SOFTENG 701 Theme 2 Project Report

[redacted]
Department of ECSE
University of Auckland
Auckland, New Zealand
[redacted]

I. Introduction

History Quest is an innovative educational application designed to enhance the learning of modern history for Year 9-11 students by integrating engaging, interactive, and theoretically grounded features. Drawing on the pedagogical frameworks of behaviourism, constructivism, connectivism, and cognitivism, the application creates a dynamic learning environment that balances structured guidance with exploratory and collaborative opportunities. By leveraging software engineering principles such as intuitive user interfaces, real-time feedback, and modular content delivery, History Quest fosters both factual recall and deeper conceptual understanding, aligning with secondary curriculum standards.

This report outlines the education design of History Quest, detailing how each learning theory is implemented through specific features such as gamified quizzes, historical timelines, and collaborative tools, all grounded in four major learning theories. The literature review synthesises key academic sources to justify the application's design choices, highlighting their relevance to effective educational technology. Subsequent sections will reflect on personal contributions to the project and experiences during its development, including the role of generative AI tools in supporting the process. Through this multi-faceted approach, History Quest aims to transform passive historical learning into an active, engaging, and collaborative experience, setting a benchmark for innovative educational software in the secondary history education space, as supported by pedagogical research and comparative platform analysis.

II. Literature Review

The design of History Quest, an educational application aimed at enhancing historical learning for Year 9-11 students, is informed by a robust theoretical foundation, chosen to comprehensively address diverse learning styles, instructional needs and technological affordances in digital pedagogy. This review synthesises key literature to support the pedagogical and software engineering principles underpinning History Quest's development, focusing on their relevance to creating an engaging and effective learning environment.

A. Behaviourism

Behaviourism emphasises learning through stimulus-response cycles and reinforcement, a principle central to History Quest's gamified features. Neuringer demonstrates that reinforcement-driven tasks enhance student responsiveness and variability in learning outcomes, validating behaviourism's efficacy in tertiary education [1]. This supports History Quest's use of immediate feedback in its Quiz and History Guesser features, where correct answers yield points and visual cues, as behaviourist reinforcement strengthens memory encoding by linking correct responses with positive stimuli. Similarly, platforms like Kahoot and Duolingo [2] [3] employ gamification to sustain engagement through points and real-time feedback, informing History Quest's leaderboard and scoring systems that encourage competitive yet rewarding learning experiences.

B. Constructivism

Constructivism advocates for active knowledge construction through exploration and interaction. Piaget's cognitive constructivism [4] and Bruner's discovery learning theory [5] emphasise learner-driven engagement, as seen in tools like Scratch [6], where students build understanding through creative exploration. History Quest's Timeline and Map tabs facilitate this by allowing self-directed navigation of historical events, enabling students to construct narratives through spatial and temporal exploration. Vygotsky's Zone of Proximal Development [7] and scaffolding [8] further inform the application's guided pathways and contextual prompts, which support learners as they develop independence in understanding historical relationships.

C. Connectivism

Connectivism views learning as a networked process of connecting information sources, particularly relevant in digital environments. Goldie [9] frames connectivism as combining technology and socialisation, a principle reflected in platforms like GitHub and Stack Overflow, which foster collaborative knowledge building. History Quest integrates connectivist principles through its Sources tab and Comments section, enabling students to access diverse perspectives and engage in discussions, creating a networked learning ecosystem with decentralised, user-driven communities. The Flat Classroom Project [10] illustrates how collaborative tools enhance global interaction, supporting History Quest's aim to foster peer-to-peer learning and critical thinking.

D. Cognitivism

Cognitivism focuses on internal mental processes, particularly how learners process, organise, and retain information. Information Processing Theory [11] posits that learning

involves guiding attention and structuring content to support memory encoding, a concept applied in History Quest's Timeline feature and Home Page, which present events in manageable, visually hierarchical segments. Cognitive Load Theory [12] highlights the need to minimise extraneous cognitive load, as exemplified by Khan Academy's structured history lessons [13], which use timelines and concise content to reduce complexity. History Quest adopts similar strategies by segmenting historical events and employing minimalist interface designs, ensuring students can focus on understanding without cognitive overload.

