Exploring the Transformative Potential of Virtual Reality in History Education: A Scoping Review

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Abstract. This paper reviews serious games and Virtual Reality (VR) integration into teaching and learning. Serious games are educational video games designed to engage users and improve learning outcomes. VR technology provides an immersive virtual space that enhances learning experiences through visual, auditory, and tactile modes. Mobile games offer portability, allowing students to access educational content and learn outside traditional in-person classes. The integration of serious games and VR has the potential to provide immersive and engaging learning experiences. The paper specifically focuses on the effects of VR and mobile games in history education. It explores how these technologies enhance history learning, provide personalised and smart learning experiences, and improve learning enthusiasm and academic performance compared to traditional teaching methods. The paper follows a scoping review methodology to explore the potential of VR and mobile educational games to facilitate learning history and provide smart or personalised history learning. The findings indicate improved learning enthusiasm and academic performance compared to traditional teaching methods.

Keywords: Virtual Reality · History Education · Scoping Review · Serious Games · Games in Education

1 Introduction

This scoping review aims to systematically explore and synthesise existing literature on the impact and challenges of incorporating Virtual Reality technology into history education, to identify gaps and future directions for research in

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this emerging interdisciplinary field. Studying history is an important human social practice activity that captures the past and allows individuals to reflect on their identity and cultural heritage. However, it is a fact that history cannot be repeated or experimented upon, making it challenging to experience firsthand [23]. Therefore, history teaching relies heavily on teaching aids such as words, images, and movies to visualise abstract concepts and materialise general information [12]. Language descriptions, in particular, play a significant role in transforming historical knowledge into vivid pictures of life, enabling students to indirectly know or perceive history [5,15]. This approach creates an ideal creative space for developing students' imagination and cultivating their image thinking, which allows them to understand the past more profoundly and engage in critical analysis and interpretation [15]. History is a subject that encompasses a broad range of knowledge, information, and events, which can make it challenging for students to engage and maintain interest [23]. The complex background and numerous characters involved in historical events can make it difficult for students to comprehend and contextualise the presented information. Unfortunately, this can lead to a lack of motivation to learn history. Therefore, it is essential to systematically and innovatively approach history teaching to enhance student learning experiences and improve their engagement and motivation [36]. Systematic teaching is equally essential in history teaching. Teachers should organise their teaching materials and methods to ensure that students can follow the logical sequence of historical events and understand the relationship between them. This approach can help students better understand the historical narrative and make it easier to remember and retain information [23]. Innovative teaching methods can help to make history lessons more exciting and engaging for students. Teachers can use multimedia, simulations, and interactive activities to enhance students' understanding of historical events and promote their critical thinking skills [36]. One of those innovative ways of teaching history is the use of virtual reality (VR).

Furthermore, using VR technology in history teaching can enhance students' understanding of historical events by creating immersive and interactive learning experiences. VR technology can simulate historical environments, allowing students to experience history firsthand and understand the context in which events occurred. For instance, students can visit historical sites and monuments virtually, allowing them to observe and interact with objects and artefacts that may not be readily available to them in their physical learning environment. This approach can help students better understand the cultural significance of these objects and how they relate to historical events. In addition to enhancing students' understanding of history, VR technology can also help to develop their critical thinking and analytical skills. Students can explore historical events from different perspectives, enabling them to develop empathy and understand the complexities and nuances of historical events [22]. They can also engage in problem-solving activities and decision-making scenarios, allowing them to apply their knowledge of historical events to real-world situations. Moreover, VR technology can create an ideal environment for project-based learning, where stu-

dents can collaborate to develop their historical narratives and explore different historical events and scenarios.

Despite the potential benefits of VR technology in history teaching, some challenges must be addressed. The cost of implementing VR technology in the classroom is a significant challenge for many schools and educational institutions. While the cost of VR technology has decreased in recent years, it remains relatively expensive compared to traditional teaching methods. Additionally, VR technology requires specific hardware and software, which may not be readily available in all schools or require significant investments. This can limit the accessibility of VR technology in history teaching, particularly for schools with limited resources. Another challenge is the lack of standardisation and guidelines for developing VR content for educational purposes. Therefore, developing a comprehensive framework for VR technology's practical use in history teaching is essential to ensure that it is accessible and affordable to all students and is aligned with curriculum standards and educational goals.

