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Immersive Storytelling in Social Virtual Reality for Human-Centered Learning about Sensitive Historical Events

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Abstract: History is a subject that students often find uninspiring in school education. This paper explores the application of social VR metaverse platforms in combination with interactive, nonlinear web platforms designed for immersive storytelling to support learning about a sensitive historical event, namely the Asia Minor Catastrophe. The goal was to design an alternative method of learning history and investigate if it would engage students and foster their independence. A mixed-methods research design was applied. Thirty-four (n = 34) adult participants engaged in the interactive book and VR space over the course of three weeks. After an online workshop, feedback was collected from participants through a custom questionnaire. The quantitative data from the questionnaire were analyzed statistically utilizing IBM SPSS, while the qualitative responses were coded thematically. This study reveals that these two tools can enhance historical education by increasing student engagement, interaction, and understanding. Participants appreciated the immersive and participatory nature of the material. This study concludes that these technologies have the potential to enhance history education by promoting active participation and engagement.

Keywords: storytelling; virtual reality; social virtual reality; metaverse; twine; spatial; Asia Minor Catastrophe; history education; sensitive history; educational textbooks

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1. Introduction

History is a subject that students in many countries often find uninspiring [1]. In the realm of school education, history course books at all levels have long been renowned for their weightiness; there are not a few people who have characterized them as bricks, laden with the weight of historical insights and narratives [2]. Despite their voluminous content, these tomes are often reluctantly opened by students across the educational spectrum. Whether at primary or tertiary levels, the allure of history lessons can occasionally pale in comparison to their more immediately applicable counterparts. Nevertheless, the undeniable truth remains; history serves as a potent compass, guiding us away from the pitfalls of repeating the mistakes of the past.

In a rapidly evolving educational landscape, the drive to embrace progressive teaching methodologies and integrate cutting-edge technologies stands as a pivotal avenue for transforming the overall history learning experience. Central to this ambitious endeavor is the shift away from conventional, instructor-centric pedagogies toward the dynamic realm of student-centered practices. The emergence of immersive technologies, notably VR and AR, presents an unprecedented opportunity to breathe new life into the teaching and learning of history as it enables the visualization and virtual experience of the past [3,4]. These technologies, while capturing the imagination, are not mere novelties; they can serve as powerful tools in an instructor's arsenal, enriching the educational journey in ways that were previously unattainable through active learning methods such as storytelling [5].

This study is firmly grounded in the fact that stories, woven into the fabric of history, deserve platforms that transcend the confines of traditional teaching and learning

methodologies [6]. By leveraging the potential of interactive course e-books, learners are granted the unique opportunity to craft an immersive, multidimensional portal to the past. The aim of this paper is to study whether it is possible to enhance history teaching by integrating interactive, student-centered learning methods with the support of immersive technologies. In this context, this study aims to commemorate the stories of those affected by a sensitive historical event, the Asia Minor Catastrophe, through an interactive course book and a virtual classroom, empowering learners to engage actively with history and connect with their heritage.

2. Background

2.1. Virtual Reality in Education

Recent hardware and software breakthroughs enabled the emergence of the field of spatial computing and the metaverse based on extended-reality technologies, which includes virtual reality (VR), augmented reality (AR), and mixed reality (MR) [7,8]. VR is the computerized 3D cosmos in which the users interact as they do in real life by promoting the use of human senses including sight, touch, and sound [9]. Education has become one primary application field of immersive technologies [10]. Through multimedia or interactive whiteboards, the contemporary classroom can be transformed into an oasis of technology-enhanced learning. Especially after the COVID-19 pandemic, educators have begun brainstorming creative alternatives that are bound to defeat the known phenomenon of Zoom fatigue, which correlates with turned-off cameras and muted microphones [11]. By creating fully immersive settings, these technologies allow real-time contact between instructors and students, regardless of their physical locations [12].

In all levels of education and subjects, XR is growing into an everyday experience. Several existing studies have supported the adoption of immersive technologies inside the classroom since it can transform the process of learning. The teaching goal is to establish a learning environment in which students are active, participate, and cooperate; and all these can only be achieved if learning is meaningful, constructive, intentional and authentic [13,14]. Students who have participated in studies have admitted that they were given a chance to experience the new wave of learning without considering the cost [15,16]. Taking into account VR's capability of instructing remotely without the requirement of physical presence, it is safe to point out that for individuals who are disabled, bedridden, or unable to participate in person, the variant adoptions of VR can accommodate their needs without requiring any modifications [14,15]. The process of learning becomes enjoyable even for individuals diagnosed with a learning difficulty given that VR promotes its interactive benefits without the burden of memorization under pressure [15].

Social VR forms the virtual part of the metaverse [17]. Multiuser, social VR platforms can combat the repetitiveness and impersonality of 2D or web-based meeting platforms like Zoom, Webex, Skype, etc. The personalized representation of users as avatars or personas in a virtual space elicits a sense of presence or telepresence [18,19]. Moreover, the complete sensory immersion of the user in the metaverse is achieved in most cases by a headset and motion switch, which document the user's environment through body movement and cameras during the process and can be categorized into three methods: "headset and controller tracking, hardware tracker-based tracking, and camera-based tracking" [9] (p. 138). In fact, social VR offers its users the ability to choose from a variety of templates and ready-made spaces, and students can be fully immersed into virtual environments which mirror the physical cosmos and all its stimuli, including sounds and sensations [20]. To exemplify, learners get the opportunity to create their own avatars, and at the same time, during lessons, they can chat with their classmates or open their microphones and speak. One would point out that the gamified aspects of this application are far more tempting, even for the most bored student, to try at least once [21]. At the same time, it is crucial to point out that immersive VR, just like a plethora of technological advances, has several drawbacks and limitations in educational settings, some of the most evident being its high cost, motion sickness, and suggested age limits. To counter

them, desktop VR is still appealing in several contexts. To further explain, users have the opportunity to experience first-hand the benefits of impressiveness and inclusivity without being burdened with the cost of buying an expensive headset or accessing a VR CAVE environment [22–25]. This aspect is extremely important for educators who have limited budgets but still want to offer their students the immersive instructing resources which they can find online, often for free or at an affordable price. Simultaneously, previous literature indicates that desktop VR, in contrast to immersive VR, does not limit the user's viewpoint by blocking out elements of physical space, nor does it cause any nausea or physical ailments [24,25]. That is to say, desktop VR is a valuable and viable alternative for anyone who desires to experience the benefits of social VR (impressiveness, inclusivity, interactivity with other users) without any limits imposed.

