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New Horizons in Social Studies Education with Mixed Digital Reality[1]

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Abstract

This theoretical study examines the impact of digital transformation on education systems, with a particular focus on Social Studies instruction, and explores the pedagogical contributions of Mixed Digital Reality (MDR) technologies. As digitalization profoundly transforms how individuals access and utilize information, it necessitates a re-evaluation of traditional educational paradigms. Within this context, the significance of the study lies in the potential of MDR technologies to deepen conceptual understanding in Social Studies and to enhance essential student competencies such as historical empathy and cultural awareness. The study adopts a literature-based approach to present a theoretical framework that explains the relationship between MDR technologies and Social Studies education. Definitions, technical perspectives, and example applications from existing scholarship are examined in detail to articulate how these technologies can be employed within educational contexts. The findings indicate that MDR applications support student-centered, personalized, and experience-based learning processes; enhance the retention of learning materials; and facilitate interaction between physical and digital environments. Tools such as 360-degree videos, augmented reality applications, and virtual field trips enable students to reenact historical events and engage with social phenomena in a multidimensional manner. These technologies are proposed to be functional not only in enhancing student learning but also in teacher preparation programs. Mixed reality simulations allow preservice teachers to develop instructional competencies in safe and controlled environments, while also contributing to the formation of their professional identity. However, it is also emphasized that issues such as technological inequality, user safety, and adherence to ethical standards must be carefully addressed. In conclusion, this study demonstrates the transformative potential of MDR technologies in Social Studies instruction and teacher education, and underscores the necessity of multi-dimensional evaluations—pedagogical, technical, and social—for their effective integration. It is recommended that future research empirically validate these theoretical propositions to support the sustainable implementation of MDR in educational settings.

Keywords: Augmented Reality, Mixed Digital Reality, Social Studies Education, Virtual Reality.

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Introduction

Today, social change and technological progress are bringing about radical transformations in the nature and structure of education systems. This transformation, which affects a wide range of areas from lifestyles to ways of doing business, from social relations to learning processes, reshapes how individuals access and use information. In particular, the use of digital tools in education has made information acquisition processes more personalised, flexible and interactive, making it necessary to review the traditional understanding of education.

In light of these developments, the use of educational technologies and their integration into education has gained importance. In particular, innovative technologies such as mixed digital reality, augmented reality and virtual reality redefine the traditional classroom environment and make learning experiences multidimensional. Mixed digital reality applications contribute to the development of students' ability to make sense of information and transform it into knowledge by providing the opportunity to combine theoretical information with practice. The use of mixed digital reality technologies in education increases the permanence of learning by contributing to the enrichment of learning materials, the development of students' spatial and visual perception skills, and the deepening of conceptual understanding processes.

In this context, the use of Mixed Digital Reality (MDR) technology in education brings a new dimension to education and makes learning experiences versatile. Mixed digital reality supports students' processes of accessing information, making sense of it and developing their skills by providing the interaction of virtual and real worlds. These technologies have the potential to increase the retention of learning by combining the theoretical aspects of information with practical applications. Especially for a discipline such as social studies education, where individuals' ability to understand and analyse social events is developed, MDR technology offers new and enriching learning opportunities.

Purpose

The study focuses on the significance of integrating digitalization and mixed digital reality technologies into social studies education. The impact of digitalization on education will be assessed from pedagogical, social, and cultural perspectives, with particular attention to the evolving roles of students and teachers in this transformation. The primary aim of this research is to emphasize the necessity of interactive and experiential learning practices in education driven by advancing technology, thereby providing a framework to guide future studies in this field.

In this context, the study explores the potential opportunities and challenges presented by the digital transformation in education through mixed digital reality applications. It specifically examines the contributions that these technologies can offer to the field of social studies education. By doing so, the research aims to establish a theoretical foundation and offer a comprehensive analysis of how MDR technologies can transform instructional processes within the domain of social studies.

Methodology

This is a theoretical study based on an extensive review of the relevant literature. Throughout the research process, the literature on mixed digital reality (MDR) was thoroughly examined, and definitions pertaining to the theoretical and conceptual frameworks were identified (Girvan, 2018, Milgram & Kishino, 1994, Hayes & Downie, 2024, Aloqaily, Bouachir & Karray, 2023, Rasimah, Ahmad, & Zaman, 2011, Kirkley & Kirkley, 2005, Microsoft, 2025, Fisher & Baird, 2020, Price, 2018, O'Brien & Heafner, 2022, Hanson & Shelton, 2008, MacCallum & Jamieson, 2017, MacCallum & Parsons, 2022, Piro & O'Callaghan, 2018, Aloqaily, Bouachir & Karray, 2023). This analysis involved a comprehensive examination of the literature with the aim of defining the relationship between MDR technologies and social studies education.

