JRIIE Journal of Research Innovation and Implications in Education
Center for Research Implications & Practice

Website: www.jriiejournal.com ISSN 2520-7504 (Online) Vol.10, Iss.4, 2026 (pp. 1338 - 1349)

Pedagogical Strategies Employed by History Teachers for the Effective Integration of Google Earth in Fostering Students' Learning of Historical Sites in Dodoma Secondary Schools

Alfredina Mwanguya & Opanga David
St John's University of Tanzania
Email: dinamwanguya@gmail.com

Abstract: *Instruction regarding historical sites in secondary education often presents significant logistical hurdles, as important heritage locations are frequently remote and inaccessible for routine field excursions. Google Earth offers an interactive geospatial platform that enables educators to virtually pinpoint, navigate, and analyze historical landmarks, terrain, routes, and topographical conditions linked to historical occurrences. This study investigated the pedagogical strategies utilized by history teachers to effectively integrate Google Earth for enhancing students' learning of historical sites in Dodoma secondary schools, Tanzania. Grounded in the Technology Acceptance Model (TAM) focusing on perceived ease of use and perceived usefulness this qualitative study examined the instructional practices and perspectives of twelve purposively sampled history teachers across three secondary schools using semi-structured interviews. Data were evaluated through thematic analysis, involving thorough familiarization, coding, categorization, theme formulation, and synthesis. Findings revealed that while all participants routinely merged conventional and digital instructional tools, only one-third had actively applied Google Earth within their history lessons. Educators who implemented the platform relied primarily on spatial visualization techniques, leveraging the software as a cognitive anchor to bridge text-based accounts with concrete geographic features such as distance, scale, and local topography. However, systematic pedagogical integration was substantially hampered by persistent digital infrastructure constraints, high data costs, tight curricular schedules, and gaps in technological-pedagogical knowledge. The study concludes that while Google Earth serves as an impactful supplementary strategy for historical site instruction, its success hinges on targeted professional development, robust internet connectivity, and deliberate alignment with curriculum benchmarks.*

Keywords: *Google Earth; pedagogical strategies; history instruction; historical landmarks; geospatial tools; Dodoma secondary schools; Technology Acceptance Model*

How to cite this work (APA):

Mwanguya, A. & Opanga, D. (2026). Pedagogical Strategies Employed by History Teachers for the Effective Integration of Google Earth in Fostering Students' Learning of Historical Sites in Dodoma Secondary Schools. *Journal of Research Innovation and Implications in Education, 10*(4), 1338 – 1349. **https://doi.org/10.59765/mlrs34jh**

1. Introduction

Modern History instruction places greater emphasis on developing historical reasoning competencies rather than relying on the passive memorization of dates, names, and key events. Developing a comprehensive understanding of history requires students to investigate the dynamic relationships among time, individuals, geographic locations, evidence, continuity, change, causation, and the

physical environments in which historical events transpired (Seixas & Morton, 2013; VanSledright, 2011). Because phenomena such as trade, migration, warfare, territorial expansion, settlement, cultural exchange, and resistance are inherently spatial, history pedagogy is significantly enriched by instructional approaches that anchor historical accounts to landscape, distance, location, and human movement (Barton & Levstik, 2004; Bodzin et al., 2014).

Historical landmarks are especially impactful educational tools because they connect documentary and narrative sources with concrete physical locations. Nevertheless, organizing regular field excursions to key historical sites is frequently hindered by logistical challenges, including financial constraints, geographic distance, transportation expenses, student safety, and limited curriculum hours. Under these conditions, digital geospatial applications serve as valuable supplementary tools, providing virtual access to historical environments that learners might otherwise only encounter through static photographs, textbooks, or traditional paper maps (Demirci et al., 2013; Patterson, 2007).

Among accessible virtual-globe platforms, Google Earth stands out as a highly versatile tool for academic contexts. The platform allows users to locate geographic sites, adjust spatial scales, analyze satellite imagery and topography, and interactively explore geographic relationships. Its true educational value extends beyond offering visually engaging displays; it enables educators and students to contextualize historical content within real-world environments while evaluating the connections between human action, terrain, distance, and location (Demirci et al., 2013; Patterson, 2007). Furthermore, scholarship in history education indicates that Google Earth enhances historical thinking most effectively when embedded within structured inquiry-based activities rather than deployed merely as a passive visual display (Bodzin et al., 2014; VanSledright, 2011).

The integration of such digital tools aligns directly with Tanzania's contemporary educational policies and curriculum goals. Policy frameworks explicitly promote student-centered learning, diverse instructional media, digital information retrieval, and the systematic incorporation of information and communication technologies within classroom instruction (Ministry of Education, Science and Technology [MoEST], 2023). In addition, national educational analysis underscores the importance of embedding safe, dependable, and pedagogically sound digital resources across secondary schools and teacher training programs (Komba & Shukia, 2023; MoEST, 2023).