The integration of these theories in History Quest aligns with software engineering principles observed in educational tools like Khan Academy, Scratch, and GitHub. These platforms demonstrate the importance of intuitive user interfaces, real-time feedback, and networked systems, which History Quest adapts through modular content delivery, interactive features, and collaborative functionalities. The application balances structured learning (behaviourism and cognitivism) with exploratory and social elements (constructivism and connectivism), addressing the tensions between guided and autonomous learning. This hybrid approach ensures accessibility and engagement, aligning with curriculum goals for modern history education.

III. Educational Design

History Quest is designed to deliver an engaging and effective learning experience by integrating four key educational theories: behaviourism, constructivism, connectivism, and cognitivism. These theories are thoughtfully applied through specific features to accommodate diverse learning styles, fostering a dynamic environment where users can explore historical content interactively and meaningfully.

By combining immediate feedback, active knowledge construction, networked learning, and structured information processing, History Quest creates a robust platform that balances educational rigour with user engagement. This section explores how each theory is implemented through the application's features and their collective impact on learning outcomes.

A. Behaviourism

Behaviourism, which emphasises learning through stimuli, responses, and reinforcement, is a cornerstone of History Quest's design, particularly in features that provide immediate feedback and motivation.

The History Guesser feature, Figure 1, challenges users to estimate the locations of historical events, offering instant feedback through visual markers and precise distance calculations. A tolerance system deems answers within 50 kilometres as correct, providing positive reinforcement for approximations and reducing the discouragement associated with narrowly incorrect answers. The scoring system reinforces correct answers with points, while clear success/failure indicators provide immediate clarity, fostering a sense of achievement.

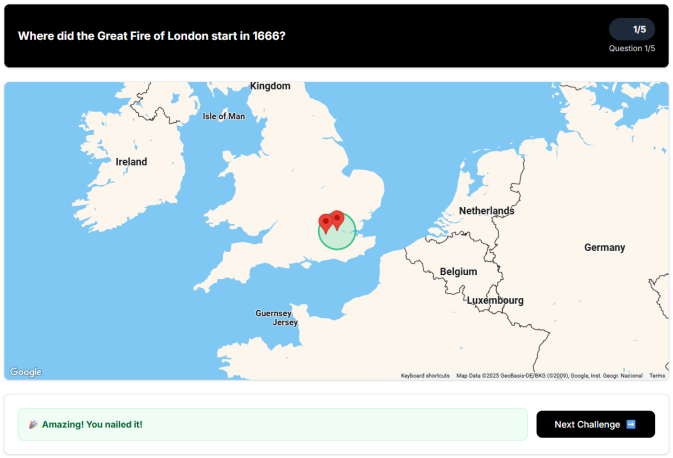

Fig. 1. History Guesser

Similarly, the Quiz feature, Figure 2, employs behaviourist principles by displaying green for correct answers and red for incorrect ones, accompanied by concise explanations to reinforce understanding. It tracks scores (points for each correct answer), records highest scores and attempts, and includes a progress tracking system to motivate sustained engagement.

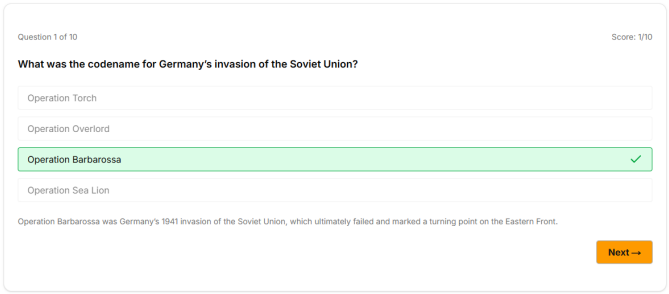

Fig. 2. Quiz tab for an Event

The Leaderboard, Figure 3, enhances this approach by introducing competitive motivation and displaying user rankings on a visual podium hierarchy. By highlighting the user's position and points, it reinforces achievement and encourages users to improve their performance, making learning both rewarding and engaging.

B. Constructivism

Constructivism, which posits that learners actively construct knowledge through interaction and exploration, is central to History Quest's design, particularly in the Timeline feature, a core component of the application.

The Timeline, Figure 4, enables active exploration by allowing users to navigate historical events at their own pace, clicking on specific points to explore content that interests them. This self-directed approach empowers learners to construct their own understanding rather than following a predetermined path, fostering personalised learning experiences.

