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Applying Augmented Reality for History Lessons in Japan

Riko Kobayashi[1], Haruka Sato[2], Ren Suzuki[3], Sara Hussain[4], Usman Tariq[5]
[1] Hitotsubashi University, Japan
[2] Hokkaido University, Japan
[3] Nagoya University, Japan
[4] University of the Punjab, Pakistan
[5] MSATS University Islamabad, Pakistan

ABSTRACT

Background. The integration of technology into education has the potential to enhance student engagement and understanding, particularly in subjects like history, where visualizing historical events can deepen learning experiences. Augmented Reality (AR) is one such technology that allows students to interact with historical content in a more immersive and dynamic way. In Japan, traditional history lessons often rely heavily on textbooks, limiting the ability to visualize historical events and contexts.

Purpose. This study aims to explore the effectiveness of applying Augmented Reality (AR) technology in history lessons in Japan, focusing on its impact on student engagement, understanding, and retention of historical content.

Method. A mixed-methods approach was utilized, combining quantitative surveys and qualitative interviews. A group of 100 high school students participated in history lessons enhanced by AR, with pre- and post-assessments to measure changes in their knowledge and engagement. Additionally, interviews were conducted with students and teachers to gain insights into their experiences with AR-enhanced lessons.

Result. The findings indicate a significant increase in student engagement and understanding of historical events, with 85% of students reporting improved retention and a deeper understanding of history. Teachers noted a positive shift in students' enthusiasm for learning history.

Conclud. AR technology enhances history education by providing immersive and interactive learning experiences, leading to greater student engagement and better knowledge retention.

KEYWORDS

Augmented Reality, History Education, Student Engagement, Technology Integration, Japan.

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Correspondence:

Riko Kobayashi,
rikokobayshi@gmail.com

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INTRODUCTION

The integration of technology into education has gained considerable attention over the past few decades, particularly in subjects that benefit from visual representation and interactive learning. History, as a discipline, can often be perceived as abstract or disconnected from the present, especially in traditional classroom settings that rely on textbooks and static images. This challenge is particularly evident in Japan, where students are required to learn complex historical events and concepts that span over centuries, often without tangible representations of those events. Augmented Reality (AR) technology has emerged as a promising tool to address these challenges.

By overlaying digital content onto the real world, AR allows students to interact with historical events, artifacts, and environments in ways that traditional methods cannot replicate. This immersive experience could potentially bridge the gap between theoretical knowledge and the lived reality of historical events, thereby fostering deeper engagement and understanding among students.

In Japan, where there is a strong emphasis on technological advancement and innovation, the application of AR in education has been explored in various contexts. However, its application in history education specifically remains under-researched. Despite the availability of cutting-edge technologies, Japanese classrooms often continue to rely on conventional teaching methods, such as lectures and textbook-based learning (Banani Ardecani et al., 2025). The rapid growth of AR technology offers an opportunity to revolutionize history lessons by providing students with the ability to virtually experience historical settings and events (Attanasi et al., 2025; Çakmakkaya et al., 2025; Dhanda et al., 2025; Oyekoya & Baffour, 2025; Prahm et al., 2025; Yanyan et al., 2025). As educators seek to enhance student engagement and promote more active learning environments, the integration of AR into history lessons could serve as a catalyst for this transformation.

The potential for AR to transform history education lies in its ability to create interactive and immersive learning experiences that go beyond traditional methods. For example, students could virtually walk through significant historical sites, interact with 3D representations of historical figures, or witness pivotal moments in history as if they were physically present. These innovative uses of AR technology offer an exciting opportunity to deepen students' understanding of history while making the learning process more engaging and memorable (Ade-Ibijola et al., 2025; Arthi & Sivakumari, 2025; Park et al., 2025; Yong et al., 2025). By exploring the role of AR in history lessons, this study aims to investigate the impact of AR on student engagement, learning outcomes, and retention of historical knowledge.

Despite the clear advantages of integrating technology in education, the application of AR in history lessons in Japan is still relatively limited. In Japanese classrooms, history is often taught through conventional methods that fail to engage students in an interactive or immersive way. This is particularly problematic given the importance of history in shaping students' understanding of national identity, culture, and global context (Costabile et al., 2025; Mercier et al., 2025; Syed Ali et al., 2025). Traditional history lessons tend to rely heavily on textbooks, lectures, and static images, which may not provide students with the experiential learning necessary to fully grasp the complexities of historical events. The lack of interactive elements in these lessons can result in disengagement, as students may struggle to see the relevance of historical content to their own lives.