However, the mere availability of digital infrastructure does not automatically translate into effective classroom implementation. Teachers remain the primary decision-makers regarding whether a digital tool aligns with curriculum objectives, fits within instructional time constraints, is technically viable, and complements their instructional methods. Studies on educational technology adoption consistently demonstrate that teacher attitudes, perceived utility, digital confidence, pedagogical knowledge, and institutional support directly influence whether technological tools are successfully integrated into routine practice (Davis, 1989; Mishra & Koehler, 2006). Examining history teachers' perceptions is therefore crucial for determining whether Google Earth can transition from an occasional visual aid into an established pedagogical resource.

1.1 Statement of the Problem

High-quality history instruction regarding historical sites requires students to comprehend not only historical occurrences but also the geographical settings of those events and the ways physical environments shaped human behavior. While conventional instructional tools—such as printed maps, textbooks, and teacher-led lectures—remain foundational, they often struggle to convey spatial relationships, scale, distance, and topographic features accurately. Google Earth offers a viable solution to these limitations by providing spatially referenced, interactive visualizations of physical environments and historical landscapes (Demirci et al., 2013; Patterson, 2007).

Despite these technological possibilities, existing empirical research on Google Earth has traditionally focused on geography and spatial education rather than secondary history instruction. Studies within geography education demonstrate that virtual-globe applications enhance conceptual understanding, spatial thinking, and student engagement (Bodzin et al., 2014; Demirci et al., 2013; Solem et al., 2013). Meanwhile, emerging research in history education suggests that using Google Earth can boost student motivation, contextual awareness, and historical inquiry skills (Bodzin et al., 2014; Patterson, 2007). Nevertheless, empirical data regarding how Tanzanian history teachers perceive the practical feasibility, instructional utility, and curriculum alignment of Google Earth remain scarce.

Furthermore, educators serve as the primary conduits bridging technological capabilities and classroom implementation. A valuable digital application may remain underused if teachers encounter systemic obstacles, such as inadequate device availability, unstable internet connections, steep data expenses, exam-driven curriculum constraints, or gaps in technological-pedagogical

knowledge. On the other hand, even limited technological tools can facilitate deep learning when teachers effectively align content, pedagogy, and technology (Mishra & Koehler, 2006). To address this gap, this paper investigated pedagogical practices and strategies employed by history teachers for the effective integration of Google Earth in fostering students' learning of historical sites in Dodoma Secondary Schools.

1.2 Significance of the Study

This study expands the evolving body of literature on subject-specific digital pedagogy by investigating the application of geospatial tools through the lens of secondary school history educators within an African educational setting. The insights generated are valuable for teachers looking to enrich static maps and traditional textbooks with dynamic, spatially detailed visualizations, school administrators overseeing digital infrastructure and continuous professional training, and curriculum planners working to operationalize ICT integration within history education (Komba & Shukia, 2023; Ministry of Education, Science and Technology [MoEST], 2023). Additionally, the paper provides context-sensitive empirical evidence to broader scholarly discussions regarding the specific conditions under which perceived technological utility translates into sustained classroom implementation (Mishra & Koehler, 2006).

2. Literature Review

2.1 Empirical Literature Review

2.1.1 Google Earth Software

Google Earth is a three-dimensional digital model that depicts the Earth as well as other celestial bodies like Mars and the Moon, allowing users to freely navigate a virtual environment by adjusting viewing coordinates and angles. Unlike conventional physical globes, virtual-globe applications display a wide range of surface perspectives, incorporating physical features, human-made infrastructure like roads and buildings, and abstract data layers such as population density.

Yu and Gong (2012) provided a comprehensive overview of the history and evolution of virtual-globe technologies. A virtual globe enables users to: (1) explore virtual environments; (2) generate and share localized data; and (3) visualize both natural and human-built features across the Earth's surface. These applications offer intuitive annotation functions and seamless access to landscape and satellite data. Among these platforms, Google Earth stands out as the most prominent geographical information application since its release in 2005. Originally named EarthViewer 3D, it was created by Keyhole, Inc.a firm supported by CIA venture funding before being acquired by Google in 2004 (Luo et al., 2014).

Historically, the platform evolved through three versions offering escalating feature sets: GE Free, GE Pro, and GE Enterprise. Originally launched as a paid, professional upgrade to the free edition, GE Pro provided enhanced capabilities for importing remote sensing and GIS datasets, advanced spatial measurement utilities, faster processing, and higher-resolution printing and video export. In late January 2015, Google made GE Pro free for all users, making GE Pro (Version 7.3) the standard desktop edition. Conversely, GE Enterprise was designed for institutions managing proprietary geospatial datasets or satellite imagery requiring secure hosting, allowing developers to create customized 3D globes. Google discontinued GE Enterprise in March 2015, with technical support officially ending in March 2017.

Fundamentally, GE displays global surface features by rendering a true-color (RGB) composite view from a macro perspective. As users zoom closer to specific locations, the display transitions into higher-resolution imagery collected at various dates and times by satellite and aerial sensors. These images feature spatial resolutions ranging from 15 meters down to 15 centimeters.