2 Literature Survey

VR technology has the potential to revolutionise teaching and learning by creating immersive and engaging learning experiences for students. One of the critical benefits of VR technology is that it allows teachers to use 3D models to demonstrate the content to the students, enabling them to have a more intuitive understanding of the teaching content and realise abstract concepts [10]. Moreover, applying VR technology in teaching activities can go beyond creating virtual teachers, virtual labs, and virtual classrooms. It can also create virtual environments where students can explore and learn about related issues [1,30]. This way, complex historical facts can be visualised in a virtual environment, enabling students to obtain more information through self-experience in virtual vision and virtual feeling. This facilitates student behaviour and enthusiasm in the learning process and enhances their retention of historical knowledge [21,29]. Using VR technology, students can step into historical scenes and interact with them as if they were there. This provides them with a unique opportunity to learn about historical events in a way that textbooks and other teaching materials cannot provide. For example, students can virtually visit historical sites, walk around, and explore architecture and other historical details. They can also see how people dressed, interacted with each other, and lived in that era, which can help them better understand historical events. The popularity of mobile games, particularly among teenagers, has increased due to the rapid growth of mobile media. Mobile devices provide a convenient and portable platform for mobile learning, enabling learners to access educational resources anytime, anywhere. The flexibility offered by mobile technology allows for personalised learning experiences and greater control over the learning process. Research suggests that mobile games can enhance learning motivation and engagement, particularly in history education [11]. Mobile games' immersive and engaging nature contributes to increased student interest and improved learning outcomes. Additionally, mobile games provide a context-specific learning environment, allowing

learners to play and learn in similar settings. Overall, mobile games can potentially improve the effectiveness and efficiency of education.

The work in [32] discusses a meta-analysis of 21 experimental studies on the impact of virtual reality (VR) on learning outcomes in K-6 students. The studies show that VR enhances learning outcomes compared to control conditions, with an effect size of 0.64. The effect is even more significant when immersive VR is used, with an effect size of 1.11, compared to semi-immersive and non-immersive systems. The positive effect of VR does not depend on educational level or knowledge domain. Short interventions, less than two hours, were more effective than longer ones. While meta-analysis provides valuable insights into the impact of virtual reality on learning outcomes, there are a few potential criticisms of the work, such as the limited sample size. The meta-analysis only included 21 experimental studies, which may limit the generalisation of the findings.

The work in [7] explores the use of Immersive Virtual Reality (IVR) technology as a remote teaching tool for educational institutions, focusing on teaching architectural history using the Pantheon in Rome as a test case. The study involved two assessments with 57 and 68 students, respectively. It evaluated five independent variables related to learning about architecture, history, sense of presence in VR, structural realism, and comparison to in-class learning. The findings suggest that IVR technology in teaching architectural history provides an excellent learning experience, allowing students to accurately gauge, recognise, and appreciate virtual spaces' 3D aspects, size, and proportion. While the sample size is better than that in [32], Generalisability is a concern. The study only focuses on one test case, the Pantheon in Rome, which may limit the Generalisability of the findings to other historical sites or architectural styles. Further research would be necessary to determine the effectiveness of IVR for teaching a more comprehensive range of architectural history topics.

The work in [14] found that immersive technology, specifically Virtual Reality (VR), positively correlates with positive outcomes such as increased excitement for learning, motivation, deeper learning, and long-term retention. Students reported deeper learning with VR compared to other media or engagement strategies. The study recommends providing professional development for faculty and students to lower the barriers to entry, being flexible in designing learning options for students, making learning exciting and building community, and adopting VR technology for more assignments or in their classrooms. The study also found that students and faculty members are generally open to using VR technology, and its adoption can benefit education.