2.2. Immersive Storytelling

The act of storytelling has been part of human nature since the dawn of civilization. In prehistoric times, humans recorded stories of their experiences by painting cave walls and passed on their stories from mouth to mouth [26]. This form of visual and oral storytelling transitioned to the written one with the invention of alphabets. Yet, with the introduction of visual arts, such as cinematography and television, diverse storytelling techniques were initiated, including music videos and video games. In the twenty-first century, social media network platforms have made storytelling accessible to the masses [11].

Thanks to VR technology, history learning and storytelling are no longer boring procedures which students must endure either in the school setting or on school field trips to museums [6,13–16,27–30]. The adoption of VR applications has illustrated the benefits regarding history education both in schools and museums [13–16,28–30]. If the above are taken into account, all these diverse VR applications and interventions in the classroom have the capacity to apply to all of students' needs for a creative, critical, reflective learning space [13,29,30], yet knowledge is not limited to formal spaces. During the last few years, informal learning has been brought into the spotlight, and more and more research is being conducted in order to improve locations such as museums [16,28,30]. By broadening the recipients of history learning to everyone interested in the subject, education becomes accessible and the concept of "learning by knowing" becomes the basis of teaching/learning practices.

Storytelling in virtual immersive environments has the potential to expand from two-dimensional textbooks to methods of absorbing historic facts first hand in a 3D virtual cosmos filled with the potential to be creative [6]. This factor of the accessibility of VR is even evident in the fact that schools and museums have the chance to promote history and storytelling even online by constructing games which are bound to win learners over with their immersive nature [16,31]. Ultimately, regardless of what has already been mentioned regarding storytelling or history education, one thing is clear: that with the technological progress which has been made during the last few decades, VR technology and spatial computing are spreading across all levels of education and training. Hence, teaching personnel and parents need to be prepared to embrace the new immersive wave, and in particular, educators must be equipped with the according knowledge and skills in order to facilitate to their learners' needs [29].

2.3. Immersive Technologies and History Education

Classic history works can be brought to life through immersive experiences, such as virtual trips to ancient cultural locations or simulations of imaginative worlds, which can deepen engagement with the subject [12]. Additionally, using VR might let students take on different personas or participate in interactive storytelling activities that encourage imagination and analytical thinking [32]. Teachers can enable students to pursue exciting research and discovery by bridging the gaps between technology, history, and the tradition of storytelling.

The instructor facilitates learning by forcing the participants to exploit "more than just one of their senses, especially the use of touch and movement" to trigger the individual's brain tactile and kinesthetic, as well visual and auditory memories [33] (p. 5). The crux of this perspective lies in the profound acknowledgment of the transformative power that such techniques wield, transcending conventional boundaries and breathing new life into the classroom experience [33]. The very essence of education, as Boardman portrays it, becomes a dynamic symphony of sensory engagement, where the amalgamation of touch, sight, sound, and more coalesce to form a comprehensive and immersive platform for knowledge acquisition, and in the case of the present study, the learning of history [33].

In other words, VR can address a plethora of challenges in history teaching including:

1. Content overload: History is a vast and complex subject, spanning centuries and covering a wide range of topics. It can be difficult to select the most vital and relevant content to teach, especially within the constraints of a school curriculum [27].
2. Multiple perspectives: Historical events can be interpreted in different ways, depending on the perspective of the historian or the reader. This can make it challenging to present a balanced and objective account of the past [27].
3. Student engagement: History can be a challenging, overwhelming, and abstract subject for students, especially during the earlier years of education. It can be difficult to keep them engaged in learning about historical events that may seem remote and irrelevant to their lives [27].

2.4. Challenges of Teaching Sensitive Historical Events

Sensitive and controversial historical events are marked by immense suffering, widespread violence, and often the loss of countless lives, which can be traumatizing to students [34]. Sensitive historical events including slavery, colonialism, wars, atrocities and genocides such as the Holocaust, the Armenian genocide, the Pontian genocide, and the Asia Minor Catastrophe, can be overwhelming for both educators and students [35]. Balancing the need for historical accuracy and sensitivity is crucial, ensuring an objective approach which avoids minimizing or justifying atrocities, in relation to genocides like these [36]. Be that as it may, the current mode of instruction, which is mainly focused on facts and statistics, risks turning individuals and their stories into mere numbers, hindering the learners' development of empathy and understanding.

Memoirs, autobiographies, diaries, and testimonies when included in textbooks can offer a vital window into human experiences in response to these tragedies [37]. By delving into personal narratives, students are not just confronted with the vast number of victims, but with the stories of individuals, their struggles, their choices, and the lasting effects of trauma. These firsthand accounts bridge the gap between big history (the broad, macroscopic strokes of historical events) and small history (the microscopic, personal experiences of those who lived through them) [38]. Through these micro-historical, personal narratives, learners have the opportunity to cultivate their empathy for those who endured unimaginable suffering and to be reminded that the impersonal statistics represent real people, their lives, losses, and resilience [38]. Only through relatable teaching materials are educators empowered to teach in a way that acknowledges the past and motivates students to actively participate in preventing such tragedies from repeating in the future.

3. Materials and Methods

3.1. Methods

The present study aims to explore the immersive qualities of online history education workshops that merge interactive books and social VR metaverse spaces, as well as to examine the benefits and shortcomings of immersive storytelling. To accomplish this, the following research questions have been formulated:

RQ1. How can interactive books and social VR help participants explore historical narratives from different perspectives and experiences within a sensitive historical event?

RQ2. In what ways can differences in historical viewpoints, teaching methods, and learning environments contribute to expected participant engagement and knowledge retention?

RQ3. What strategies can be employed to address challenges and opportunities in immersive history learning materials towards a positive impact on learning outcomes?

To address these questions, the research instrument was a self-administered mixed-methods-approach questionnaire consisting of 14 questions, incorporating open-ended questions that require longer answers, multiple choice, Yes/No/Maybe questions along with a 5-point Likert scale. The first four questions were utilized to obtain the participant's personal information, including their ethnicity, their age, and their level of their education, and to provide a four-digit number of their preference that would have been used in case of a specific reference during the data analysis. As can be deduced, each research question corresponds to questions in the questionnaire. RQ1 corresponds to questions 5–11 in order to obtain the participants' views of the material and space. Meanwhile, RQ2, exploring the differences between traditional and immersive storytelling, is linked to questions 13 and 14. Finally, RQ3, investigating the drawbacks of this experiment, solely utilizes question 12. The questionnaire is provided in Appendix A. These questions were developed by the first author.