To simulate three-dimensional topography over a two-dimensional interface, GE incorporates Digital Elevation Model (DEM) data gathered through NASA’s Shuttle Radar Topography Mission (SRTM). By providing Very High Resolution (VHR) imagery—defined as spatial resolution finer than five meters—GE allows users to inspect geographical sites from oblique angles. The combination of accessible VHR imagery and historical time-series photographs contributes significantly to the platform's widespread adoption. Today, GE is widely utilized across the natural sciences, social sciences, humanities, research, public policy, and educational instruction.

2.1.2 Learning Using Google Earth

Empirical research indicates that incorporating online learning applications enhances students' grasp of core concepts and technical skills while building their confidence in subject matter (Solem & Gersmehl, 2005). Furthermore, cognitive psychology demonstrates that visual representations are retained more effectively in memory than plain text (Wager, 2005).

In educational settings, Google Earth fosters critical thinking, technical proficiency, and spatial reasoning

capabilities (Marr, 2020). Educators can structure lessons that prompt students to evaluate the context, accuracy, and construction of geographic information. Beyond independent work, the software facilitates interactive, collaborative learning among peers sharing common learning goals. Integrating internet-based tools into classroom instruction allows students to explore topics of interest in greater depth. As Leamnson (1999) noted, meaningful learning often extends beyond the classroom; digital tools empower students to broaden their knowledge base, refine analytical thinking, and transfer classroom concepts to novel real-world situations.

Within the instructional process, Google Earth strongly supports the "4Es" learning cycle model (Cates et al., 2003) by enabling learners to Engage with lesson content, explore real-world environments, Explain observed phenomena, and evaluate the implications of their learning. By design, Google Earth offers an interactive and dynamic workspace where students develop a nuanced understanding of spatial context through engaging, location-based learning experiences.

2.1.3 The Use of Google Earth in History Instruction and Student Learning

Google Earth offers a dynamic, interactive platform that allows learners to examine historical sites in three dimensions, providing spatial perspectives that static textbooks cannot deliver. Using high-resolution imagery, 3D terrain modeling, and street-level views, students can virtually visit landmark locations such as the Roman Colosseum or the Great Wall of China, deepening their appreciation of geographic settings and architectural structures (Marr, 2020). Additionally, the platform's Voyager feature provides guided educational tours combining multimedia with interactive mapping, helping students visualize the intersection of geography and historical development.

In addition to spatial exploration, Google Earth contains archival imagery that allows students to analyze how geographic areas change over time. This functionality is especially valuable for studying urban expansion, environmental change, and the physical impacts of major events like wars or natural disasters (Goodchild, 2018). For example, students can use the time-slider tool to observe changes in Berlin's landscape before and after World War II, obtaining a time-lapse perspective of historical transformation (Tate & Jarvis, 2019). These tools contextualize historical events by linking temporal progressions directly to physical landscapes, encouraging a comprehensive understanding of history.

Furthermore, Google Earth boosts student engagement by allowing learners to construct custom historical projects using tools like "My Maps" and "Tour Builder." These features enable students to create interactive presentations that map historical timelines, trade routes, cultural exchanges, and migration paths, fostering active learning and creativity (Tate & Jarvis, 2019). By translating historical narratives into interactive mapping formats, students experience history as an evolving narrative rather than a collection of static facts. This exploratory approach aligns with constructivist learning theories by promoting inquiry-led discovery and a deeper emotional connection to historical events.

2.1.4 Teaching and Learning History Through Technology

In an investigation into history essay-writing skills, Mohamed and Zali (2005) highlighted persistent learning difficulties among students. Their study noted that learners often lacked enthusiasm for history, struggled with memorizing facts, showed limited interest in reading, found key concepts difficult to grasp, and were exposed to uninspiring teaching methods. The heavy reliance on dense textbook facts is a major contributor to these challenges (Ahmad et al., 2016). Similarly, Magro et al. (2014) observed that students frequently view history as uninspiring, largely because instructional approaches fail to connect with their personal experiences and daily realities.

To address these pedagogical issues, Pascu and Duroisin (2026) evaluated secondary students' perceptions of learning geography with Google Earth Pro among learners in Romania. Their findings revealed that students exposed to Google Earth displayed higher motivation, engagement, interest, and conceptual understanding than peers taught via traditional methods. Learners particularly valued the visual, interactive nature of the application, which helped bridge theoretical concepts with real-world geographical spaces. The authors concluded that Google Earth positively shapes student learning experiences and attitudes toward instruction.

Similarly, Dewi and Hariadi (2024) investigated the impact of digital mapping on history and social studies learning. Their results demonstrated that Google Earth significantly enhanced student motivation, classroom participation, and academic performance. Learners viewed the technology as an innovative learning tool because it allowed them to virtually explore historical locations and grasp the spatial dimensions of historical events. The study concluded that Google Earth made instruction more interactive and meaningful than conventional textbook instruction.