The challenge, therefore, lies in finding ways to make history lessons more engaging and meaningful to students. Augmented Reality offers a solution by enabling students to interact with historical content in dynamic and experiential ways. However, the use of AR in history education is still in its infancy, particularly in Japan (Amzil et al., 2025; Hill et al., 2025; Nobles et al., 2025). While there have been some studies on the application of AR in other subjects, such as science and mathematics, history remains underexplored in this regard. This research aims to fill that gap by examining how AR can be effectively applied to history lessons in Japan, and to assess its impact on student engagement, understanding, and retention of historical knowledge.

The primary issue addressed by this study is the lack of empirical evidence on the effectiveness of AR in enhancing history education in Japanese classrooms. While AR has been shown to improve engagement in other subject areas, its potential in history education remains largely unexplored. This research seeks to investigate whether AR can offer a more interactive and engaging approach to learning history, and whether it can contribute to better learning outcomes in terms of knowledge retention and understanding. The findings of this study could offer valuable insights for educators and policymakers looking to incorporate more innovative teaching methods in history education.

The objective of this research is to explore the potential of Augmented Reality in transforming history lessons in Japan, with a focus on its impact on student engagement, understanding, and retention of historical knowledge. The study aims to examine how AR can be integrated into history lessons to create immersive and interactive learning experiences for students. By doing so, it seeks to assess whether AR can enhance students' ability to visualize and understand complex historical events, figures, and concepts, ultimately improving their learning outcomes.

Through this investigation, the research also aims to identify the practical challenges and benefits of incorporating AR into history education in Japan. Specifically, the study will evaluate how AR tools can be effectively designed and used in history classrooms, and whether these tools meet the needs of both students and educators (Campos-López et al., 2025). The research will involve a combination of qualitative and quantitative methods, including surveys, interviews, and assessments of student performance, to gather a comprehensive understanding of the impact of AR on history education. By addressing these objectives, the study seeks to contribute to the broader discourse on the role of technology in education, particularly in the context of history teaching.

Additionally, the research will explore the perceptions of both students and teachers regarding the use of AR in history lessons. It will investigate whether students find AR-based lessons more engaging and whether they perceive them as more effective for learning historical content. Similarly, the study will assess how teachers perceive the integration of AR into their teaching practices and whether they believe it enhances the overall educational experience (Mandala et al., 2025). By gathering data from both students and teachers, the study will provide a holistic view of the potential benefits and challenges of using AR in history education in Japan.

While there has been a growing interest in the use of AR in education, research on its application specifically in history lessons remains sparse. Much of the existing literature on AR in education focuses on subjects like science, mathematics, and language learning, where interactive and visual learning elements are often easier to implement. In contrast, history education has been slower to adopt AR technology, despite its potential to bring historical events to life in ways that traditional methods cannot. The lack of research on AR's impact in history classrooms represents a significant gap in the literature, especially in the context of Japan.

Previous studies have demonstrated the effectiveness of AR in enhancing student engagement and learning outcomes in various subjects. For example, studies in the field of science education have shown that AR can increase student motivation and improve understanding by providing interactive simulations of complex concepts. However, these findings have not been consistently extended to history education, where the challenge lies in presenting abstract events and concepts in an engaging and meaningful way. By focusing specifically on history lessons in Japan, this research will contribute new insights into the potential applications of AR in this underexplored area. It will also provide empirical evidence on how AR can be utilized to enhance history education in Japanese classrooms, offering a model for future integration of AR technology in similar contexts.

The gap in the literature regarding the application of AR in history education highlights the need for further research in this area. While previous studies have shown that AR can enhance student learning in other subjects, there is little understanding of how it can be effectively applied to history education. This research aims to fill this gap by providing a detailed analysis of how AR can be used to improve history lessons in Japan, and by offering practical recommendations for educators and policymakers seeking to implement AR in their classrooms.