The Relationship between Social Studies and Digitalisation

Social studies education is a discipline that aims to help individuals understand and evaluate social events and address them from a comprehensive perspective. Although traditional learning methods have served these goals for many years, transformations in this field have become inevitable as the digitalisation process has accelerated. By examining the digitalisation process in social studies education in depth, it is necessary to examine the pedagogical, social and cultural dimensions of this transformation. In this context, it becomes increasingly important to closely examine the impact of digitalisation on social studies education. Digitalisation is fundamentally changing teaching and learning practices, expanding students' access to information and introducing them to interactive learning experiences. This process transforms not only the integration of technological tools into education, but also the role of educators, curriculum designs and learning goals. This digitalisation process in social studies education represents a turning point in the discipline's efforts to achieve its core purpose of providing students with up-to-date, meaningful information.

It is important to consider the key elements of digitalisation in social studies education and their impact on educational practice. Firstly, the integration of digitalisation into the social studies curriculum and its impact on students' access to information. It is then necessary to focus on how educators are adapting to this transformation, looking at changes in teacher roles and the adaptation of digital tools to classroom activities. It is critical to understand and evaluate the opportunities offered by digitalisation in social studies education and the challenges that this transformation brings and to shape future educational practices.

Pedagogical Transformation: The Contribution of Digitalisation to Social Studies Education

The contributions of digitalisation to social studies education enable students to become not only information consumers but also information producers. Through digital tools and resources, students can research social issues, learn through interactive content and collaborate with other students around the world. This allows social studies to move from being just a subject to becoming an integral part of our daily lives.

As A Concept: Mixed Digital Reality

Mixed digital reality (MDR) is a hybrid technology that combines Virtual Reality (VR) and Augmented Reality (AR) technologies (Figure 1.).

Virtual Reality is a simulated environment that fulfils the world framework. However, what makes it different from the material or physical world is the types of experiences offered to the user by combining different technical features, especially virtual characters (Girvan, 2018).

Augmented Reality (AR) refers to all situations where the image of a real environment is augmented through virtual (computer-generated) objects (Milgram & Kishino, 1994). AR technology enriches rather than alters the user's perception of reality by superimposing content on the real world. AR devices are equipped with cameras, sensors and displays. These devices may include smartphones and tablets that create mobile AR experiences, or 'wearables' such as smart glasses and headsets. These devices capture the physical world and then integrate digital content (e.g. 3D models, images or videos) into the scene, blending digital and virtual worlds (Hayes & Downie, 2024).

Figure 1.

Mixed Digital Reality Spectrum (Microsoft, 2024)

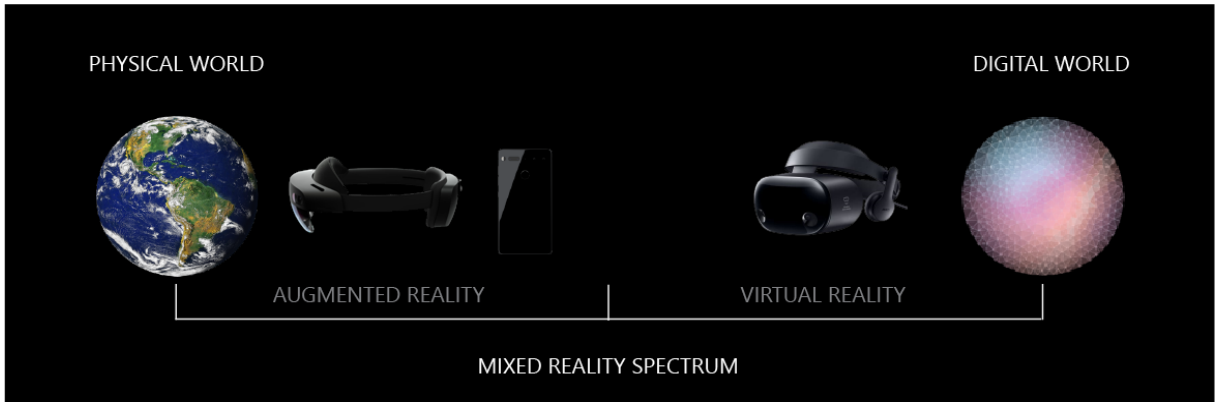
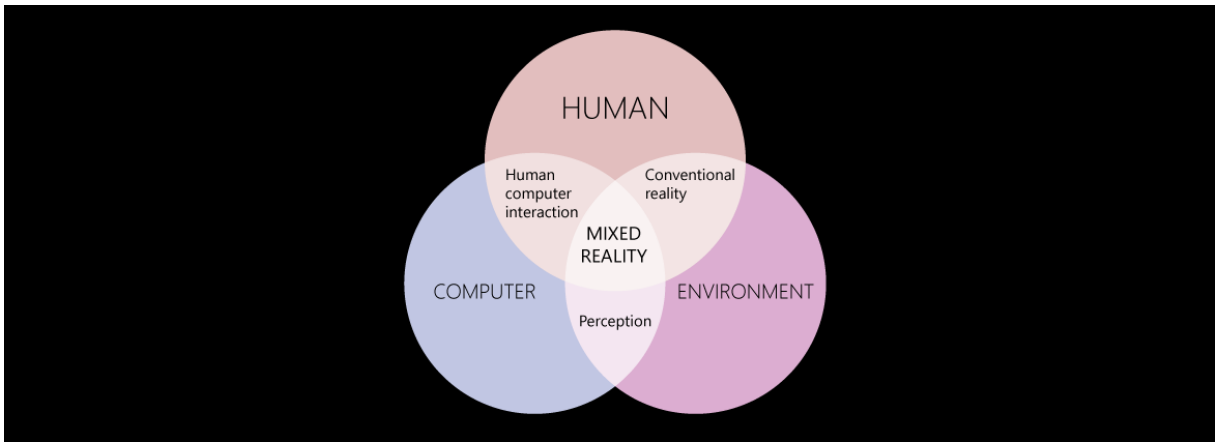