In another study, Situmorang et al. (2024) examined the effectiveness of Google Earth in spatial visualization. The findings indicated that students developed a deeper understanding of content and achieved improved academic results after working with geospatial software. Participants reported that visualizing landmarks through 3D views and satellite imagery made lessons more memorable, engaging, and accessible compared to conventional teaching techniques.

Similarly, Petrisia et al. (2025) designed and evaluated interactive Google Earth instructional media for vocational secondary school history classes. The study showed that students demonstrated increased interest and comprehension because the tool provided contextual, visual representations of historical sites and events. The researchers concluded that Google Earth helps demystify abstract historical concepts by connecting them to tangible geographical locations.

Furthermore, Putra, Ragil, and Thang (2025) assessed the integration of Google Earth within spatial problem-based learning among high school students. Their results demonstrated that students using Google Earth developed stronger spatial reasoning skills and higher engagement levels than those receiving traditional instruction. The study highlighted the role of Google Earth in stimulating inquiry, analytical thinking, and student-led exploration.

Finally, a study in Nigeria by Oyewale and Familugba (2021) explored teacher and student attitudes toward educational technology in history instruction. The authors found that technological tools including computers, internet access, projectors, and audio-visual media can be effectively integrated into history teaching. The study emphasized that when thoughtfully implemented, technology provides a versatile, interactive, and varied learning environment that supports effective history instruction.

2.2 Theoretical Framework

2.2.1 Technology Acceptance Model

This study was anchored in the Technology Acceptance Model (TAM) formulated by Davis (1989). TAM posits that individual acceptance and adoption of technology are primarily determined by two core constructs: perceived usefulness and perceived ease of use. Perceived usefulness represents the degree to which an individual believes that employing a specific technology will enhance their performance, whereas perceived ease of use denotes the extent to which utilizing the technology is anticipated to be effortless (Davis, 1989).

Within the context of this study, perceived usefulness captured history educators' convictions that Google Earth could elevate historical site instruction by enriching visualization, spatial reasoning, historical contextualization, and student engagement. Conversely, perceived ease of use encompassed teachers' capacity to navigate the application, pinpoint historical landmarks, design relevant learning tasks, secure hardware and internet access, and seamlessly fit the software into scheduled class periods. TAM is exceptionally well-suited for this inquiry because it helps explain the discrepancy between positive attitudes and limited classroom implementation: educators may recognize a tool's pedagogical utility, yet real-world logistical and technical hurdles can impede its operational usability and widespread adoption (Davis et al., 1989).

To complement TAM, the Technological Pedagogical Content Knowledge (TPACK) framework was incorporated into the discussion. TPACK asserts that effective digital integration demands a holistic blend of subject-matter expertise, instructional strategies, and technological knowledge, rather than isolated digital skills (Mishra & Koehler, 2006). This theoretical lens proved valuable for contextualizing teachers' demands for targeted professional training that directly links Google Earth with history topics, inquiry methods, and curriculum goals.

Existing empirical literature reinforces Google Earth's educational capabilities in fostering spatial thinking, visual learning, classroom engagement, and inquiry-based discovery (Bodzin et al., 2014; Demirci et al., 2013; Patterson, 2007; Ratinen & Keinonen, 2011). Nevertheless, the majority of these studies focus on geography instruction and are situated outside Tanzania. Although recent educational technology research demonstrates encouraging outcomes, there remains a paucity of empirical data on how Tanzanian history teachers evaluate the practical feasibility and instructional merit of Google Earth. This paper directly fills that disciplinary and contextual gap by examining the lived experiences and perceptions of secondary history teachers in Dodoma City.

3. Methodology

3.1 Research Approach and Design

While the broader study employed a mixed-methods research framework, this paper focuses exclusively on the qualitative strand evaluating history teachers' perceptions. A qualitative descriptive design was selected to capture detailed, context-bound accounts of how educators understood, implemented, and assessed Google Earth within their instructional practices. Qualitative description

is particularly suitable when the primary goal is to present a comprehensive, data-near summary of participant experiences without forcing high-level theoretical abstractions (Sandelowski, 2000). This design was also appropriate because the investigation did not involve experimental manipulations or causal measurements of student academic achievement. Instead, it examined teachers' perceived usefulness, perceived ease of use, classroom practices, instructional challenges, and professional development needs. This distinction is critical: the findings reflect teachers' self-reported perceptions and professional observations rather than direct empirical measurements of student performance.

3.2 Study Location

The study was carried out across three secondary schools located in Dodoma City, Tanzania. These institutions were selected because they possessed basic digital infrastructure—such as desktop computers, laptops, or mobile devices—making it feasible to explore perceptions regarding a technology that could realistically be integrated into classroom instruction. Furthermore, Dodoma serves as a compelling context for examining the practical friction between national digital education goals and the ground-level infrastructural realities that govern school-level execution (Komba & Shukia, 2023; Ministry of Education, Science and Technology [MoEST], 2023).