The integration of these diverse data collection methods facilitated a triangulated analysis approach [39]. Qualitative insights derived from open-ended responses were juxtaposed with quantitative findings from the Likert scale and categorical responses. This allowed for a robust examination of the alignment between participants' qualitative reflections and quantitative assessments, enhancing the credibility and validity of the research outcomes.

Ethical considerations were paramount throughout the research process. All participants were informed about the project's goals, clarifying their voluntary participation and confidentiality. Additionally, participants' unique circumstances were noted, including potential technological limitations and unavailability of take part in a synchronous e-workshop due to the summer break and the vacation period. That is why half of the participants took part in a synchronous context, while the other half took part in an asynchronous e-workshop.

3.2. Materials

In the sixth-grade history textbook in Greece, students learn about a sensitive event in recent history. After World War I, Greece, in accordance with its western allies, sent an army to Asia Minor (also called Anatolia) to liberate the Greeks living there under Ottoman occupation. However, after the Greek army was defeated by the Turks in the ensuing war, millions of Greek people in Asia Minor were killed or forced to flee to the Greek mainland after an uninterrupted presence of thousands of years [40]. It is a significant and traumatizing event in Greek history, but it is often overlooked or marginalized in history education to avoid conflicts. The event itself is quite complex, and it can be challenging to teach about it in a manner that is both accurate and respectful. Similarly, there is a lack of resources and educational materials dedicated to anonymous heroes or victims who saved lives or defended humanity. Hence, tribute is owed to the faceless heroes that history tends to neglect.

The captivating narratives that form the core of this immersive educational experience originate from invaluable firsthand accounts of descendants of those who endured the harrowing events of the Asia Minor Catastrophe. These stories, passed down through generations, serve as a testament to the enduring legacy of historical events that have left an indelible mark on the collective memory. Rooted in oral traditions, these firsthand experiences embody authenticity and resilience, transporting us back in time to honor the victims of this tragic chapter in history.

To make all of this accessible to learners, two main materials were used: (i) an interactive digital book with historical accounts and narratives, and (ii) a social VR environment in the edu-metaverse. By combining these two digital environments, learners receive the benefits

of actively engaging in the learning process, developing their critical thinking and their emotional intelligence, while interacting with other learners and learning from others even if they are not in the same physical space.

3.2.1. Interactive Storytelling Book

An interactive digital storytelling book was created on the Twine platform. By selecting Twine as the canvas for this pedagogical endeavor, this case study embraced an avant-garde approach that transcended the traditional boundaries of education. Twine's value lies in its unique ability to empower educators to design branching narratives and to invite the readership to make choices, navigate alternate paths, and witness the impacts of their decisions tangibly and directly [41]. The architecture of the resulting storyboard, depicted in Figure 1, unfurled like a carefully woven spider web—a metaphor that aptly captures the intricacy of its design. Akin to the delicate threats that interconnect in the natural world, the different facets of the book were intricately linked, forming a cohesive narrative fabric. Through this synthesis of technology and storytelling, this project stands as a testament to the evolving landscape of education.

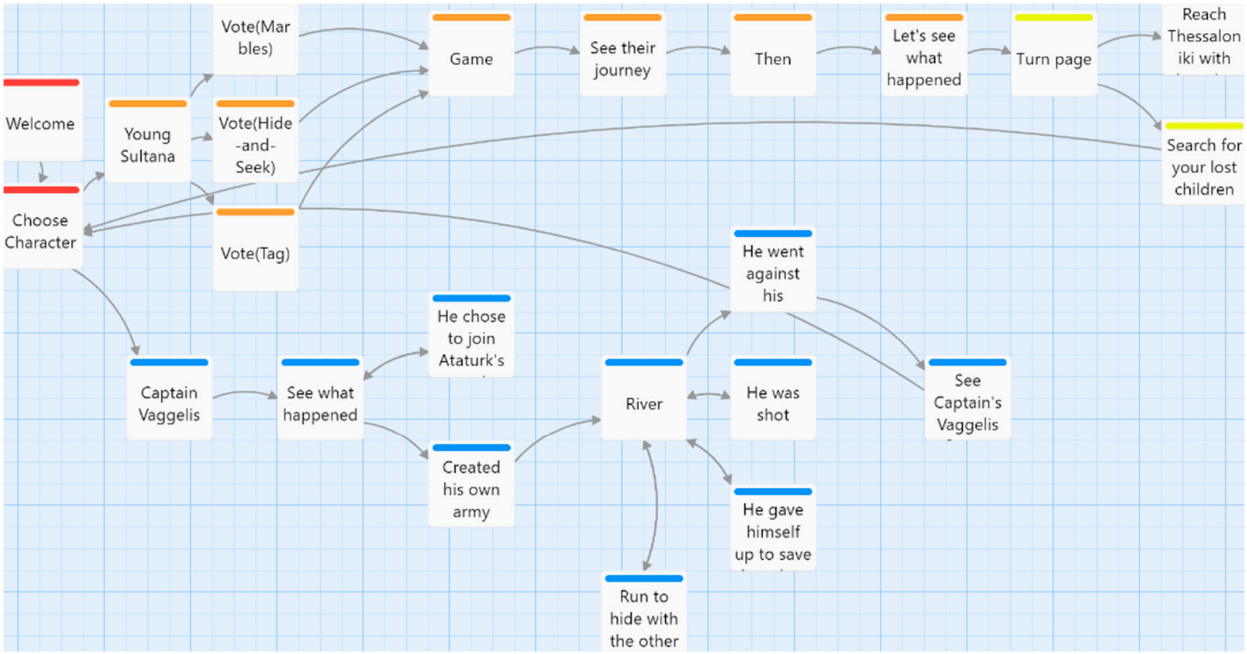

Figure 1. Interactive book storyboard on Twine.

Given that the storyline mimics branches, each section has been color-coded to signify not only the diverse sections of each character but also to facilitate the proofreading process. To exemplify, the red sections can be viewed as an introduction to the book, the blue ones are dedicated to Captain Vaggelis, the orange ones to Sultana, and the yellow ones to Sultana's mother, Aggeliki. During the stage of collecting stories from the older generations, each story had its own significance. The Asia Minor Catastrophe had affected people from all age groups, socioeconomic backgrounds, and genders, and it was only right that this book, regardless of its size, reflected all those characteristics.