Figure 2.

The interactions between computers, humans, and environments. (Microsoft, 2024)



MDR" refers to a technology concept that combines the real world with digital content. MDR refers to the combination of real and virtual worlds to create a new environment where physical and three-dimensional digital objects coexist and interact in real time (Aloqaily, Bouachir and Karray, 2023), (Figure 3.). MDR offers an "interactive" reality experience where the real world and digital content merge. By combining these two technologies, MDR enables real-world objects and interactive virtual objects to be experienced simultaneously.

The MDR environment is unique because it combines real and virtual objects, is interactive in real time and is recorded in three dimensions. It can support a seamless interaction between real and virtual environments (Rasimah, Ahmad, & Zaman, 2011). These features make the experiences offered by MDR realistic, authentic, engaging and fun (Kirkley & Kirkley, 2005).

Figure 3.

Mixed Digital Reality (Microsoft, 2025)

Users can interact between real world and virtual objects and combine virtual objects with real world objects. For example, a user wearing an MDR goggle can place a virtual object on a table and interact with it, experiencing its physical properties in the real world (Fig. 3. Microsoft, 2025).

Applications and Technologies

Microsoft HoloLens

Microsoft HoloLens is a mixed digital reality headset developed by Microsoft. The first version was released in 2016 and HoloLens 2 was released in 2019. This device combines

augmented reality (AR) and virtual reality (VR) features, allowing users to interact with the real world around them.

Key Features:

- *Mixed Digital Reality:* HoloLens allows the user to see the real world and overlays digital holograms over this physical environment, providing a mixed experience. Thus, the user can interact by combining virtual objects with the physical world.

- *Hands-Free:* This device detects hand gestures, eye movements and voice commands, allowing users to control the device without using their hands.

- *Area Detection:* The device can map the surrounding area so that holograms can be realistically placed in the environment. For example, a virtual object can be placed on a table and kept there.

- *Industrial and Education Applications:* HoloLens has found wide use in fields such as engineering, medicine, architecture, education and industry. In the field of education, it allows students to see complex structures and processes in a three-dimensional environment, making learning more visualised and comprehensible.

Figure 4.

Microsoft HoloLens (Chatgpt, 2024)

Areas of Use

HoloLens

It appeals to a wide range of users and combines complex visuals with the physical world by offering augmented reality-based content. In education, it can help students visualise theoretical information. These devices are impressive solutions that demonstrate the potential of mixed digital reality technology in education and business. For example, augmented and mixed reality technologies provide benefits such as reinforcing previously learned content, enabling real-time access to resources, and mentoring students remotely. San Diego State

University developed a virtual teaching tool where nursing students use HoloLens headsets to observe and treat virtual patients in real-time 3D. These students can also receive expert support instantly, such as recognizing early symptoms of allergic reactions, thus enriching the learning experience with real-world relevance (Fisher & Baird, 2020, Price, 2018).

Mixed digital reality has potential applications for many different fields. In the educational relationship, which is the subject of this study, it can provide students with individualised, interactive and visual learning experiences. It is useful to look at the relationship between MDR and education in depth.