The work in [24] explores the potential of gamification in historical education and its impact on developing critical professional competencies. An experimental study was conducted with forty students who participated in a 3-month online learning course called "Technology for Constructing Historical Interpretations" using gamified learning techniques. The study found that gamification led to the acquisition of practical knowledge and allowed learners to acquire skills highly relevant to professionals of the 21st century. The results suggest that gamification in history education positively affects the evolutionary development of a

personality adaptive to the socio-economic conditions of the 21st century. One limitation of this paper is that no quantitative assessments confirm the effectiveness of gamified learning in history education. As a result, future research should focus on developing assessment tools to demonstrate the effectiveness of gamified educational practices.

Finally, the work in [6] used the Technology Acceptance Model (TAM) to analyse students' acceptance and intention to use AR and VR technologies in university teaching. They found that using AR and VR objects in teaching aroused great interest among the students, and they expressed a high degree of acceptance of the technologies utilised. AR and VR objects' design and usability were also noted to be essential for their acceptance. The study found no significant differences in acceptance between the AR and VR objects used, suggesting that students perceived participating in a mixed reality experience, drawing no distinctions between both resources. However, the authors note that the study's small sample size and absence of a control group are limitations. The concern about this study is how inclusive the findings are. The study sample is not large enough to generalise the findings, and it needs to include more diverse participants.

3 Research Methodology

3.1 Research Objectives

In this study, the authors followed a scoping review methodology proposed in [2] to explore the potential of VR and mobile educational games to facilitate learning history and provide smart or personalised history learning. A scoping review aims to provide an overview of the existing research literature on a particular topic, research question or concept without necessarily attempting to answer a specific research question [2]. Scoping reviews are often used to map out the breadth and depth of a particular area of research, identify gaps in the existing literature, and help to inform future research agendas [18,31]. Unlike a systematic review or a meta-analysis, a scoping review does not usually assess the quality of the studies included, nor does it attempt to synthesise the results of those studies. Instead, it focuses on identifying the key concepts, definitions, and methods used in the literature and presenting a descriptive summary of the available evidence. The scoping review process typically involves a systematic search of the literature, screening of articles for relevance, and data extraction and synthesis. The results of a scoping review may be presented in various formats, including tables, diagrams, and narrative summaries.

The study aims to investigate (1) what ways can the use of VR and mobile educational games facilitate learning history? and (2) Do VR and mobile educational games provide smart or personalised history learning? VR technology has been valued in teaching for its ability to create a more immersive and engaging learning environment. In history education, VR technology and mobile games have significant educational value due to the vast number of knowledge points on the subject and the difficulty of vividly imparting knowledge of buildings and

events to students. To answer the first research question, the study will investigate the methodology of applying VR technology and mobile games in history education, the types of interventions used, and the interactions between the participants during the intervention. The second research question will explore the application and limitations of VR technology and mobile games in the smart learning of history education. The study will examine how VR technology and mobile games can provide personalised history learning experiences and enhance the efficiency and effectiveness of history learning.

In this study, the authors employed a systematic literature review approach to screen and select relevant literature using publication year and keywords as criteria. This enabled them to examine the field of study comprehensively, identify recent publications, and focus on the most relevant sources. The literature analysis allowed them to understand the field's development and identify research status, hotspots, and future directions. This knowledge can aid researchers in developing proposals and finding potential areas for collaboration. The approach provided a clear overview of the field's development and facilitated informed decisions regarding future research.

This study's search for relevant literature was mainly conducted using Google Scholar. The search terms for the two groups of search categories were determined by combining subject terms with free words. For VR, the search terms included "History AND Game", "History AND Education", and "History AND Learning". For mobile games, the search term was "History". The increased availability and affordability of VR technology since 2014 has led to its widespread adoption in various fields, including education, resulting in a surge of interest and research on its application in educational settings. Thus, the time range for this study was limited to 2018 to 2022. The search strings were: "VR: History AND Game, History AND Education, History AND Learning" and "Mobile game: History" using Google Scholar. Google Scholar is a comprehensive tool to search multiple disciplines (i.e. education, gamification, etc.) that requires a broad search across various fields.

