starting point, attributed to a lack of engagement with conventional history teaching media, underscores the need for an innovative intervention to improve learning outcomes, as the use of engaging media can increase student interest and subsequently enhance learning results (Brown et al., 2022; Guo et al., 2023; Venn et al., 2023).

Following the pretest, the experimental class received the treatment using the Google Earth and YouTube-based virtual tour to facilitate memorization of historical locations. The control class continued with conventional lecture and discussion methods. After the treatment, a posttest was administered to both classes to measure the impact of the virtual tour intervention, as a posttest assesses the condition of samples after treatment (Pan & Carpenter, 2023).

1) Control Class Posttest Results

The control class posttest scores showed improvement but were modest. Scores ranged from 72.5 to 90. The frequency distribution was: 2 students scored 72.5, 3 scored 75, 7 scored 77.5, 6 scored 80, 4 scored 82.5, 6 scored 85, 2 scored 87.5, and 2 scored 90. Categorization showed 2 students (6.25%) remained in the "Low" category, 16 students (50%) were in the "Adequate" category, and 14 students (43.75%) achieved the "Good" category. The mean posttest score for the control class was 80.85, with a highest score of 90 and a lowest score of 72.5.

2) Experimental Class Posttest Results

The experimental class posttest results demonstrated a marked improvement. Scores ranged from 80 to 100. The frequency distribution was: 1 student scored 80, 3 scored 82.5, 5 scored 85, 3 scored 87.5, 7 scored 90, 2 scored 92.5, 6 scored 95, 3 scored 97.5, and 2 scored a perfect 100. Categorization revealed a dramatic shift: 1 student (3.13%) was in the "Adequate" category, 18 students (56.25%) were in the "Good" category, and 13 students (40.63%) reached the "Excellent" category (score ≥ 90). The mean posttest score for the experimental class was 90.39, with the highest score at 100 and the lowest at 80. Crucially, every student in the experimental class met or exceeded the KKTP of 75.

Comparative Analysis of Posttest Results

While both classes showed improvement from pretest to posttest, the gain in the experimental class was significantly greater. The control class mean increased by 11.56 points (from 69.29 to 80.85). In contrast, the experimental class mean increased by 20.86 points (from 69.53 to 90.39). This represents a substantially larger improvement. The experimental class's lowest posttest score (80) was higher than the control class's lowest (72.5), and its mean (90.39) far surpassed the control class's mean (80.85). The presence of two students in the control class still scoring below the KKTP, compared to zero in the experimental class, further underscores the effectiveness of the intervention. This finding aligns with prior research by Nurmalla (2020), confirming that virtual exploration using Google Earth can improve history learning outcomes.

Detailed Pre-Post Comparison for Each Class

For the control class, the mean increased from 69.29 to 80.85. Although this moved the class average from the "Low" to the "Good" category and met the KKTP, the gain of 11.56 points, or an N-Gain of 0.22, is categorized as low effectiveness. The improvement from conventional methods was present but not substantial.

For the experimental class, the mean leaped from 69.53 to 90.39, moving from "Low" to "Excellent" category. The gain of 20.86 points, corresponding to an N-Gain of 0.69, is categorized as moderate effectiveness. This significant increase suggests that the virtual tour media, which packaged material in an engaging audiovisual format, successfully captured student interest and facilitated deeper understanding. This supports the findings of Tan et al. (2020) that attractive learning media boost student interest and learning outcomes.

Factors potentially limiting even higher scores for a few experimental students, as identified through response questionnaires, included insufficient smartphone specifications, unstable internet connectivity, and initial lack of proficiency in operating the Google Earth and YouTube applications for this specific purpose. Despite these minor hurdles, all students achieved the learning objectives.

Theoretical underpinnings for this improvement can be linked to cybernetic theory, which emphasizes orderly information management and repetition for self-learning. The virtual tour allowed for repeated, self-paced exploration, helping to transfer information into long-term memory. Furthermore, the multisensory engagement (visual and auditory stimuli) likely promoted whole-brain activation. Research by (Makransky & Petersen, 2021) suggests that simultaneous engagement of both brain hemispheres strengthens abilities and enhances memory retention through the thickening of the myelin sheath with repeated activity.

To rigorously determine the impact of the virtual tour, statistical tests were conducted on the pretest and posttest data after establishing their validity.

1) Normality Test

Using the Shapiro-Wilk test via SPSS 27, the significance values for both pretest and posttest data from control and experimental classes were all greater than 0.05 (Control Pretest: 0.144; Control Posttest: 0.238; Experimental Pretest: 0.103; Experimental Posttest: 0.203). This confirms that all data sets were normally distributed.