At the heart of the book rests a profound exploration centered on the narratives woven through the lives of immigrants who experienced the harrowing events of the Asia Minor Catastrophe. This exploration inevitably led to a compelling imperative: to establish connections by bridging the temporal and cultural gaps that separate the present from the past. In a sense, the learning should occur by stepping into the characters' shoes and embodying their experiences [42]. Hence, the book starts with a pop-up box, in which participants enter their names. After "time-traveling" to 1922, the year of the Asia Minor Catastrophe, they are obliged to select which character they want to be first. Regardless

of the choice, both stories will be ready; thus, the order of the selection does not account for or affect the narrative in any way (see Figures 2 and 3). Although, the narrative may appear non-linear, is in fact linear, and the choices will not affect how the stories are read.

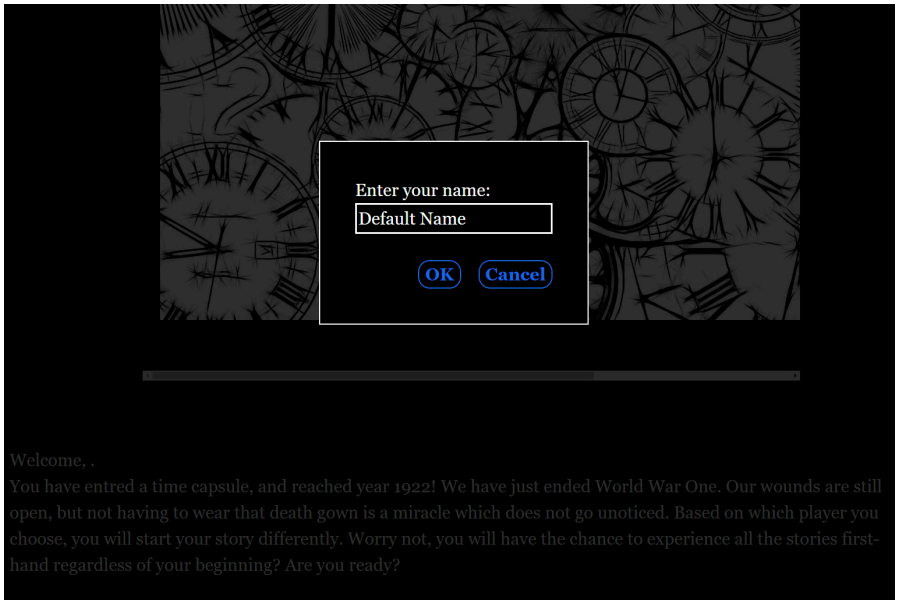

Figure 2. Readers enter their name at the beginning.

Figure 3. Readers must choose a character.

Should the reader opt to embark on their reading odyssey with the tale of Captain Vaggelis, a distinctive narrative pathway unfurls, characterized by an immersive engagement that invites them to actively participate in the unfolding story. Here, the journey commences not merely with words on a screen but with an intriguing question that serves as both an introduction and an interactive threshold: "How did he spend his day?" It is this question that carries a dual significance; the inquiry not only beckons the reader into the intricacies of Captain Vaggelis' life but simultaneously encourages them to tap into their own reservoir of knowledge about the catastrophe. As a result, the beginning of this story becomes an invitation to dialogue with history, to ponder its nuances, and to challenge one's assumptions. Following that, the learner then comes across his first narrative and receives historical information, and then they must "write" the ensuing events. If they select "He chose to join Ataturk's army, but he rebelled afterwards", they are met with an alert box signifying "Think again" and return to the previous page, as depicted in Figure 4, whereas if their pick is "Created his own army", they move on to the next page of the book and are rewarded with praise, as depicted in Figure 5.

Figure 4. The "Think again" box appears after a mistake.

Figure 5. The reward box pops up after a correct answer is selected.

Continuing the immersive narrative style, the next five pages of the book require the reader's decisions to drive the story. With each page, pivotal choices arise, enabling readers to steer the characters' destinies and engage more deeply with the story. These decisions empower readers, bridging them closely with the characters and enhancing their emotional involvement. This interactive approach goes beyond conventional storytelling, allowing readers to shape the narrative's course and fostering emotional investment. The initial crossroads presented to the reader comprises a selection of three distinct options, each with its own complex implication: "Run to hide with the other immigrants", "He gave himself up to save the others", and "He was shot". It is noteworthy that these picks trigger a pause for reflection, prompting the reader to re-evaluate their initial inclination before advancing further. In contrast, the narrative progression is subtly guided by the sole choice that aligns with Captain Vaggelis' determination to stand firm against his adversary: "He went against his opponent". In the case that the wrong choice was selected, a "Think again" box appears, as shown in Figure 4. Once the reader makes the correct choice, a congratulating alert pops up. This interactive engagement enhances the immersive experience, fostering a deeper connection with the narrative's central figure while allowing the reader to appreciate the intricacies of their choices and actions. In the final stages of Captain Vaggelis' chapter, the reader is treated to a culmination of his narrative in the form of a speech that encapsulates his dedication and contributions. Accompanying this moment is a vivid image capturing the essence of his legacy—his statue gracing the quaint village of Kirasli in Greece. This visual serves as a powerful testament to his enduring impact on his community and the profound role he played in the tumultuous events detailed within the book. Following this moment of reflection and tribute, the reader is thoughtfully guided back to the initial page of the immersive book. This strategic transition serves as a poignant reminder of the interconnectedness of these stories, promoting the audience to seamlessly shift their focus towards the subsequent chapters that delve into young Sultana's story.