The Timeline also provides scaffolded discovery by offering a chronological framework that supports learners as they

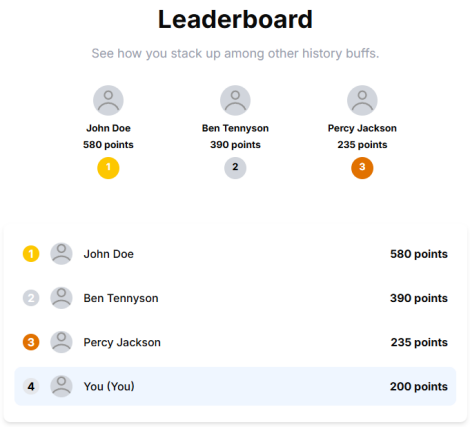

Fig. 3. Leaderbaord

uncover connections between events. By exploring relationships between historical moments, users construct a personal understanding of cause and effect, supporting curriculum outcomes related to historical reasoning, such as sequencing, causality and continuity and change. Contextual learning is further supported by presenting events within their historical context, enabling users to derive meaning from surrounding circumstances.

The visual representation of knowledge in the Timeline, including a progress bar showing movement through time, helps users construct mental models of historical progression, reinforcing temporal relationships.

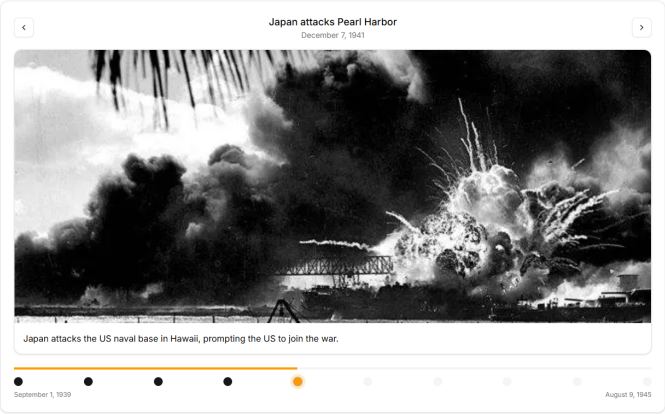

Fig. 4. Timeline tab for an Event

Additionally, the Map tab, Figure 5, complements this approach by providing spatial context for historical events. Its interactive map interface encourages active learning through exploration of geographical relationships, with visual representations of historical locations fostering a deeper, self-directed understanding of content.

C. Connectivism

Connectivism, which views learning as a process of connecting information sources and building knowledge networks, is integral to History Quest's social and exploratory features.

Fig. 5. Map tab for an Event

The Sources tab, Figure 6, provides access to a diverse array of primary and secondary sources, enabling users to explore multiple perspectives on historical events. This feature creates a networked learning environment where users can conduct deeper research, cross-reference information, and develop critical thinking skills by synthesising varied viewpoints.

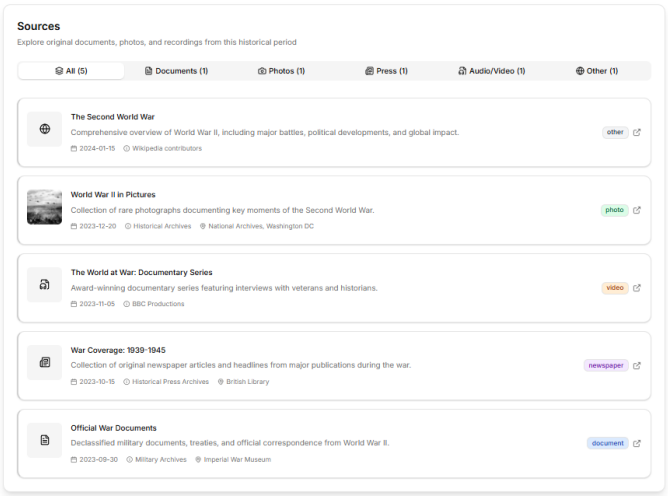

Fig. 6. Sources tab for an Event

The Comments Section further enhances connectivism by fostering social learning through user-generated discussions. Users can share insights, interpretations, and questions, creating a community of learners who collaboratively construct knowledge. Features such as likes and replies support dynamic discussion threads, encouraging engagement and the exchange of diverse perspectives.