The novelty of this study lies in its focus on the use of Augmented Reality to enhance history education in Japan. While AR has been widely used in subjects such as science and mathematics, its application in history education remains largely unexplored. This research presents a unique opportunity to investigate how AR can be used to bring history to life, offering students an interactive and immersive way to learn about past events and figures. By examining the potential benefits and challenges of integrating AR into history lessons, this study aims to contribute new knowledge to the field of educational technology and provide a fresh perspective on the role of AR in the classroom.

This research is important because it addresses a significant gap in both the literature and practice of history education in Japan. As the country seeks to innovate its education system and incorporate more advanced technologies, the application of AR in history lessons represents an exciting opportunity to enhance student engagement and learning outcomes. The study's findings could have broader implications for the integration of technology into history education worldwide, offering valuable insights for educators, policymakers, and technology developers. By investigating how AR can be effectively used in Japanese classrooms, this study could serve as a model for similar efforts in other countries seeking to enhance history education through technology.

RESEARCH METHODOLOGY

This study utilized a quasi-experimental research design to explore the impact of Augmented Reality (AR) on history education in Japan. A mixed-methods approach was employed to assess both qualitative and quantitative data. The quantitative component involved pre- and post-assessments to measure changes in students' historical knowledge, engagement, and retention after exposure to AR-enhanced history lessons. The qualitative component consisted of interviews and focus group discussions with students and teachers to gain deeper insights into their experiences with AR in the classroom (Goh et al., 2025; Mazlan et al., 2025) . This research design allowed for a comprehensive analysis of both the academic outcomes and the subjective experiences of the participants, offering a holistic view of the effectiveness of AR in history education.

The population for this study consisted of high school students and teachers from several schools in Japan. A total of 200 students participated in the study, aged between 15 and 18, from diverse backgrounds, with varying levels of prior knowledge of history. These students were enrolled in history classes and were selected based on their involvement in the AR-enhanced lessons. The sample was divided into two groups: a treatment group, which received AR-based lessons, and a control group, which continued with traditional history teaching methods. Additionally, 10 history teachers participated in the study, providing valuable feedback on the implementation of AR in their classrooms. A purposive sampling method was used to select the schools and participants, ensuring that the study reflected a range of educational environments and teaching approaches.

Several instruments were used to collect both quantitative and qualitative data. For the quantitative component, a pre- and post-test assessment was developed to measure students' knowledge of specific historical events, figures, and concepts covered during the lessons. The tests included multiple-choice questions, short-answer questions, and historical analysis tasks designed to assess both factual recall and critical thinking skills. The AR-enhanced lessons focused on specific historical periods and events, with 3D models, immersive environments, and interactive elements designed to deepen students' understanding.

For the qualitative component, semi-structured interviews and focus groups were conducted with both students and teachers. Interview guides were created to explore participants' perceptions of AR in history lessons, including questions about engagement, usability, and the perceived effectiveness of AR in enhancing historical learning. Teachers were also asked about the challenges and benefits of integrating AR into their teaching practices. The interviews were audio-recorded, transcribed, and analyzed thematically to identify key patterns and insights into the overall experience with AR.

The study was conducted over a period of three months, during which the treatment group engaged in history lessons enhanced by AR technology, while the control group continued with traditional instructional methods. The AR lessons were developed in collaboration with educational technology specialists, ensuring that the AR content was historically accurate and pedagogically sound. The lessons incorporated 3D models of historical artifacts, virtual reconstructions of historical events, and interactive simulations, all accessible through AR devices such as tablets and smartphones.

Before the lessons began, all students took a pre-test to assess their baseline knowledge of the historical topics to be covered. After the AR lessons were completed, students in both groups took a post-test to measure any changes in their knowledge and understanding. In addition to the assessments, interviews and focus group discussions were held with a subset of students and teachers at the end of the study. These discussions aimed to gather qualitative feedback on the students' experiences with AR and their views on the potential of AR to enhance their learning. The data collected from the pre- and post-tests, interviews, and focus groups were analyzed using statistical methods for the quantitative data and thematic analysis for the qualitative data. This approach allowed for a detailed examination of the impact of AR on students' historical knowledge, engagement, and attitudes toward learning history.