In Sultana's chapter, the aim behind the introductory question is that the reader should realize that the main character is a child; in many sources, children's voices are silenced although they experienced the same trauma as the adults. All three alternatives—tag, hide-and-seek, and marbles—are games played by children throughout the generations. The user, regardless of their age, has probably played them at least once in their life. It will make it less complicated for them to be immersed in Sultana's story and witness the events from her perspective. Spanning the following four pages of Sultana's story, the narrative follows her journey upon arriving in Greece, specifically homing in on a pivotal incident in which she became separated from her cousin amidst a sea of migrants on the route to Thessaloniki. This moment serves as a poignant illustration of the challenges and disorientation faced during migration. As the readers traverse this passage, they are immersed in the chaos, vulnerability, and weight of uncertainty felt by Sultana and her cousin. However, the narrative trajectory of Sultana's story takes an intriguing detour as the interactive book prompts the reader to grapple with a profound hypothetical scenario: the disappearance of their own children. By confronting them with the harrowing notion of a lost child, the book forges a direct connection between the reader's emotions and the characters' experiences, blurring the lines between fiction and reality. The ensuing flashback that unfolds in response to this inquiry amplifies this intimate connection, casting a spotlight on Sultana's mother as the central figure. Within this narrative temporal shift, the readers gain a more intricate understanding of Sultana's family dynamics, her anxieties, and the relentless search for the missing children. Consequently, the inclusion of Sultana's father provides a nuanced portrayal of parental reaction and coping mechanisms. Apart from the showcasing of the typical habits of that period, it is equally significant that the story showcases the specific habits and traditions of the characters. For this reason, it should go without saying that Sultana's mother, Aggeliki, was a child bride. Aggeliki and thousands of other young girls were, are, and will remain trapped in this cycle of forced marriage, given that experts believe that it will take another 300 years for this ritual to completely disappear [43]. Even when they did not live under the shadow of forced migration, people "sold" their young girls in hopes of being rid of the financial burden of feeding them. While the point of the book is to finally listen to the voices of the victims of the catastrophe, we ought to learn about humanity in general. Consequently, as the reader engages in a comprehensive review of the narrative's flashback events, a thought-provoking invitation emerges, beckoning them to reconsider their previously made choice. The act of re-evaluation is a narrative device that encourages readers to view the story from a more informed and empathetic standpoint, thereby enhancing their capacity to engage with the complex emotions and moral quandaries that shape the characters'/readers' journeys. When an individual opts for the initial choice, "Search for the lost children", a thought-provoking consequence is triggered. A pop-up box appears, its words echoing the complexity of the situation: "How could one search for two small humans in a crowd of a thousand people?" This prompt not only confronts the reader with the practical challenges of such a task but also taps into the emotional weight carried by the characters. The mere notion of attempting to find two children amidst a sea of unfamiliar faces underscores the daunting nature of their predicament. Conversely, selecting the alternative path, "Reach Thessaloniki with the other immigrants and then look for them", evokes a different response. Here, an alert bears the poignant query: "How could they wait? They are their children and their family!" This narrative juncture thrusts readers into the characters' anguish as they grapple with the heart-wrenching decision to prioritize their collective safety or risk all to reunite with their missing loved ones. These divergent pop-up messages act as poignant narrative signposts, urging readers to immerse themselves into the characters' dilemmas and fostering a deeper emotional connection to the story's unfolding. In the final two pages of Sultana's story, readers come face to face with one last question: "How would you picture the perfect family photo?" In providing closure to the narrative, this question holds a deeper meaning. It prompts reflection on the intricate threads of family, identity, and human experience that bind the three stories. In like manner,

it serves as a reminder that these stories are grounded in real families' lives, urging readers to connect with the characters' struggles and the historical backdrop. This question bridges the fictional and the historical, inviting readers to consider both the art of storytelling and the weight of history. As a narrative crescendo, it leaves a resonant impact, prompting contemplation long after the stories' end.

This digital experience becomes a gateway through which the legacy of the victims can be apprehended, their experiences and struggles seen through more spherical lenses than those of the traditional mediums. By infusing the benefits of an interactive e-book and a social VR space, storytelling becomes an active exercise that strengths the learners' communication skills, confidence, and empathy [44]. The process of participating in storytelling urges learners to explore different fields, developing their emotional intelligence and offering a deeper understanding of the human condition. To encapsulate, the combination of a virtual classroom and an interactive book is to empower and equip the learners with tools to engage actively with history, interact with their roots, and weave themselves into the tapestry of remembrance while being in constant interaction with other learners, making the learning process even more interactive.

3.2.2. Workshops in Social VR/Metaverse

An online virtual immersive meeting environment was crafted in the metaverse, mirroring spaces learners are accustomed to. This digital twin cyberspace was seen as necessary given that a space was required to host the material and act as a meeting place for learning, depicted in Figure 6. While a surface-level analysis might suggest that a traditional website or 3D application could achieve similar functionality, the social VR space functioned as a critical element that fostered participant engagement and ultimately ensured the project's cohesion. This immersive environment provided several unique advantages that demonstrably contributed to the experiment's success. In fact, the social VR space facilitated a heightened sense of presence and communal support between the participants. That is to say, by sharing views and opinions, participants interacted with each other, and this interactivity helped them broaden their horizons. By embodying digital agents, avatars, or personas within a shared virtual environment, they transcended the limitations of a traditional computer interface, fostering a deeper investment in the activities. If the above are taken into account, the social VR space enabled a more interactive experience compared to a static website or 3D application.

Figure 6. Overview of the workshop space.

All participants were invited to access the platform via their laptops or desktop computers; this ensured that their devices would not lag in comparison with the mobile application. As illustrated in Figure 7, there was a round table, typically employed in workshops with fewer attendees, and a projector was utilized to show a deepfake video. This video was crafted by taking photographs of the characters in the book and using the online tool HeyGen. The process of crafting this introductory video was straightforward since the only requirements were the photos and a short script, which was written by the researchers. However, the downside of using this app was the 30 s limit on the video that one could assemble with the help of artificial intelligence (AI). Following this introductory video of the book's characters welcoming the attendees to the workshop, the main features of this e-class were the books on the table. When the learners clicked on the description of the book, they were transported to the website hosting the book. The Spatial.io platform did not support the HTML file of the game, thus Itch.io was utilized to host the book given that Twine stories like this one are supported there.

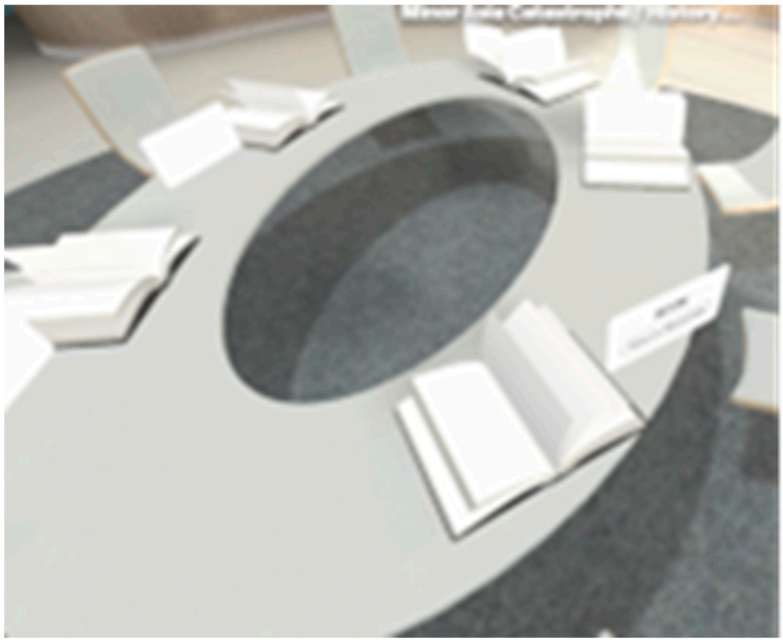

Figure 7. The location of the interactive books at the workshop.