To ensure the inclusion of only relevant literature, the study applied exclusion criteria, including removing duplicates and articles written in languages other than English, excluding non-national history topics like architectural or art history, and using advanced search options on Google Scholar to filter articles by title. The search strategy found 34 articles, from which 29 were screened for relevance, and 12 were ultimately excluded for not being pertinent to the topic. The next step involved assessing the eligibility of the remaining 17 articles using the defined criteria. A full-text review was conducted, and five articles were removed, leaving 12 articles for the scoping review. The selection process for this study is presented in Fig. 1, which provides a visual representation of the search strategy and selection criteria used to identify relevant articles for the scoping review. This process ensured that only articles that met the study's eligibility criteria were included in the final analysis.

Table 1 provides a detailed breakdown of the study selection process for different keywords. The table illustrates the number of articles found for each

keyword, the number of duplicates, and the number of articles excluded based on their irrelevance or failure to meet the eligibility criteria.

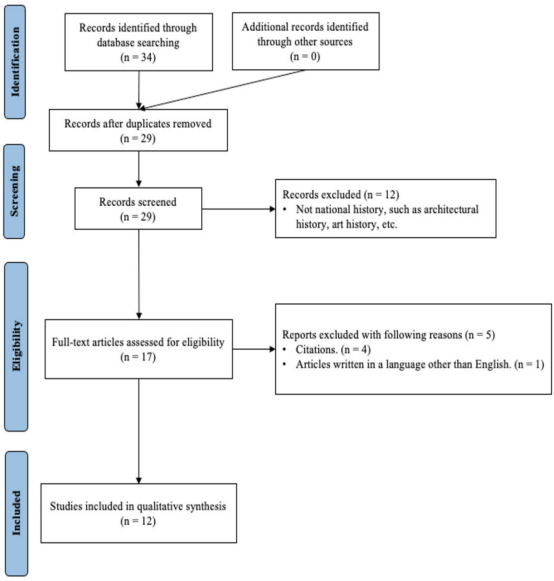

Fig. 1. Literature Screening and Selection flowchart

The data extraction process is a crucial step in systematic reviews of educational games, involving downloading the full text of selected articles and extracting relevant information such as publication year, history content, participant demographics, data collection methods, experiment methodology, and critical findings. This data is essential for understanding the effectiveness of educational games in promoting learning and identifying patterns and trends in game design, evaluation, and effectiveness across different contexts. The extracted data from systematic reviews of educational games can serve multiple purposes: guiding the development of experimental protocols, informing the design and evaluation of future games, and ensuring a systematic and rigorous approach to promote learning and enhance the quality of educational games. Researchers can develop robust protocols for evaluating these variables by identifying key variables associated with successful outcomes. Critical findings about users' games and learning experiences also help design more engaging and effective games. This comprehensive approach contributes to advancing educational game design and evaluation, ultimately improving learning outcomes.

4 Results Discussion

After the screening, 12 articles were chosen for a scoping review. The selected articles were published over the past 5 years. The selected articles' analysis

Table 1. Article Inclusion and Exclusion

Search Terms	Total Articles (%)	
	Collected	Excluded
VR AND History AND Game	6 (23.08)	2 (11.76)
VR AND History AND Education	6 (23.08)	3 (17.65)
VR AND History AND Learning	14 (53.84)	7 (41.12)
Sub-Total	26 (100)	17 (100)
Mobile game AND History	8 (100)	4 (100)
Sub-Total	8 (100)	5 (50)
Total	34 (100)	22 (61.76)

showed no clear trend in the number of relevant articles published over the past five years. In most years, a similar number of relevant articles were published. In 2018, 4 relevant articles (33%) were published, while in 2019, 3 relevant articles (25%) were published. In 2020, only one relevant article (8%) was published. However, in 2021, the number of relevant articles published increased to three again (25%). Overall, based on these data, it can be concluded that there is no significant upward or downward trend in the number of relevant articles published over the past five years.

The total number of participants across all studies included in the analysis is 598. Figure 2 depicts the participants' educational backgrounds. Out of these, 495 participants have age information available. Among those with age information, 153 participants (31%) fall within the age range of 8–12 years old, while 342 participants (69%) fall within the age range of 13–34 years old. The studies also included participants from diverse backgrounds, from primary school to undergraduate level. Out of the 500 participants with information on educational level, 171 (44%) were elementary school students, 50 (13%) were junior high school students, 66 (17%) were high school students, and 105 (26%) were college students. Overall, the findings suggest that the studies included in the analysis recruited participants from a wide range of ages and educational backgrounds, providing a diverse sample for the experiment and assessment.