2) Homogeneity Test

Levene's test for homogeneity of variances yielded significance values greater than 0.05 for both pretest (0.590) and posttest (0.194) data between the two classes. This confirms that the variances of the control and experimental groups were homogeneous, fulfilling a key assumption for parametric comparative tests.

3) Hypothesis Testing

A simple linear regression analysis was used to test the hypothesis that the virtual tour (independent variable X) influenced learning outcomes (dependent variable Y). The t-test results from the regression analysis showed a calculated t-value of 11.393. With degrees of freedom ($df=31$), the critical t-table value is 1.69726. Since $11.393 > 1.697$, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This indicates a statistically significant partial influence of the virtual tour on student learning outcomes in history.

The significance value (Sig.) for the virtual tour coefficient was less than 0.001, which is far below the alpha level of 0.05. This confirms that the influence of the virtual tour on learning outcomes is statistically significant.

The analysis produced the regression equation: $Y = 31.299 + 0.653X$. The positive regression coefficient (0.653) indicates a positive relationship: the use of the virtual tour is associated with an increase in learning outcome scores. The constant (31.299) suggests the predicted baseline score without the virtual tour intervention.

The R Square value was 0.812. This means that approximately 81.2% of the variance in student history learning outcomes can be explained by the use of the Google Earth and

YouTube-based virtual tour. The remaining 18.8% is influenced by other factors, such as those identified in the student questionnaires (device limitations, internet issues, user skill).

The N-Gain score provides a standardized measure of improvement relative to the maximum possible gain. The control class had an N-Gain of 0.22 (categorized as "Low"), while the experimental class had an N-Gain of 0.69 (categorized as "Moderate"). In percentage terms, the average improvement effectiveness was 22.90% for the control class (classified as "Ineffective") and 69.62% for the experimental class (classified as "Moderately Effective"). This quantifies the superior efficacy of the virtual tour treatment over conventional methods in improving learning outcomes.

Discussion

The significant influence of the virtual tour on learning outcomes is fundamentally rooted in its capacity to enhance cognitive processing and long-term memory retention. As established by (Barideaux & Pavlik, 2023), memory is a pivotal determinant of academic achievement, and pedagogical strategies that strengthen recall directly impact performance. The Google Earth and YouTube-based virtual tour facilitates this by enabling repeated, self-directed engagement with the material, a process aligned with cybernetic learning principles which emphasize orderly information management and repetition for knowledge consolidation (Cope & Kalantzis, 2022; Morris et al., 2025). The media's audiovisual nature, combining immersive spatial visuals from Google Earth with narrative explanations from YouTube, creates dual-coding stimuli that are more effectively encoded into memory than textual information alone (Barideaux & Pavlik, 2023; Mayer, 2024). This multisensory engagement promotes deeper cognitive processing, which is essential for transferring information from working memory to long-term storage, thereby directly addressing the low initial recall observed in students during the pretest phase.

This cognitive advantage is powerfully augmented by the virtual tour's ability to dramatically increase student interest and intrinsic motivation, transforming the learning dynamic from passive reception to active exploration. The engaging packaging of historical material through interactive 3D maps and dynamic videos captures and sustains student attention, a critical first step in the learning process (Guillaume et al., 2023; Tan et al., 2020). The observed disparity in classroom engagement—94% attention in the experimental class versus 63% in the control class—provides empirical support for the claim that attractively presented material boosts interest and motivation (Lussier et al., 2023). This heightened engagement is crucial in history education, where student apathy is often a barrier, as it fosters a more active learning posture where students are willing to invest cognitive effort (Reeve et al., 2020). Consequently, the virtual tour does not merely present information but creates an exploratory experience that aligns with the digital lifestyles of contemporary students, making learning more relevant and compelling (Adi Badiozaman et al., 2022; Daniela & Aierken, 2020).

Beyond engagement, the virtual tour directly supports the specific pedagogical goals of history education by concretizing abstract historical narratives and fostering spatial-temporal understanding (Thorp & Persson, 2020). The use of Google Earth to visualize the exact location and setting of the Rengasdengklok incident or the Proclamation reading site helps ground historical events in tangible reality, moving beyond textbook

abstractions. This spatial contextualization aids in constructing accurate mental models of historical events, which is essential for deep comprehension. Furthermore, by virtually "visiting" these sites, students can better appreciate the physical and logistical contexts of history, which in turn nurtures a more empathetic and nuanced connection to the past, supporting the development of nationalistic values and historical consciousness (Patterson et al., 2022). This method effectively addresses the challenge identified by (Bartelds et al., 2020) regarding the logistical difficulties of physical field trips, providing a viable and impactful alternative.