As a follow-up activity designed to foster continued interaction and reflection, an innovative addition was introduced in the form of a Padlet platform, depicted in Figure 8. By viewing and responding to each other's posts, participants could establish connections, identify common themes, and build upon one another's insights. The incorporation of this dynamic tool aimed to extend the learning process beyond the workshop session itself, allowing participants to delve deeper into the material and engage in meaningful discussions. Lastly, to enhance accessibility and participation in the post-workshop survey, a direct and prominently displayed link to the survey was thoughtfully provided within the classroom, as is shown in Figure 9 below. Its strategic placement on the board, where it could easily catch the eye of all attendees, aimed to ensure that everyone, without exception, would have access to a Google Form. The decision to make participation obligatory not only underscored the value placed on everyone's input but also ensured a balanced representation of perspectives, experiences, and insights, which not only optimized the results of the present case study but also set the path for future educational endeavors. During the transitional phases of moving from one activity to another, participants had the opportunity to explore the VR meeting space, interact with each other, and in general immerse themselves in the space and the material.

Figure 8. The location of the link to the follow-up activity.

Figure 9. The location of the Google Form survey.

3.3. Sample Demographics

The questionnaire was administered to 34 adult participants after the workshop, and participants were asked to complete it individually and anonymously. The majority of participants, constituting 28 out of 34 responses, had attained a higher level of education, which indicates not only they may hold bachelor's, master's, or doctoral degrees but also that they have experienced a plethora of teaching in their lives and are familiar with teaching methods. However, the limited presence of participants with only a secondary level of education indicates that their answers are less significant than those with higher education. On the contrary, it shows that people want to continue learning throughout their lives and keep up with the progression of teaching methodologies. Participants were carefully selected for their dual strengths, i.e., a genuine interest in history and expertise within the education sector, resulting in a highly engaged and knowledgeable group who could cope with the challenge of the material being in English. This questionnaire was designed to assess participants' perceptions of the immersive storytelling workshop, including their engagement level, learning experience, and overall satisfaction.

Within the scope of this study, an examination of the participants' ages has been conducted to gain insights into the demographic composition of the sample. This feature is

crucial since we aim to see how people from diverse age groups would react to the concept of immersive storytelling and the teaching experience.

38.24% were within the age range of 20 to 29, meaning that they belong in the early stages of adulthood and that their relationship with technological applications has the potential to be different from that of older people. Following this, participants aged 30 to 39 accounted for 11.76%, while those aged 40 to 49 and 50 to 59 represented 14.71% and 17.65%, respectively.

4. Results

The investigation encompassed participants' experiences with the usability of the Spatial.io metaverse platform, their perceptions of the interactivity of history workshops and social VR, and their evaluations of the interactive history book. The results are explored in Table 1 and analyzed in terms of each RQ.

4.1. How Can Interactive Books and Social VR Help Participants Explore Historical Narratives from Different Perspectives and Experiences within a Sensitive Historical Event?

The evaluation of the interactivity of the history book denotes positive feedback about the notion of storytelling. This positive attitude was also evident during the workshop experience in terms of the participants' points of view regarding the interactive book (Question 7). The most common preferences were related to the interactivity and engagement provided by the book, catering to different learning preferences and enhancing the overall experience. Participants appreciated the ability to actively participate in the stories by making choices, guessing outcomes, and even playing through different character options (Question 8). The multiple choices for story paths and the inclusion of questions after each story were also well received. By the same token, many characterized the inclusion of photos and the ability to actively build the story as extremely innovative; these elements captivated the participants' attention because they were entirely integrated. In other words, the opportunity to be part of the story led to the desire for hands-on experience (Question 10).

As can be understood from the above, the book's content with its emphasis on personal narratives, along with the VR space, succeeded in making the history workshop more accessible and relatable by allowing participants to immerse themselves and empathize with the victims. The vividness brought by the interactive form enabled them to empathize with the characters and gain a more profound insight into their experiences (Question 9). The memoir or e-book served as a vehicle for emotional connection, allowing readers to grasp deeply the personal struggles and tragedies endured during the Asia Minor Catastrophe (Question 11). Interestingly, even those who had prior knowledge of the event noted that the immersive book still contributed positively by adding emotional depth and humanizing the historical facts. To exemplify, there were many similar comments that the child's perspective in the story resonated profoundly, rendering the experiences more authentic, raw, and heartbreaking. It was in the book's nature to enable the readers to be immersed in the lives of the characters and foster empathetic perspective-taking as the participants experienced the challenges and triumphs alongside them (Question 6).

To gauge the participants' experiences with the usability of the social VR Spatial.io platform, respondents were asked to rate their perceptions of the ease of navigation using a Likert scale. The outcome implies that a substantial portion of respondents found the platform's navigation to be straightforward and user-friendly (Question 5). Upon closer examination of the distribution, it is evident that a considerable number of participants assigned ratings toward the higher end of the scale (4 or 5). This clustering of responses at the positive end of the spectrum underscores a prevalent view of the platform's seamless navigation. However, it is important to note that a small percentage of participants assigned lower scores (1 or 2). This subset of respondents encountered complexities during their navigation of the platform. Most of them were not able to use technological applications with ease, and they required a lot of guidance during the teaching. By incorporating both

the strengths highlighted by the positive ratings and the areas of improvement suggested by the lower ratings, the insights derived from this analysis contribute to a more holistic understanding of how to employ this platform for teaching purposes. Even though educators may explain and be there for the students during the learning process to help them with any technological difficulties and enquiries, there will always be a small percentage who will not have technical proficiency or may experience stress since this is an innovative platform.

Table 1. Participants' questionnaire results.