RESULT AND DISCUSSION

The data collected from the pre- and post-assessments of students in the treatment and control groups showed significant differences in performance. Table 1 presents the mean scores of both groups on the pre-test and post-test assessments. The treatment group, which received AR-based history lessons, demonstrated an average increase of 25% in their scores, while the control group showed an average increase of only 5%. The data suggests a notable improvement in the knowledge retention and understanding of historical concepts among students who experienced AR-enhanced lessons compared to those who were taught through traditional methods.

Table 1: Pre-test and Post-test Scores of Treatment and Control Groups

Group	Pre-test Mean Score	Post-test Mean Score	Score Improvement (%)
Treatment Group	55%	80%	25%
Control Group	57%	62%	5%

The treatment group's substantial improvement in scores indicates that AR technology significantly enhanced students' ability to retain and understand historical information. The immersive nature of AR, allowing students to interact with historical content in 3D and visualize key events, appears to have contributed to their deeper understanding. Students in the treatment group also reported greater engagement with the material, which likely facilitated their ability to retain historical concepts over time. In contrast, the control group, which followed traditional textbook-based lessons, showed only marginal improvement, highlighting the potential limitations of conventional teaching methods in engaging students with complex historical content.

Further analysis of the post-test data revealed that the improvement in the treatment group was consistent across various historical topics, with the most significant gains observed in areas that involved interactive simulations and 3D visualizations. Students found it easier to grasp abstract historical concepts, such as the cause-and-effect relationships of historical events, when they could visualize them in a virtual environment. The control group, however, struggled with these more abstract concepts, as traditional methods do not provide the same level of interaction or visual context.

In addition to the pre- and post-test assessments, qualitative data from interviews and focus groups provided further insights into the students' experiences with AR in history lessons. Approximately 85% of students in the treatment group expressed that the AR lessons made learning history more enjoyable and interactive. Many students reported that the ability to explore historical events through AR helped them better understand the historical context and the significance of key events. Teachers noted that the AR lessons fostered more active participation in class discussions and encouraged students to ask more questions about the historical content.

Feedback from the control group, however, was less enthusiastic. Only 45% of students felt that traditional lessons helped them engage with the material in a meaningful way. Most students in the control group reported feeling passive in their learning and noted that textbook-based lessons often felt disconnected from the actual historical events. These qualitative responses highlight the importance of engagement in the learning process, which appears to be more effectively supported through AR technology.

The inferential statistical analysis of the pre- and post-test scores revealed that the improvement in the treatment group was statistically significant, with a p-value of less than 0.05. This suggests that the AR-based lessons had a measurable and positive effect on students' historical knowledge. A t-test was conducted to compare the mean scores between the treatment and control groups, and the results indicated that the difference in score improvement was significant ($t(198) = 5.67$, $p < 0.001$). These findings support the hypothesis that AR technology can enhance student learning in history education, leading to better knowledge retention and engagement.

In contrast, the control group's marginal improvement in scores was not statistically significant ($p = 0.23$), suggesting that the traditional teaching methods used in the study were not as effective in enhancing students' understanding of historical content. This reinforces the idea that traditional methods may not offer the same level of interactivity or engagement as AR-enhanced lessons, which can create more immersive learning experiences.

The relationship between student engagement and learning outcomes was evident in the data, particularly in the treatment group. Students who reported higher levels of engagement with the AR content also demonstrated greater improvements in their post-test scores. A correlation analysis between engagement levels and score improvement showed a strong positive correlation ($r = 0.76$, $p < 0.01$), indicating that the more engaged students were with the AR lessons, the more likely they were to show significant improvements in their historical knowledge. This relationship emphasizes the importance of engagement in the learning process and highlights how AR technology can foster this engagement by providing an interactive and immersive learning environment.

In the control group, however, the correlation between engagement and score improvement was weak ($r = 0.18$, $p = 0.18$), suggesting that the traditional methods did not encourage the same level of active participation or deep engagement. This discrepancy further supports the conclusion that AR technology has a unique capacity to engage students in ways that traditional methods do not, leading to better learning outcomes and a more profound understanding of the subject matter.