The integrative design of the virtual tour, combining route mapping, site visualization, and video explanation, creates a structured yet flexible learning scaffold that caters to diverse learning paces and preferences. The QR-code-driven workflow guides students through a logical sequence—from geographical orientation to situational analysis to narrative understanding—mirroring effective historical inquiry methods (Boxtel et al., 2021; Cinnamon et al., 2021; Lim & Lim, 2020). The opportunity for repeated, autonomous review empowers students to take control of their learning, allowing them to revisit complex segments until mastery is achieved, a key factor in the significant posttest score improvement (Tilak et al., 2023; van der Graaf et al., 2022). This self-paced, iterative practice strengthens neural pathways associated with the historical content, a process explained by the neuroeducational perspective that repeated engagement thickens the myelin sheath, enhancing recall speed and accuracy (Nickl & Bäuml, 2023). Therefore, the media acts not just as an information delivery tool, but as a platform for deliberate, reinforced practice.

The quantitative findings of this study, including the significant mean difference gain (20.86 points in the experimental class) and the moderate N-Gain score of 0.69, are robust indicators of the intervention's efficacy. These results are consistent with prior research affirming the positive impact of well-designed digital media on learning outcomes (Lacka & Wong, 2021). The regression analysis, showing that 81.2% of the variance in learning outcomes can be attributed to the virtual tour, underscores its powerful role as an independent variable (Ruberto et al., 2023). While external factors like device capability and internet stability accounted for some variance, the core pedagogical design proved overwhelmingly effective. This success demonstrates that the strategic integration of commonplace technologies like Google Earth and YouTube—platforms already within students' digital ecosystems—can be repurposed to create powerful, low-cost, and scalable educational solutions that overcome traditional barriers to interest and comprehension in history (Garcia et al., 2023; Ofianto et al., 2023; Petersen et al., 2020; N. Wang et al., 2022).

In the end, the virtual tour's effectiveness stems from a synergistic combination of cognitive, motivational, and pedagogical strengths. It leverages dual-coding theory through audiovisual integration to enhance memory (Huang et al., 2023; Liberman & Dubovi, 2023), triggers active learning through interactive exploration (Hite et al., 2024; Netland et al., 2024). By aligning with the cybernetic principle of structured, repeatable practice, it facilitates the transition of knowledge into long-term memory (Chin et al., 2024; Ebersbach et al., 2020). Ultimately, this approach successfully addresses the chronic issues of low interest and poor retention in history education by transforming the learning process into an immersive, student-centered investigation, thereby not only

improving test scores but also potentially fostering the deeper historical awareness and national character that are the ultimate aims of the discipline (Makransky & Mayer, 2022; Popa, 2022).

Conclusion

Based on the research findings and discussion, it can be concluded that the implementation of a Google Earth and YouTube application-based virtual tour proved significantly effective in improving student learning outcomes in the History subject, specifically on the topic of the Proclamation of Indonesian Independence. This effectiveness is reflected not only in the substantially higher posttest mean score of the experimental class (90.39) compared to the control class (80.85) but also in the achievement of learning completeness by all students in the experimental class. This improvement is mediated by two primary mechanisms: first, the enhancement of memory retention through audiovisual material presentation that facilitates dual coding and self-directed review; second, the increase in learning interest and motivation, as indicated by higher levels of student attention and comprehension during the learning process. Therefore, this technological integration successfully transforms history learning from a passive and abstract activity into an immersive and meaningful exploratory experience.

The findings of this study hold significant implications both theoretically and practically. Theoretically, the results reinforce the application of dual coding theory and experiential learning within the context of digital history education, while also supporting a cybernetic approach that emphasizes structured information management and repetition for self-directed learning. Practically, this research provides an innovative learning model that can be adopted by history teachers to address classic challenges such as low student interest and difficulties in visualizing past events. Educators can leverage easily accessible digital platforms (Google Earth and YouTube) to design virtual field trips without the significant costs and logistical constraints of physical visits. Furthermore, schools and policymakers may consider integrating digital literacy and the development of similar learning media into curricula or teacher training programs to create learning experiences more relevant to the lives of Generation Z students.

This study has several limitations that must be acknowledged. First, the research was conducted with a limited sample from a single vocational high school (SMK); therefore, generalizing the findings to broader populations (such as students from senior high schools in different contexts) requires caution. Second, the effectiveness of the virtual tour is highly dependent on supporting infrastructure, such as smartphones with adequate specifications and stable internet connectivity, which may not be uniformly available across all regions. Third, the relatively short intervention period could not reveal the long-term impact on memory retention and students' attitudes toward history. For future research, it is suggested to: (1) Conduct replications with broader and more diverse samples to test the robustness of the findings; (2) Develop and test more interactive and self-contained virtual tour platforms, potentially utilizing simple Virtual Reality (VR) technology; and (3) Undertake longitudinal studies to measure the sustained impact of virtual tour-based learning on students' conceptual understanding and historical consciousness.

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