Survey Question	Answers	Percentages
5. How would you describe your ability to navigate the Spatial.io platform?	Hardest	8.8%
	Hard	11.8%
	Neutral	17.6%
	Easy	23.5%
	Easiest	38.2%
6. How would you describe the interactivity in the VR history lesson compared to the traditional one?	Not Interactive	14.7%
	Less Interactive	0
	Neutral	8.8%
	Interactive	23.5%
	Most Interactive	52.9%
7. How would you describe the interactivity of the history e-book compared to the traditional one?	Not Interactive	8.8%
	Less Interactive	11.8%
	Neutral	5.9%
	Interactive	23.5%
	Most Interactive	50.0%
8. Did you like any elements of the interactive e-book? If yes, which element was your favorite?	Writing	5.9%
	Impressiveness in Story Building	29.4%
	Characters	20.6%
	Choices	26.5%
	Photos	8.8%
	Questions	8.8%
9. How did the immersive e-book impact your understanding of the Asia Minor Catastrophe and its victims?	Nothing	11.8%
	Connection with Victims	55.9%
	Easy to Learn History	32.4%
10. How did you benefit from the immersive and interactive e-book?	Immersion	64.7%
	Critical Thinking	35.3%
11. How did the e-book evoke empathy or emotional responses within you towards the victims of the Asia Minor Catastrophe?	Understanding	38.2%
	Empathy	23.5%
	Proud of Heritage	5.9%
	Realistic	5.9%
	Sadness	26.5%
12. In what ways can the immersive e-book be improved to further enhance the audience's understanding and connection to the stories of the victims?	Social Media	5.9%
	Audio Narration	8.8%
	Less Text	2.9%
	More Characters	23.5%
	More Graphics	47.1%
	Nothing	11.8%
13. How realistic can the transition from traditional course books to interactive books be in teaching?	Impossible	5.9%
	Hard	8.8%
	Neutral	32.4%
	Almost Possible	35.3%
	Possible	17.6%
14. Which of these denotes the expected advantages of utilizing immersive technologies in education? *	High Engagement	80%
	Deep Understanding	76.67%
	Personalized Learning	73.33%
	Collaborative Learning	66.67%
	Accessibility	60%

* This question allowed for selection of multiple answers, thus the percentages shown refer to how often these answers were selected by participants.

The investigation into the level of interactivity provided by the VR history workshop in comparison to a traditional instructional approach was gauged through the participants' responses, captured using a Likert scale. In detail, the responses yielded a mixed spectrum

of perceptions, which warrants nuanced exploration to discern trends in the attendees' viewpoints (Question 6). Several participants assigned lower scores (1 to 3) indicating a perception that the VR history workshop was not inherently more interactive than a traditional one. This dichotomy in responses can be attributed to the fact that these participants faced technological problems and were confused by the Spatial.io platform at the beginning. On the other hand, a substantial number of participants assigned higher scores (4 to 5), indicating an affirmative belief that the VR version of workshops/lessons provides a heightened level of interactivity. It needs to be underlined that almost all learners were unfamiliar with the concept of VR classrooms and lessons, thus the process was novel in their eyes due to the unique nature of the project.

4.2. In What Ways Can Differences in Historical Viewpoints, Teaching Methods and Learning Environments Contribute to Expected Participant Engagement and Knowledge Retention?

During the procedure of questioning participants on their views about this intervention, two questions were asked about the integration of immersive technologies into the curriculum and how realistic it seems in their eyes. The findings underscore the potential for the interactive book to serve as a transformative pedagogical tool, albeit with the need for thoughtful consideration of implementation strategies and potential barriers (Question 13). Upon scrutinizing the data, it becomes evident that there was a diverse range of viewpoints; the analysis reveals that the majority of responses cluster within the range of 3 to 5, indicating a generally favorable outlook toward the feasibility of such a transition. Remarkably, the distribution skews away from the lower end of the scale (1 and 2), suggesting that very few participants consider the transition to be fundamentally unrealistic. Rather, the data show a predilection toward moderate to high feasibility viewpoints, with responses clustering around the midpoint (3) and slightly higher (4) on the scale. This pattern underscores the prevailing sentiment that this transition is within the realm of possibility. While replies at the highest end of the scale (5) were relatively fewer, they still indicate a notable number of participants who perceived the transition as reasonably attainable. Conversely, the scarcity of extremely high ratings suggests that while participants acknowledged the potential, they might also point to challenges or complexities associated with the transition (Question 13).

Foremost, a sense of enhanced student engagement resonates throughout, reflecting the capacity of immersive technologies to captivate attention and establish deeper connections with educational content (Question 14). Aligned with this, the benefits of improved retention and understanding underscore the immersive experience's potential to facilitate profound comprehension of intricate concepts. Participants affirmed the adaptability of immersive technologies and storytelling, catering to diverse learning preferences through personalized and adaptive experiences. The collaborative potential of these comes to the fore, fostering collaborative learning environments that promote interaction and teamwork. These insights provide a holistic understanding of the multifaceted advantages that these methods of teaching offer to education across all levels, indicating valuable considerations for educational practitioners and policymakers.

4.3. What Strategies Can Be Employed to Address Challenges and Opportunities in Immersive History Learning Materials towards a Positive Impact on Learning Outcomes?

The evaluation of the immersive history book included a range of constructive recommendations by participants (Question 12):

1. While some participants acknowledged the book's current efficacy, there were also many who expressed their hope that the stories in the book would be expanded. In fact, several participants proposed the inclusion of narratives from varying vantage points, including antiheroes and lesser-known figures.
2. Along with the above comments, many opined that even more immersive components, including maps and audio recordings from that time, could have been features of the book since they would amplify the book's historical identity and elucidate the severity of this tragedy more vividly.

3. Finally, there were comments which pointed out the potential for community engagement by fostering interactions between users online on a national scale or enabling the sharing of this immersive experience on social platforms. This element is related to the collaborative affordances in metaverse platforms.

The interactive nature, character-driven narratives, and ability to make choices all contributed to a richer learning experience and to the cultivation of critical thinking and evaluation of the teaching materials. Even in the case of some participants commenting that history lessons in school made them uninterested in sustained reading, the interactive nature of the book provided a solution as it allowed for structured breaks without losing interest in the narratives while having the chance to communicate in an interactive space.

5. Discussion

5.1. How Can Interactive Books and Social VR Help Participants Explore Historical Narratives from Different Perspectives and Experiences within a Sensitive Historical Event?

Immersive storytelling has emerged as a versatile and adaptable medium, capable of dynamically tailoring its form and content to resonate with each learner's preferences and learning styles [45]. This inherent flexibility can be interpreted as a testament to its inclusivity, fostering an educational paradigm that acknowledges and celebrates the heterogeneity of the student population [13,30]. VR cyberspace integration inherently begets an environment that not only stimulates engagement but also fosters interactivity on a profound level. The historical content, enriched and enlivened within the virtual world, attains a newfound depth, enabling learners to traverse temporal landscapes with an unprecedented sense of connection and understanding [13,29,30,46]. This convergence of visual and textual elements fosters a transformative experience, effectively dissolving temporal boundaries and reinterpreting historical narratives into relatable and comprehensible constructs that align with the contemporary understanding of learners [29]. These interactive narratives function as metaphorical bridges, facilitating a connection between historical epochs and contemporary generations, thereby transcending the inherent limitations imposed by the passage of time. Reflecting this nuanced understanding of historical narratives, this empirical study adopted an inclusive approach, inviting participants to actively engage with the interactive history book. This was carried out while keeping in mind the need to cater to a variety of learning preferences, given that a multifaceted learning experience acknowledges the diversity of individual cognitive processes. The user-friendly nature of the social VR platform used in this case study highlighted that little or no coding is required to create an immersive experience.