3.3 Participants, Sampling, and Sample Size

The study involved twelve secondary school history teachers across the three selected institutions. Purposive sampling was used to identify information-rich participants with relevant experience in history instruction and familiarity with visual tools used for teaching historical sites. In qualitative inquiry, purposive sampling is well suited for intentionally selecting participants who possess direct knowledge of the phenomenon under study (Palinkas et al., 2015). Four history teachers were selected from each school, yielding a total sample of twelve ($n=12$). The sample was not intended to achieve statistical generalization across all history educators in Dodoma City; rather, it aimed to produce nuanced, contextually grounded accounts from varied school environments. Additionally, any references to student engagement or spatial comprehension in the findings represent teachers' self-reported observations rather than student-sourced data.

3.4 Data Collection

Data were gathered using semi-structured face-to-face interviews with the twelve history educators. Semi-structured interviews provided a standardized core structure while giving participants the flexibility to elaborate on specific classroom experiences, pedagogical examples, and unforeseen constraints. The interview protocol covered several key areas: existing instructional materials, familiarity with and adoption of Google Earth, perceived usefulness and ease of use, observed impacts on spatial visualization and student interest, instructional methods, technical and curriculum-related barriers, and training needs.

3.5 Data Analysis

Interview transcripts were analyzed using thematic analysis. The analytical process followed an established sequence: transcript immersion, initial code generation, code clustering, candidate theme identification, theme refinement, and interpretive synthesis. These analytical steps align with recognized thematic analysis standards designed to identify, organize, and interpret patterns of meaning across qualitative data (Braun & Clarke, 2022; Byrne, 2022). Descriptive counts were used solely to highlight the prevalence of specific views among the twelve participants; these frequencies were not analyzed using inferential statistics nor used to assert population-wide trends. Qualitative interpretation remained the central focus, supported by verbatim participant quotes to demonstrate how themes emerged directly from the data.

3.6 Rigor and Trustworthiness

To ensure research quality, trustworthiness was evaluated through credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985; Korstjens & Moser, 2018). Credibility was established by comparing teacher accounts across the three school sites and supporting analytical claims with direct participant quotes. Dependability was maintained by using a standardized interview guide and documenting the analytical audit trail. Confirmability was enhanced by maintaining clear connections between participant statements, raw codes, and final themes. Finally, transferability was facilitated by providing detailed descriptions of the study site, participant profiles, and local institutional contexts.

3.7 Ethical Considerations

Ethical clearance and research approvals were obtained from institutional and regional education authorities.

Participation was entirely voluntary, with teachers fully informed of the study's purpose and their right to skip questions or withdraw at any point. To safeguard participant confidentiality and anonymity, alphanumeric codes (e.g., Teacher A1, School 1) were assigned instead of personal or institutional names. All audio recordings and interview transcripts were stored securely and accessed exclusively for academic research purposes.

4. Results and Discussion

This section details data presentation, findings and discussion on pedagogical practices by history teachers on the use of Google Earth.

4.1. The use of GE by history teachers in the classroom

This analysis is based on aggregated data from 12 classroom observations across three secondary schools in Dodoma. The protocol specifically monitors how History teachers utilize Google Earth (GE) to teach historical sites like Kilwa Kisiwani, Olduvai Gorge, and the Kondoa Rock-Art Sites.

4.1.1 Sophisticated visual aid rather than an interactive investigative tool

Characterizing teacher-led virtual tours (Strategy A1) solely as passive observation overlooks the vital pedagogical function of expert scaffolding in complex digital environments. Grounded in cognitive load theory (Mayer, 2004, 2009), teacher-guided instruction prevents cognitive overload by helping learners navigate dense geospatial datasets and multi-layered historical landscapes without becoming disoriented by unstructured exploration (Kirschner et al., 2006). When an educator acts as an expert pilot—strategically utilizing zoom features (Strategy A5) to highlight key topographical shifts—they direct learners' attention to critical historical evidence that students might otherwise overlook or misinterpret on their own (Hmelo-Silver et al., 2007). Rather than reducing students to passive spectators, this structured modeling establishes a foundational cognitive schema, enabling learners to decode complex spatial relationships before attempting independent navigation (Mayer, 2009).

Furthermore, the assertion that hands-on manipulation (Strategy A2) is an absolute prerequisite for acquiring geospatial literacy undervalues the power of teacher-orchestrated visual analysis in cultivating historical reasoning. Research on instructional methods demonstrates that unguided or minimally guided discovery approaches frequently fail to build deep conceptual understanding, particularly when students lack prior familiarity with digital mapping interfaces (Kirschner et al., 2006; Mayer, 2004). Expert-led demonstrations allow teachers to model historical inquiry directly, demonstrating how to interrogate satellite topography, evaluate landscape changes over time, and connect physical terrain to human action (Hmelo-Silver et al., 2007). Through this guided discourse, students engage in rigorous collective problem-solving and critical evaluation, developing robust spatial reasoning skills within a supportive classroom community of inquiry (Tondeur et al., 2012).