By facilitating connections between users and information sources, History Quest cultivates a networked learning ecosystem that mirrors modern, technology-driven edu-

cational paradigms, while simultaneously promoting digital literacy, critical evaluation of sources, and respectful online communication—key competencies in modern education.

D. Cognitivism

Cognitivism, which focuses on how learners process, organise, and retain information, is evident in History Quest's structured content presentation.

The Home Page uses a clear visual hierarchy and presents content in manageable sections, featuring just two key events to avoid overwhelming users. This streamlined approach enhances usability by guiding attention and encouraging intuitive navigation, while the full list of events remains accessible on the dedicated Events page.

Similarly, the Details tab, Figure 7, breaks down intricate historical events into manageable sections, using structured layouts and comprehensive context to support cognitive processing. By presenting in-depth information in an organised manner, this feature helps users build mental frameworks for understanding historical narratives, reducing cognitive overload, and enhancing retention by facilitating more efficient storage and retrieval of related information.

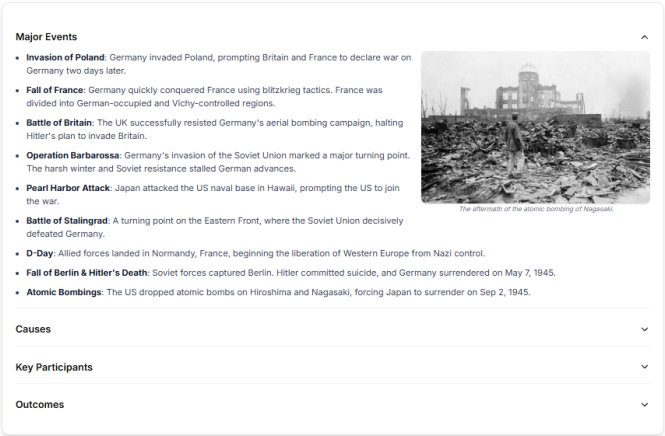

Fig. 7. Details tab for an Event

The Timeline feature also incorporates secondary elements of cognitivism to enhance learning. By breaking down complex historical periods into discrete, manageable events, the Timeline supports information chunking, aiding cognitive processing and memory formation. The chronological structure and visual representation of time passing further facilitate the development of accurate mental models of historical sequences, supporting cognitive processing of temporal relationships.

These design choices reflect a deliberate effort to align with how learners process and internalise information, ensuring an effective learning experience.

E. Integrated Multi-Theoretical Approach

History Quest's strength lies in its seamless integration of behaviourism, constructivism, connectivism, and cognitivism to create a holistic learning environment.

Behaviourist features like immediate feedback and scoring systems motivate users and reinforce learning outcomes. Constructivist elements, such as the interactive Timeline and Map tabs, empower users to actively construct knowledge. Connectivist features, including networked sources and discussion forums, foster collaborative and exploratory learning. Cognitivist principles ensure that information is presented clearly and logically, supporting effective processing and retention.

This multi-theoretical approach accommodates diverse learning preferences, making History Quest accessible to a wide range of users, from those motivated by competition to those who thrive on exploration or collaboration. The application's design demonstrates careful consideration of educational principles, resulting in an engaging, user-friendly interface that maximises learning impact. By blending these theories, History Quest not only facilitates historical understanding but also sets a standard for innovative educational application design.

IV. Personal Contributions

I believe I played a pivotal role in shaping History Quest's pedagogical framework through design discussions and research-driven proposals. Initially envisioned as a general K–12 history app, I proposed narrowing the target audience to Year 9–11 students after consulting with our lecturer. This was a critical turning point: these are formative years when students are introduced to history through social sciences, particularly under the Cambridge IGCSE History (0470) curriculum, which is globally recognised [14]. Refocusing the app's scope allowed us to align content and features with users' developmental stages and curriculum-specific learning outcomes, with a particular emphasis on modern history topics such as the World Wars.

My Part IV Project, which explored educational theories, served as a foundation for many of my contributions. Drawing on this research, I proposed the Sources feature, inspired by connectivist learning principles, to provide students with access to a range of primary and secondary sources, encouraging critical thinking and the development of networked learning. I also advocated for the Timeline tab, which enables non-linear, self-directed navigation of historical events, aligning with constructivist approaches to self-directed knowledge exploration.