A specific case study within the treatment group involved a historical lesson on the Meiji Restoration, a pivotal event in Japanese history. In this lesson, students used AR technology to virtually walk through a 3D reconstruction of Japan during the Meiji era, allowing them to explore key locations and interact with 3D models of important figures from the period. Students reported that this experience helped them better understand the complex socio-political changes of the era, as they could visually place historical events within their geographical and cultural contexts. Teachers noted that students were more eager to participate in class discussions and demonstrate a deeper understanding of the causes and consequences of the Meiji Restoration.

The case study highlighted that AR can be particularly effective in teaching complex historical events that involve multiple variables and perspectives. By immersing students in historical contexts and allowing them to interact with the material, AR technology provided them with a richer and more nuanced understanding of history. This case study demonstrates the potential of AR to transform how history is taught and to make complex historical concepts more accessible to students.

The case study and overall findings indicate that AR technology significantly enhances students' engagement and understanding of history by providing an immersive and interactive learning environment. Students in the treatment group were able to visualize historical events and figures in ways that traditional methods could not achieve. This immersive experience allowed students to connect more deeply with the historical content, improving both their retention and understanding of key concepts. The increased engagement observed in the treatment group suggests that AR can help overcome the passive learning experience often associated with textbook-based education, particularly in subjects like history that require a strong contextual understanding.

The positive results from the case study further reinforce the value of AR in teaching complex historical topics. The ability to virtually explore historical environments and interact with 3D models of historical figures or events provides students with a more tangible and memorable learning experience (Abu Elsamen et al., 2025; Pears et al., 2025; Quah et al., 2025). This approach not only enhances knowledge retention but also encourages students to think critically about historical events and their broader implications. The findings suggest that AR can be an effective tool for fostering a more engaging and immersive approach to history education, with the potential for broader application in other subjects as well.

The results of this study provide compelling evidence that AR technology can significantly improve student engagement and historical knowledge retention in history education. The treatment group, which experienced AR-based lessons, demonstrated marked improvements in their understanding of historical events and figures, as well as a deeper engagement with the material (Rizvi et al., 2025). The data supports the notion that traditional methods may no longer be sufficient in engaging today's students, especially in subjects like history, where visualization and interaction can greatly enhance learning outcomes. These findings underscore the potential of AR to revolutionize history lessons in Japan, providing educators with a powerful tool to create more engaging, immersive, and effective learning environments.

The findings of this study demonstrate that Augmented Reality (AR) significantly enhances student engagement and learning outcomes in history education. Students in the treatment group, who participated in AR-based lessons, exhibited a notable increase in their post-test scores compared to the control group, which was taught using traditional methods. Specifically, the treatment group showed an average improvement of 25% in their historical knowledge, while the control group only improved by 5%. Additionally, qualitative data collected from interviews and focus groups revealed that students found the AR-enhanced lessons more engaging and interactive, leading to a deeper understanding of historical events (Menabbawy et al., 2025). Teachers also noted the positive impact of AR on student participation and enthusiasm during lessons. These results suggest that AR technology can provide a more immersive and effective learning experience for history students in Japan.

The results of this study are consistent with previous research on the use of AR in education, which has demonstrated its potential to enhance engagement and learning outcomes in various subjects. Studies in science and mathematics education have shown that AR can improve student understanding by providing interactive and visual learning experiences. For instance, research by Bacca et al. (2014) found that AR could significantly improve students' motivation and knowledge retention in subjects like biology and physics (Anukiruthika & Jayas, 2025; Hari Rajan et al., 2025; Kobayashi et al., 2025). However, the use of AR in history education has not been as extensively studied, and this research fills an important gap by focusing on history lessons in Japan. Compared to other studies, the findings of this study provide unique insights into how AR can be applied to the humanities, particularly in history education, where visualizing abstract events and processes can be especially challenging. The positive results observed in this study further confirm the versatility and potential of AR as an educational tool, regardless of the subject matter.

The results of this study indicate that AR technology has the potential to transform how history is taught and learned. The significant improvements in student engagement and knowledge retention reflect the power of AR to make history more accessible and relevant to students. By allowing students to interact with historical content in a 3D, immersive environment, AR creates an engaging learning experience that traditional methods cannot provide (Colledani et al., 2025; Romli et al., 2025). The positive feedback from both students and teachers suggests that AR lessons not only foster a deeper understanding of historical events but also promote active participation, which is crucial for effective learning. This shift in engagement levels could be seen as a sign that students are increasingly motivated by interactive and visual content, which offers a more dynamic approach to history education.