5.2. In What Ways Can Differences in Historical Viewpoints, Teaching Methods and Learning Environments Contribute to Expected Participant Engagement and Knowledge Retention?

The marriage of immersive technologies and inclusivity becomes emblematic of a broader transformation within the realm of education regardless of whether it is being conducted in formal or informal educational spaces [28,29]. It substantiates the premise that technology, when harnessed within the educational milieu, has the potential to break free from the shackles of a standardized, one-size-fits-all approach [29]. The confluence of these findings aligns with the broader proposition that social VR inherently possesses transformative potential in educational settings. This transformative power demonstrably captures the attention of learners, surpassing the limitations of traditional educational tools and fostering a symbiotic relationship characterized by active and enthusiastic engagement [47]. Astonishingly, this profound impact extends even to the area of higher education, where interactive VR-based experiences are equally important [29]. The interactive book's success in presenting historical narratives in a vivid and engaging manner has been lauded for its ability to facilitate experiential learning by providing a structured framework for information acquisition, in particular by the scaffolding of information.

5.3. What Strategies Can Be Employed to Address Challenges and Opportunities in Immersive History Learning Materials towards a Positive Impact on Learning Outcomes?

While advancements in immersive storytelling have garnered significant attention, a concurrent examination reveals the intricate landscape of challenges and complexities inherently associated with its adoption, fostering a nuanced and dynamic narrative. Technical limitations occasionally pose obstacles within the realm of immersive storytelling, highlighting the intricate interplay between the promise of technology and its practical constraints. The temporal limit imposed by the two-month timeframe for this entire experiment emerged as a significant hurdle, impacting various aspects of its execution. The meticulous attention to detail and time investment required for assembling the interactive book presented a technical and organizational challenge. Furthermore, participant enrollment was demonstrably affected by the summer holiday exodus, limiting the potential for a broader and more diverse data set. The acknowledgment that a more extended timeline and a broader participation base could have potentially yielded a richer and more diverse tapestry of data is an insight that merits reflection. In essence, the temporal constraints that adorned the experiment's landscape stand as a testament to the delicate equilibrium researchers must navigate. While the limitations imposed by time cannot be entirely mitigated, they illuminate a pathway for future investigations to heed these lessons and undertake their inquiries with an extended temporal canvas that benefits the complexity of the research pursuit. Facilitators must take into account that educators themselves must be provided with the skills to craft these intricate yet immersive environments, and this must be prioritized in order to follow the flow of technological evolution [29].

6. Conclusions

The current article's resounding refrain is the potent potential of immersive storytelling, particularly when applied to weighty subjects like sensitive or controversial history. This potential manifests as a conduit for students' delight in the act of learning. In this digital age, where students exhibit an unswerving devotion to their phones, we stand as witnesses to the depth of this obsession. Rather than imposing limitations on this inclination, which might precipitate undesirable conduct, the following proposition emerges: Let us take advantage of this digital current and recalibrate our pedagogical approaches, especially through mediums like VR, which can augment the teaching–learning panorama. Picture the splendor of allowing the annals of history, especially the sagas of Asia Minor, to unfurl organically before eager minds. To permit them to be not merely spectators but co-creators, actively shaping and reshaping narratives, forging connections with the past.

This endeavor, though modest in scale, serves as a prologue to the grand opus that beckons. The vista stretches wide before us, the vision one of inclusion and expansion. Hopefully, in the future, we will be allowed to not only expand the repository of stories from immigrants and refugees who were forced to flee but also introduce the nascent concept of workshops and pedagogical forays into the metaverse, tailored to the inquisitive minds of even younger learners. The path, though trodden by a selected few, has the promise of burgeoning into a thoroughfare where the voices of the past resonate profoundly with the aspirations of the future.

Throughout this project, it became evident that face-to-face meetings were crucial, despite the ability to have remote meetings. In-person communication was required due to some participants' lack of technological proficiency and hearing impairment. One big ethical constraint was remaining objective throughout the writing process. The point of this book is to give voice to dead people and the gospel about their misfortunes when they migrated; it was not to point the finger at the Ottoman government or at the Greek one for failing to assist them.

Future studies in the exploration of immersive storytelling in the metaverse for the enhancement of history education could be directed along the following three avenues: (i) comparative studies contrasting immersive with conventional educational materials, (ii) psychological evaluation of affective outcomes such as empathy, and (iii) the incorporation of artificial intelligence into immersive narratives.

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Appendix A

Evaluation Questionnaire

A. Demographics
   1. What is your ethnicity?
   2. What is your age?
   3. What is your level of education?
   4. Enter a unique 4-digit number of your preference. This number will be used to refer to the data.

B. Reflection on Immersive Experience
   5. How would you describe your ability to navigate the Spatial.io platform? (5-point Likert scale)
   6. How would you describe the interactivity in the VR history lesson compared to the a traditional one? (5-point Likert scale)
   7. How would you describe the interactivity of the history e-book compared to the a traditional one? (5-point Likert scale)
   8. Did you like any elements of the interactive e-book? If yes, which element was your favorite? (Open-ended)
   9. How did the immersive e-book impact your understanding of the Asia Minor Catastrophe and its victims? (Open-ended)
   10. Did the e-book change any preconceived notions or assumptions you had about the Asia Minor Catastrophe? If so, how? (Open-ended)
   11. How did the e-book evoke empathy or emotional responses within you towards the victims of the Asia Minor Catastrophe? (Open-ended)
   12. In what ways can the immersive e-book be improved to further enhance the audience's understanding and connection to the stories of the victims? (Open-ended)

C. Reflection on Immersive Education
   13. How realistic can the transition from traditional coursebooks to this interactive book be? (5-point Likert scale)
   14. Which of these denotes the expected advantages of utilizing immersive technologies in education: High Student Engagement, Deep Retention and Understanding, Personalized and Adaptive Learning, Collaborative Learning Opportunities, Accessibility and Inclusivity. (Multiple Choice)

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