In addition to pedagogical direction, I also influenced the user experience by advocating for a minimalist UI design. I proposed a clean, visually decluttered interface to enhance accessibility for a diverse user base, including students with limited digital fluency or learning support needs. This approach was grounded in Cognitive Load Theory and best practices from platforms like Khan Academy, where content is presented in manageable, intuitive formats.

A. Technical Contributions

I developed key components and established the project's technical foundation using Next.js and TypeScript, focusing on intuitive, educationally effective features:

- **Timeline Tab**: Built an interactive timeline with previous/next buttons, a visual progress indicator, responsive image displays, and smooth animations, supporting constructivist and cognitivist learning by enabling self-directed exploration and structured content delivery.
- **Sources Tab**: Enhanced source management with categorized types (documents, photos, press, audio/video) and icon-based navigation, improving usability and connectivist learning.
- **Home Page**: Added a background image and fixed navigation bar borders, card shadows, and buttons to enhance visual clarity and reduce cognitive load.
- **Project Infrastructure**: Set up the Next.js project with TypeScript, designed a modular component architecture, and configured the database for Timeline, Sources, and Details Tabs.
- **UI Enhancements**: Developed the `events[id]` page with a consistent design and optimized mobile experience for accessibility.

V. Personal Reflection

My experience with the History Quest project and the course has been both challenging and rewarding, offering valuable insights into educational software development and teamwork. This section reflects on my personal journey, the course's impact, and how the lessons learned will influence my future as a software engineer.

A. Course Experience and Project Dynamics

I found the project-based component of the course, centred on developing History Quest, more engaging than the first half (Theme 1). The project's clear expectations and specific, actionable feedback from our lecturer made it easier to understand requirements and iterate effectively. In contrast, Theme 1's assignments, while iterative to an extent with a single round of feedback, felt more theoretical and philosophical. The generalized feedback provided for these individual assignments made it harder to gauge progress compared to the detailed guidance during the project. A more iterative, project-based approach in Theme 1, with multiple feedback cycles and practical application, could replace abstract discussions, making the course feel more cohesive and engaging from the start.

However, the project's placement in the second half of the semester posed challenges due to time constraints, especially with overlapping commitments like the CAPSTONE project. The compressed timeline led to a rushed development process, limiting opportunities to refine the end product. I believe repositioning the project to the first half of the semester, leveraging the mid-semester break, would allow for more thorough development and iteration, resulting in a more polished application.

B. Relevance to Future Software Development

The course significantly shaped my understanding of software engineering, particularly in applying educational theories to design user-centred applications. Cognitivism and constructivism stood out as the most impactful concepts. Cognitivism, with its focus on managing cognitive load and structuring information, taught me how to create intuitive interfaces that enhance user comprehension. Constructivism, emphasizing active exploration, highlighted the importance of empowering users to build their own understanding. These principles are directly applicable to my future software development journey, where designing accessible, engaging, and structurally sound applications will be critical, whether in educational tools or other user-facing systems.

A key technical lesson was learning to create and manage data locally for History Quest, eliminating the need for a complex database system. This approach, which I hadn't previously considered, streamlined development and improved performance for features. It also provided a practical blueprint for a project boilerplate, offering a reusable structure for future projects. This insight into efficient data management and project setup will inform my approach to building scalable, maintainable applications moving forward.

C. Positive and Negative Points

The project fostered collaboration and allowed me to apply technical skills in a real-world context, such as building the Next.js infrastructure and optimizing the mobile experience. Working with my team to align features with modern history curricula was rewarding, giving me a sense of ownership and impact. The process of creating data locally was a highlight, as it simplified our architecture and sparked ideas for efficient project setups in the future.

However, the time pressure was a significant drawback, occasionally leading to compromises in feature refinement. This experience taught me the critical importance of effective time management and prioritization, skills I will carry forward into future projects.

D. Use of Generative AI Tools

As someone who excels at outlining ideas in bullet points but struggles with writing cohesive paragraphs, I leveraged generative AI tools (ChatGPT and Grok) in Theme 2 to refine my writing for reports and prototyping tasks. While I can recognise cohesive writing, crafting it is challenging, and AI tools helped transform my detailed bullet points into clear, structured paragraphs, avoiding repetition and maintaining a formal, academic tone. Below is an example of how I used these tools, including prompts and their refinement process.