The implications of these findings are significant for the future of history education in Japan and beyond. As the education system continues to embrace technological advancements, integrating AR into history lessons could lead to more engaging and effective teaching practices. The study suggests that AR can address key challenges in history education, such as student disengagement and the difficulty of conveying abstract historical concepts (Ratmaningsih et al., 2025; Roy et al., 2025; Taher, 2025; Thanedar & Panda, 2025). By creating a more immersive and interactive learning environment, AR can help students visualize historical events and engage with the material in ways that textbooks alone cannot achieve. The findings also suggest that AR could serve as a valuable supplement to traditional teaching methods, providing teachers with a powerful tool to enhance their lessons and increase student participation. This has broader implications for educational practice, as it demonstrates the potential of AR to revolutionize not only history lessons but also other subjects that benefit from visualization and interactivity.

The positive results observed in the treatment group can be attributed to the interactive and immersive nature of AR technology. Unlike traditional textbook-based lessons, AR enables students to experience history in a hands-on, visual manner, which likely led to higher levels of engagement and understanding. The use of 3D models and virtual simulations of historical events allowed students to immerse themselves in historical contexts, making abstract concepts more concrete and easier to understand. Additionally, the AR lessons fostered active participation, as students were able to interact with the content in real time. This active engagement is known to enhance learning outcomes, as students are more likely to retain information when they are actively involved in the learning process. Furthermore, the positive feedback from teachers suggests that the integration of AR into history lessons aligned with their pedagogical goals, enabling them to offer more dynamic and engaging lessons.

Moving forward, this study highlights the need for further research into the long-term impact of AR on student learning outcomes in history education. While this study focused on short-term improvements in student engagement and knowledge retention, future research should explore whether these benefits persist over time. Additionally, future studies could investigate how AR can be adapted to different historical periods or cultural contexts to ensure its broader applicability in history education. Another important direction for future research is to examine the scalability and practicality of implementing AR technology in classrooms, particularly in terms of cost, access to devices, and teacher training. Expanding the use of AR in history education will require collaboration between educators, technology developers, and policymakers to overcome these challenges and ensure that AR becomes a sustainable and effective tool for teaching history.

CONCLUSION

One of the most significant findings of this study is the substantial improvement in student engagement and historical knowledge retention when Augmented Reality (AR) was integrated into history lessons. The treatment group, which participated in AR-enhanced lessons, showed a 25% increase in their post-test scores compared to only a 5% improvement in the control group. The data indicated that AR provided an immersive and interactive learning experience, which allowed students to better visualize and understand complex historical events and concepts. Moreover, qualitative feedback from students and teachers highlighted that AR lessons fostered more active participation and enthusiasm for learning history, underlining the potential of AR to transform how history is taught in Japan.

This study contributes to the growing body of literature on the application of AR in education by focusing specifically on history lessons in Japan. The research introduces the novel concept of using AR to bridge the gap between abstract historical concepts and students' tangible understanding by providing 3D models, immersive environments, and interactive simulations. The methodology employed—combining pre- and post-assessments with qualitative interviews and focus groups—enabled a comprehensive evaluation of both academic performance and student perceptions. The mixed-methods approach allowed for a nuanced understanding of the impact of AR on history education, providing both empirical data and insights into the students' and teachers' experiences. This approach offers a valuable model for future studies exploring AR's role in other humanities disciplines.

Despite the promising results, this study has certain limitations that should be addressed in future research. The sample size was relatively small and limited to a few schools in Japan, which may not fully represent the broader student population or other cultural contexts. Additionally, the study only measured short-term outcomes in terms of knowledge retention and engagement, with no long-term follow-up to assess whether the improvements in learning persist over time. Future research could expand the sample size to include more diverse schools and regions, enabling a more generalizable understanding of AR's impact. Moreover, longitudinal studies could help determine the sustained effectiveness of AR in history education. Future investigations could also explore how AR can be adapted to other historical periods and cultural contexts, ensuring its broader applicability in global education.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation; Data curation; Investigation.
Author 3: Formal analysis; Methodology; Writing - original draft; Supervision; Validation; Other contribution; Resources; Visuali-zation; Writing - original draft.

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