Participant demographics are essential to any study as they provide a better understanding of the study sample and its characteristics. In the present study, as Table 2 shows, gender information was not reported in nearly half of the studies included in the analysis, which limits the ability to draw accurate conclusions about gender differences in the study findings. However, among the studies that did provide gender information, 143 participants were male (42%), and 197 were female (58%). This unequal gender distribution may impact the study findings and should be considered when interpreting the results. In terms of the distribution of the total number of participants across the included studies, it was found that 7 out of 11 experiments had a sample size of 5–50 participants (64%), three experiments had a sample size of 66–98 participants (27%), and 1

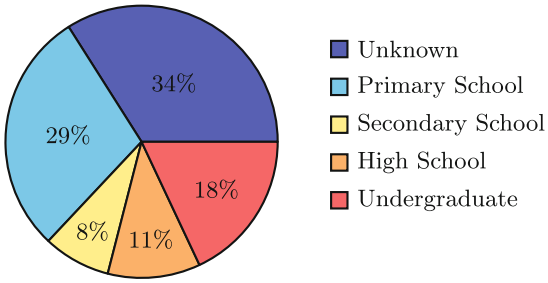

Fig. 2. Pie chart showing the educational background of participants

experiment had a sample size of 160 participants (9%). This variation in sample size across studies may impact the study findings and should be considered when interpreting the results.

Table 2. History content involved and participants' data

ID	History content	Participants (Male, Female)
[16]	Greek myth	28 primary school students
[26]	Madurese history and alphabet	29 3-rd grade students, 5 teachers
[35]	Kaaba related to Islam History	25 undergraduate students (M = 12, F = 13)
[33]	The Roman Civilisation (Augusta Emerita)	98 pupils aged 9–10, coursing fourth year of Primary Education (M = 53, F = 46)
[28]	History of the Netherlands	16 kids from class 7 and 8 of the Mariaschool in Beuningen (M = 9, F = 7)
[25]	Battles between the Japanese and Australian forces over the Australian territory, Papua, during World War II	80 undergraduate students from a university in Southern California (M = 19, F = 61)
[27]	History and life in Ancient Rome	50 first-year Secondary School students (M = 27, F = 23)
[8]	History of the Ningbo Sanjiangkou Site and heritage objects	160 undistinguished participants
[13]	–	–
[20]	History of the town of Kemijärvi, Northern Finland	5 children (M = 0, F = 5)
[17]	King Ludwig II	36 teenagers who stayed close to the starting point of the game (Max-Joseph-Platz; Munich)
[9]	Chinese history (Qing dynasty)	66 high school students (M = 24, F = 42)

4.1 Investigating the Research Questions

How do the use of VR and mobile educational games facilitate history learning? All reviewed articles' experiment results and primary findings have been compiled and summarised in Table 3. According to Table 3, most students who participated in the VR game-based learning experience had a positive overall experience. The students perceived the VR games used in these studies as simple, practical, and innovative. Additionally, younger participants, in particular, were found to be excited about the prospect of learning history through VR games. They showed great interest and curiosity in the game elements and characters, as highlighted in [8] and [20]. This level of engagement stimulates their enthusiasm for learning and helps to keep them motivated throughout the learning process.

Moreover, the results of various studies indicate that students who use VR or mobile games for history learning are more effective in acquiring content covered in the lesson and demonstrate a statistically significant improvement in their test scores compared to students taught through traditional methods based on a coursebook. Studies in [27] and [17] highlight this finding. Participants in these studies noted that using VR technologies for history learning removed negative biases they may have had towards history courses, making the learning process more enjoyable, as also noted in the study in [35]. Furthermore, VR technology benefits students' learning experience and brings convenience to the broader public. This is particularly true for individuals who face physical or financial barriers to accessing historical locations. Elderly people or people with walking disabilities may find it challenging to visit destinations physically, but VR technology allows them to explore and experience such locations virtually. The study in [35] noted this aspect, where participants acknowledged that the technology offered opportunities to visit destinations they could not otherwise go to.