Finally, dismissing whole-class teacher-led utilization as a deficient implementation fails to account for the practical realities of resource-constrained educational settings. In many developing secondary school contexts where student-device ratios preclude individual hands-on exploration, teacher-facilitated projection remains a highly effective mechanism for democratizing access to advanced digital tools (Bingimlas, 2009; Tondeur et al., 2012). Rather than representing a pedagogical failure, strategic teacher-led integration optimizes limited technological infrastructure while ensuring that all learners—regardless of device availability—gain exposure to dynamic historical visualizations (Bingimlas, 2009). When executed with skillful questioning and interactive dialogue, teacher-led digital tours successfully bridge the gap between abstract textbook narratives and concrete geographical realities, fostering rich historical inquiry without requiring individual hardware access (Hmelo-Silver et al., 2007; Tondeur et al., 2012).

Table 1: Use of GE By History Teachers in the Classroom

Strategy observed	Yes/No	Frequency	Analysis of implementation
A1. Teacher-Led Virtual Tour	Yes	5	Dominant strategy. Teachers primarily use a projector or their smartphone to lead the class through a visual journey. Rare.
A2. Student-Led Exploration	No	0.5	Limited by the one- device-per-class reality. Students rarely touch the technology themselves. Teachers frequently ask students to look at the 2D map in the textbook and compare it to the GE satellite 3D view.
A3. Comparative Analysis		2	Used occasionally to show the distance between trade centers (Bagamoyo to Tabora).
A4. Geo-Referencing/Tracing		1	
A5. Contextualization		1	Highly effective. Teachers zoom out to show the Indian Ocean context of Kilwa, then zoom in to the ruins.

Table 2: Level of Student Engagement with GE

Engagement Indicator	Rating (1-5)	Evidence/Description
B1. Participation in Activity	2	The visual clarity of GE triggers questions like Why is the mosque so close to the ocean? (Spatial analysis)
B2. Critical thinking	3	
B3. Collaboration	2	Low. Discussion is primarily Teacher-to-Student rather than Students-to-Student because of the single screen focus
B4. Overall time	15-20%	GE integration usually lasts 12-15 minutes out of 80 minutes for a double period

There is a visual engagement paradox. Students are highly motivated and silent while the images load (Rating: 4 for attention), but their actual cognitive engagement with the *data* is lower (Rating: 2 for collaboration). The inquiry is receptive rather than productive. The high score in Critical Thinking (B2) suggests that GE has massive potential to spark inquiry. Even when the teacher controls the screen, the *realism* of the site forces students to reconcile their mental images with the actual terrain. However, the low collaboration score (B3) implies that GE is not yet being used to facilitate group-based problem-solving.

Table 3: Observation Analysis of Technical and Pedagogical Challenges During Lessons

Code	Challenge Observed	Observed (Yes/No)	Average Duration	Analysis
C1	Internet/Network Failure	Yes	8 min	The most significant inquiry interrupter. Lessons often stall while images render.
C2	Device Malfunction	Yes	5 min	Projector overheating or slow smartphone processing speeds are common.
C3	Teacher Difficulty	No	2 min	Teachers observed are generally tech-savvy but struggle with specific Google Earth layers (e.g., historical timelines).
C4	Features Not Working	Yes	3 min	Street view is often unavailable for specific Tanzanian rural historical sites.

4.3.2 Technical-Pedagogical gap

The findings revealed that, technology is the bottleneck of flow. An average of 15–20 minutes per lesson is lost to technical troubleshooting. This creates a pedagogical risk, teachers may stop using GE altogether because it threatens their ability to cover the syllabus within the allotted time.

10% of the lesson is lost to loading screens, teachers will naturally default back to the safe textbook. This highlights the need for Offline GE caches or pre-downloaded Google Earth Projects to ensure that the Cognitive Bridge does not collapse during a network dip. In summary, the observation protocol reveals that Google Earth is successfully transforming the visual landscape of the History classroom in Dodoma, but it has not yet transformed the power dynamic. The teacher remains the Guardian of the Technology.

4.3.3 The Dominance of Teacher-Led Virtual Tours

The classroom observations in Dodoma revealed that the integration of Google Earth (GE) into History lessons currently functions as a digital illustrative tool rather than a catalyst for student-led inquiry. The dominance of Teacher-Led Virtual Tours (Strategy A1) and the near-total absence of Student-Led Exploration (Strategy A2) indicate that the technology is being used to reinforce traditional teacher-centered narratives. This finding is critically aligned with research by Bodzin et al. (2014), who observed that in many educational contexts, high-interactivity geospatial tools are often domesticated into passive visual aids due to structural constraints and large class sizes. While the Zoom In/Out feature (Strategy A5) provides a powerful sense of contextualization, the teacher-as-pilot model limits students' roles to that of spectators, effectively preventing the development of spatial reasoning skills central to modern historical inquiry.