1) Example 1 – Refining the Use of Generate AI Tools Section: The following is a list of points outlining the key ideas for a section of a report. Please expand on these points into a coherent, well-structured report section. The tone should be formal and academic. The section heading is Personal Reflection, feel free to create appropriate sub-headings.

- I personally struggle with writing cohesive paragraphs, but I am able to understand when paragraphs are cohesive
- I excel at writing out details into bullet points that I want to talk about

- I primarily use AI tools (ChatGPT, Grok) to refine my writing into clear cohesive paragraphs that avoid repetition
- I believe AI is useful for students such as myself that struggle with lengthy report writing as it allows us to plan a report, list out the details we want to talk about and form a well structured report with it
- albeit there are often times when AI will misrepresent your points, so proofreading is necessary, AI also tends to repeat itself if you keep repeating the same prompt as well so you have to be iteratively constructive with your prompts and editing the answer's you would get from AI.
- the prompts I would use would be something similar to the following

The initial output was overly verbose and repeated references unnecessarily. I proofread the given response and edited it to meet my needs, focusing on conciseness, resulting in a streamlined section that supports the report.

2) Example 2 – Prototyping with v0.dev: After brainstorming several ideas for our app, my team selected History Quest as the most viable concept. To kickstart our design process, I used v0.dev, a generative AI tool for front-end prototyping, to create initial wireframes and establish the app's visual look. My initial prompt to v0.dev was:

- History Quest: Subject Area: History Specific Topic: Historical events Target Grade Level(s): All Age groups Brief Description: Investigate historical events by exploring timelines or interactive maps. Chunks information into small interactive parts that visualise parts of an event. Educational theory used: Constructivism Cognitivism

The generated prototype provided a functional starting point for the events, through interactive and structured layouts. However, it lacked specific features like a leaderboard and navigation bar, which were critical for our design. I refined the design by adding iterative prompts:

- Can you also add a leaderboards page where it shows users with their total scores for all the quizzes or something similar?
- Add a navbar to the top with a user account.

AI tools like ChatGPT, Grok, and v0.dev were invaluable for students like me who struggle with lengthy report writing or face challenges in front-end design. For writing, AI transformed my bullet points into cohesive drafts, boosting my confidence in academic writing. For prototyping, v0.dev was particularly useful, as it helped overcome the common developer hurdle of deciding on a "perfect" look for an application. By generating initial wireframes and allowing iterative refinements, v0.dev accelerated our design process and provided a clear visual foundation. However, AI occasionally misrepresented details, such as overly complex designs in v0.dev or repetitive text in writing outputs, requiring careful proofreading and editing to align with my intent. This experience highlighted AI's potential to inspire rapid ideation while underscoring the need for human oversight to ensure accuracy.

VI. Conclusion

History Quest represents a significant step forward in educational software, delivering an engaging, curriculum-aligned platform for Year 9–11 students to explore modern history. By integrating behaviourism, constructivism, connectivism, and cognitivism, the application creates a dynamic learning environment that balances structured guidance with exploratory and collaborative opportunities. The Literature Review underscores the theoretical foundation of these design choices, drawing on established pedagogical research and comparative analysis of platforms like Khan Academy, Scratch, and GitHub to validate History Quest's approach. The application transforms historical learning from a passive task into an engaging, student-centred experience through features like quizzes, timelines, collaborative tools, and structured content delivery, fostering factual recall, critical thinking, and networked learning. The design reflects a deliberate synthesis of educational theory and software engineering practices.

My personal contributions to the project, from proposing a focused target audience to implementing key technical components, were instrumental in shaping History Quest's pedagogical and user-centred design. The development process, supported by insights from my Part IV Project and tools like v0.dev, highlighted the value of iterative design and efficient data management, which streamlined the application's architecture. Reflecting on the course, the project-based approach of Theme 2 was more engaging than Theme 1's theoretical assignments, though time constraints posed challenges to refinement. The use of generative AI tools proved invaluable for prototyping and writing, accelerating ideation while requiring careful oversight to ensure accuracy.

Ultimately, History Quest stands as a compelling example of how educational theory, thoughtful design, and technical execution can come together to support meaningful learning, offering valuable insights for future projects in educational software development.

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