Do VR and mobile educational games offer personalised and smart history learning experiences? To answer whether smart or personalised learning was provided to participants in the studies reviewed, experiment methodologies were extracted and summarised in Table 4. However, upon further analysis, it was found that none of the 12 articles in the scoping review offered personalised learning. To explore this topic further, a similar search strategy was used, focusing on the keywords "personalised learning", "VR", and "mobile games" in recent articles on Google Scholar. The search results revealed that most personalised services are geared towards providing users with recommendations, such as advertisements or rehabilitation training. Only a few articles were found related to personalised history learning in education.

The study in [3] introduced a mobile app called JuJu English Vocabulary to improve learners' vocabulary acquisition using the Keller Plan Personalised system of instruction theory. The app was tested in a quasi-experimental study

Table 3. Summary of studies' findings

ID	Summary of findings
[16]	The VR game was considered simple, practical, predictable, and appropriate, with a stimulating, innovative, and valuable game environment.
[26]	The feasibility study results showed the feasibility level in effectiveness, efficiency, and attractiveness. The game also functioned as a strengthening of the learning material for students.
[35]	Participants felt a part of the environment and felt present in the exact location. Besides, participants also stated that VR technology-facilitated learning by providing enjoyable learning environments and interesting content.
[33]	Results showed that students who used VR for history learning had a statistically significant improvement in their test scores compared to those taught through the traditional method based on a coursebook.
[28]	–
[25]	Immersive environments may create excessive positive emotions and distraction, distracting the learning engagement in appropriate cognitive processing of the information. Learners performed worse after viewing the immersive VR (IVR) lesson than the video lesson on transfer questions.
[27]	AR app group has more excellent grades and more high-achieving students. The performance statistics show that almost half of the students in this group have absorbed most of the concepts they were taught.
[8]	Both age and education level impacted the gaming experience. Younger participants were relatively quick to adapt to VR technology. Participants with relatively high levels of education pay more attention to the potential in learning the game's history but learn less during the process.
[13]	-
[20]	Game elements and details that make game characters interesting are important to keep children engaged. The results of the end quiz showed that participants remembered information about historical figures well.
[17]	Participants who used a combination of the smartwatch and a mobile game answered most questions correctly. Most participants believed the mobile game and the smartwatch were easy to understand and use.
[9]	Results indicated a significant improvement in students' performance in history learning after playing the mobile game. Additionally, after the gameplay, students learned more about the relations between characters and events.

involving 60 participants, and the results showed improved performance in the post-test for the experiment group compared to the control group. However, the article did not explicitly mention the advantages and benefits of personalised services. Another work in [34] proposed an architecture for an adaptive recommendation model of online learning resources. Through data analysis, the author