4.3.4 Moderate Level of Critical Thinking

Although observations revealed a degree of physical passivity among students, the protocol recorded a moderate level of critical thinking, suggesting that the visual realism of GE creates cognitive conflicts that traditional maps cannot trigger. When students ask analytical questions regarding the proximity of historical ruins to modern ecological features, they engage in visual evidence evaluation and contextual reasoning (Mwalongo & Mkonongwa, 2021). However, low ratings for Student-Student Collaboration (Indicator B3) highlight a missed opportunity for social constructivism. As Fargher (2018) posits, the true power of geospatial technology in the humanities lies in collaborative problem-solving; in Dodoma, the single-screen focus tends to bottleneck dialogue, centering all analytical discourse on the teacher rather than fostering a community of inquiry among learners.

Finally, technical challenges recorded in Section C of the protocol represent significant flow interruptions threatening the sustainability of GE integration. With an average of 15–20 minutes lost to loading screens and network failures (Indicator C1), teachers are forced into a pedagogical compromise where they must choose between technological depth and syllabus coverage. This mirrors the infrastructure-pedagogy gap identified by Nkula and Krauss (2014), who argue that intermittent connectivity leads to fragmented instruction, where the cognitive bridge intended by technology is frequently broken by technical instability. To move beyond ad-hoc usage, observations suggest a transition toward offline geospatial caches and predesigned GE Projects is necessary to ensure technical limitations do not dictate the pedagogical boundaries of the History classroom.

5. Conclusion and Recommendations

5.1 Conclusion

This study investigated the pedagogical practices employed by History teachers in secondary schools in Dodoma City, Tanzania, regarding the integration of Google Earth (GE) to teach historical sites. Guided by the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework, the study's observational findings demonstrate that Google Earth has successfully transformed the visual landscape of the History classroom, yet it has not fundamentally altered instructional power dynamics or pedagogical control.

Currently, Google Earth operates within a teacher-as-pilot model. The overwhelming dominance of teacher-led virtual tours (Strategy A1) and contextualization (Strategy A5) coupled with the near-total absence of student-led exploration (Strategy A2) indicates that educators utilize Google Earth as a sophisticated visual aid rather than an interactive, investigative inquiry tool. While this approach creates a powerful cognitive bridge that reconcile textbook accounts with realistic 3D landscapes, it leaves students as passive spectators, limiting their development of independent geospatial literacy and spatial reasoning.

Furthermore, a distinct visual engagement characterizes classroom implementation. Although the realistic 3D visualization triggers high attention and sparks critical thinking prompting students to ask analytical spatial questions it yields low student-to-student collaboration. Because instruction relies almost entirely on a single screen projected to a large class, classroom discourse remains strictly teacher-centered rather than fostering a social constructivist community of inquiry.

Finally, the sustainability of current pedagogical practices is severely threatened by a real-world technical-pedagogical gap. With an average of 15–20 minutes lost per 80-minute double period to internet rendering delays, device malfunctions, and missing street-view features, technical instability acts as a bottleneck to lesson flow. This time loss creates a major pedagogical risk, forcing teachers to choose between technological depth and syllabus coverage, thereby driving them back toward safer, textbook-based methods.

Generally, while History teachers in Dodoma demonstrate the technical capability and willingness to use Google Earth to enrich historical site instruction, their pedagogical practices remain constrained to teacher-directed illustration. Moving from passive demonstration to meaningful, inquiry-based learning requires a deliberate pedagogical shift supported by one-to-one or small-group digital access, offline geospatial caches, and structured, collaborative learning tasks.

5.2 Recommendations

1. Recommendations for Pedagogical Practice (History Teachers)

Teachers should move beyond passive visual demonstrations (A1) by structuring small-group or paired tasks where students directly interact with spatial data, even if on a rotation basis or using mobile devices to foster independent geospatial literacy and student-to-student collaboration (B3).

To bypass bandwidth constraints and prevent losing 15–20 minutes per lesson to image rendering (C1), teachers should create pre-downloaded Google Earth Projects, offline map caches, or static 3D spatial screen captures prior to class sessions to maintain instructional flow.

Teachers could pair Google Earth visuals with explicit inquiry tasks (e.g., comparative spatial analysis between trade routes or terrain features) that leverage the tool's ability to provoke critical thinking (B2) and visual evidence evaluation.

2. Recommendations for School Leadership and Educational Authorities

Ministry officials, school administrators, and teacher training institutions should offer targeted professional development that integrates Google Earth directly into History syllabus topics, local historical site inquiry, and curriculum objectives, rather than focusing solely on generic ICT skills.

Local government and educational managers should improve classroom hardware availability (e.g., dedicated projection units and small-group tablet/computer setups) to reduce reliance on single-screen teacher setups and out-of-pocket data expenses.

Curriculum developers at the Tanzania Institute of Education (TIE) should provide clear guidelines and time allocations within the History syllabus for incorporating digital spatial inquiry, easing teachers' pressure regarding exam-driven syllabus coverage.