Table 4. Summary of studies' experiment methodology

ID	Method	Participants' task/interaction
[16]	Students played "Trials of the Acropolis" after an introduction to the game and technology, wearing cardboard and earphones	Game lasted 15 mins, with 3 required trials.
[26]	Users explored Sumenep Palace Museum's historical relics in "Halo Madura" game, using VR Box and controller to move around.	Users can read information about historical objects in Madura upon approaching them.
[35]	Participants had flexible study opportunities using VR glasses and rotating chairs, with no time limits.	Participants learned about Kaaba in Islamic history education using audio and visual content. They interacted with information points and walked around to obtain audio information.
[33]	Pupils in the VR group observed examples of Roman Augusta Emerita's houses using VR glasses and VirTimePlace app, while the control group used the coursebook with images on paper. The session lasted 45 min	Participants virtually toured Roman Augusta Emerita to observe its representative houses and buildings.
[28]	Participants received Oculus Go headset with an installed application and used it while communicating with the supervisor	TParticipants verbally communicated their location in the application to the supervisor by reading their surroundings aloud.
[25]	The IVR group used a hand-held controller to experience an academic history lesson called Kokoda VR, while the video group used a mouse. Both groups had a 22-min session.	The IVR group used a hand-held controller to interact with objects, walk in a small space and view objects from different angles, while the video group used a mouse and had a stationary perspective without interaction.
[27]	AR group: 60-min lecture + 30-min AR game session. Traditional group: 60-min lecture + 30-min independent study.	Participants could design a city or use a pre-designed city during the gameplay, explore existing buildings in first-person mode, and read historical information scrolls in each building.
[8]	The time limit was set to 8 min per group of paired players carrying out their roles (merchant and post officer) after a brief site exploration	Virtual experiments reset for new groups. The merchant starts with default object positions, and the port officer interacts with the environment the merchant has changed.
[13]	-	-
[20]	Students received an interactive prototype of mobile UI via Marvel App. Three 15-min test sessions were conducted	Participants acted as 1920s postmen, delivering invitations to historical figures in Kemijärvi. VR/AR provided character and building info during gameplay.
[17]	Group 1 downloaded the game via a Wi-Fi hotspot and received smartwatches with lights. Group 2 downloaded the game but without smartwatches. Group 3 downloaded a pdf information sheet from a Google Drive link and read it	Participants received info and instructions at each station. Correctly answering questions earned 'Guldens' (15 points). Trophies were collectable, some requiring a specific number of 'Guldens'.
[9]	The experiment lasted 90 min (10 min intro/pretest, 50 min gameplay, 10 min posttest, 10 min questionnaire). 8-in mobile devices had the game system preloaded	The mobile game had 5 events and 50 figures. Participants entered the number of figures in each event into limited answer slots

found that continuous personalised and fragmented online learning improved learners' levels and cognitive abilities to varying degrees. The article concluded that online learning based on mobile devices is feasible and effective when using the construction model of personalised fragmented resource recommendation scenarios.

As for VR, very few articles were found related to personalised learning. The work in [19] introduced software for training users to inspect construction sites for potential hazards using personalised VR training scenarios synthesised through an optimisation method based on user training preferences and target training time. User research validation found that personalised guided VR Training can improve the user's construction hazard inspection skills more effec-

tively. In conclusion, personalised learning is beneficial in education. However, personalised services are primarily used in business, and their application in education, especially in educational games, is still limited. Although some articles are related to personalised learning in education, further research is needed to explore its potential benefits and drawbacks.

To better understand the participants in these studies, an exploratory data analysis was conducted to visualise their demographics, such as their gender, age, and educational background. Statistics showed that in experiments with known participant age information, most average ages were between 13 and 34 years old (69.1%). The age range of all participants was 8–34 years, indicating a lack of research on the older population. The exploratory data analysis also revealed almost no gender bias across the studies, as the gender ratio of males (143) to females (197) was almost the same. Interestingly, elementary (171) and undergraduate (105) students accounted for 46.2% of all participants, highlighting the need for a more diverse sample set for conclusive proof of the presented results. In 2008, the Australian government signed the Melbourne Declaration on Education, which stated that the educational goals included "promote personalised learning that aims to fulfill the diverse capabilities of each young Australian" and "all young Australians become successful learners, confident and creative individuals..." [4]. This document illustrates that personalised education is a significant area of education reform. However, due to the complexity of personalised services, personalised education has not been applied to VR and mobile educational games on a large scale, especially in the history curriculum. Therefore, existing games cannot provide students with personalised content, timely support, and feedback.

5 Conclusion and Future Work

Most studies in this literary analysis utilised design concepts, theories, and models to evaluate VR and mobile games, demonstrating positive effects on history learning. However, one experiment in [25] indicated lower cognitive engagement and academic performance with immersive VR technology. These inconsistent findings highlight the early stage of VR's application in history education, prompting further research and critical thinking. The experiments reviewed had a limited sample size (598 participants across 11 experiments), with a significant number of experiments (54.5%) involving fewer than 36 participants. This indicates the need for stronger reliability and consistency in the conclusions drawn. Further improvements and development are necessary in the application of VR and mobile games in history education, including determining appropriate game modes for different historical content.

When interpreting the results of this review, it's important to consider limitations for future work. The search strategy only included articles from Google Scholar, potentially excluding relevant articles from other databases. Additionally, the search was limited to keywords in article titles, potentially missing relevant articles. Future reviews should expand the search to include additional databases and broaden the search terms.

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