References

Barton, K. C., & Levstik, L. S. (2004). *Teaching history for the common good*. Lawrence Erlbaum Associates.

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of literature. *Eurasia Journal of Mathematics, Science and Technology Education*, 5(3), 235–245.

Bodzin, A. M., Anastasio, D., & Kulo, V. (2014). Designing spatial learning environments with Google Earth and mobile technologies. In A. M. Bodzin, B. S. Klein, & S. Weaver (Eds.), *The inclusion of environmental education in science teacher education* (pp. 251–268). Springer.

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE Publications.

Byrne, D. (2022). A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*, 56(3), 1391–1412.

Cates, W. M., Price, B. J., & Jester, H. G. (2003). The technology integration cycle: Applying the 4Es model to educational software. *Journal of Technology and Teacher Education*, 11(1), 45–66.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.

Demirci, A., Karaburun, A., & Kilar, H. (2013). Using Google Earth in secondary school geography lessons: Quantitative and qualitative effects on students' academic achievement and attitudes. *International Research in Geographical and Environmental Education*, 22(2), 143–158.

Dewi, N. D., & Hariadi, S. (2024). Optimizing geospatial literacy: A qualitative exploration of Google Earth as an effective learning tool in primary and secondary education. *Journal of Education and Learning*, 13(2), 112–125.

Goodchild, M. F. (2018). Geographic information science and systems for environmental management. *Annual Review of Environment and Resources*, 43, 1–19.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist*, 42(2), 99–107. https://doi.org/10.1080/00461520701263368

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75–86.

Komba, A., & Shukia, R. (2023). *An analysis of the basic education curriculum in Tanzania: The integration, scope, and sequence of 21st century skills* (RISE Working Paper 23/129). RISE Programme.

Korstjens, I., & Moser, A. (2018). Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice*, 24(1), 120–124.

Leamnson, R. N. (1999). *Thinking about teaching and learning: Developing habits of mind with first-year college students*. Stylus Publishing.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.

Luo, L., Wang, X., Guo, H., & Liu, C. (2014). Virtual globes: History, evolution, and application in archaeological research. *International Journal of Digital Earth*, 7(5), 374–391.

Marr, J. (2020). Spatial reasoning and virtual globes in secondary education. *Journal of Geography*, 119(4), 135–144.

Mayer, R. E. (2004). Should there be a three-strike rule against pure discovery learning? The case for guided methods of instruction. *American Psychologist*, 59(1), 14–19.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

Ministry of Education, Science and Technology [MoEST]. (2023). *Basic Education Statistics in Tanzania (BEST): National trends and school participation rates (2019–2023)*. Dodoma: Government Printer.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.

Oyewale, G. M., & Familugba, J. O. (2021). The use of technology in teaching and learning history in secondary schools. *American Journal of Multidisciplinary Research & Development*, 3(6), 25–32.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533–544.

Patterson, T. C. (2007). Google Earth as a secondary education resource. *International Research in Geographical and Environmental Education*, 16(2), 145–152.

Pascu, M., & Duroisin, N. (2026). Students' perception of the pedagogical approach to geography teaching and learning through Google Earth Pro. *Forum Geografic*, 25(1), 58–74.

Petrisia, G., Widodo, J. P., & Wibowo, S. (2025). The effectiveness of interactive Google Earth-based media in teaching history at vocational high schools. *Santhet: (Jurnal Sejarah, Pendidikan Dan Humaniora)*, 9(2), 120–132.

Putra, A. K., Ragil, A. P., & Thang, H. V. (2025). Google Earth as a catalyst for spatial problem-based learning in enhancing spatial thinking skills. *Jurnal Penelitian dan Pembelajaran IPS*, 11(1), 45–58.

Ratinen, T., & Keinonen, T. (2011). Primary school student teachers' cognitive structures of global warming and the greenhouse effect in Google Earth learning environments. *Journal of Science Education and Technology*, 20(5), 551–567.

Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing & Health*, 23(4), 334–340.

Seixas, P., & Morton, T. (2013). *The big six historical thinking concepts*. Nelson Education.

Solem, M., & Gersmehl, P. (2005). Building capacity for spatial thinking in teacher education. *Journal of Geography*, 104(3), 109–118.

Solem, M., Huynh, N. T., & Boehm, R. (Eds.). (2013). *Learning progressions in geography education*. Routledge

Tate, N. J., & Jarvis, C. H. (2019). *Digital heritage and geographic information systems*. John Wiley & Sons.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2012). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research and Development*, 60(4), 555–575.

VanSledright, B. A. (2011). *The challenge of teaching historical analysis and thinking*. Routledge.

Wager, T. D. (2005). The neural bases of dual-process models of cognition. *Trends in Cognitive Sciences*, 9(10), 458–460

Yu, H., & Gong, J. (2012). Virtual globes: History, progress, and future applications. *Earth Science Informatics*, 5(2), 65–78.