Mixed Digital Reality and Education

Mixed digital reality is a technology that offers various opportunities in the field of education. Some points about the relationship between mixed digital reality and education:

I. *Hands-on Learning:* Mixed digital reality enables students to experience learning hands-on. Students interact with learning materials through virtual overlays in real-world environments. This enables them to understand the practical applications of theoretical information and increases the retention of learning.

II. *Virtual Conversations and Dialogues:* MDR platforms allow learners to have virtual conversations and simulate dialogues with historical figures. This can offer students the opportunity to better understand the thoughts and opinions of historical characters.

III. *Distance Education:* Mixed digital reality can be used more effectively in distance learning environments. Students can have experiences in real-world environments using mixed digital reality tools and interactively access learning materials. This enriches students' distance learning experiences and increases their engagement.

IV. *Advanced Interactivity:* Mixed digital reality technology can be developed to offer more advanced interactive experiences. Learners can manipulate real-world objects, use virtual layers in a more personalised way and access more complex simulations.

V. *Remote Collaboration:* Mixed digital reality can offer more advanced tools for remote collaboration and group work. Students can come together from different geographical locations to work on interactive projects in real-world environments.

VI. *Customised Learning:* Mixed digital reality can be developed to provide students with customised learning experiences. Learning materials and experiences can be personalised, taking into account students' learning styles, interests and abilities.

Relationship Between Social Studies Curriculum and Mixed Digital Reality: Potential and Future

The rapid advancement of digital technologies today marks the beginning of a transformative era for social life and educational processes. Within the context of this digital transformation, social studies education plays a critical role in promoting active participation in social life, enhancing students' abilities to interpret and evaluate social phenomena, raising cultural awareness, strengthening citizenship responsibilities, and internalizing democratic values. The interdisciplinary structure of the curriculum integrates fields such as anthropology,

geography, history, sociology, politics, and economics, aiming to provide students with experiences closely related to their everyday lives.

Mixed Digital Reality (MDR) aligns directly with the core objectives and approaches of the social studies curriculum, offering innovative technologies that complement traditional social studies teaching methods by providing interactive, experiential, and in-depth learning environments. In particular, MDR technologies strongly support goals such as developing historical empathy and chronological thinking skills, experiencing democratic participation processes, and gaining cultural and social awareness. For instance, in history classes, students can vividly experience historical events like World War II through virtual and augmented reality, visit historical sites, and interact in real-time with historical figures. Such experiences allow students to concretize abstract concepts and achieve deeper learning within real-world contexts.

Similarly, in geography and disaster awareness education, MDR technologies enable students to realistically experience natural disasters and the impacts of geographic conditions on human life through virtual environments. This fosters sustainable living awareness and enhances their ability to generate solutions to environmental issues. Students can explore geographic regions using virtual maps and augmented reality elements, analyze disasters as they occur, and engage in cultural interactions.

Furthermore, MDR technologies significantly contribute to social-emotional learning and values education. Experiencing diverse cultural environments and lifestyles directly in virtual reality strengthens students' empathy and social awareness, helping them internalize national and universal values such as tolerance, respect, and responsibility. Thus, social studies education addresses technology not merely as a tool but also in terms of its social and ethical implications, developing students' comprehensive digital competencies (O'Brien & Heafner, 2022).

Key skills highlighted in the social studies curriculum, including democratic participation, active citizenship, and problem-solving regarding societal issues, can be reinforced through interactive and simulated democratic environments created by MDR technologies. Experiencing democratic processes virtually enhances students' active participation awareness.

Digital literacy skills are also directly enhanced by the use of MDR technologies. While utilizing MDR tools, students develop awareness regarding digital safety and privacy, internalizing digital citizenship responsibilities and ethical values required in the digital age.

MDR technologies contribute innovatively to assessment and evaluation processes emphasized in the curriculum. Virtual environments and simulations used to monitor and evaluate students' individual progress provide multidimensional support to teachers' assessment strategies. Additionally, employing MDR in education significantly boosts student motivation, ensuring more effective and lasting learning experiences (Hanson & Shelton, 2008).

In addition to enhancing learning outcomes, Mixed Digital Reality (MDR) significantly contributes to differentiated and personalized instruction. “Recent advances in mobile technology have provided new opportunities for teachers and students to develop their own mixed reality experiences” (MacCallum & Jamieson, 2017). This development presents new openings for social studies education, where students can collaboratively create their own content and independently explore historical, geographical, and cultural phenomena through

digital tools. The accessibility of 360-degree videos, virtual tour software, and location-based augmented applications “provides easy ways for teachers and students to develop their own virtual field trips (VFT)”, making the integration of mixed reality not only innovative but also applicable in a variety of educational settings (MacCallum & Jamieson, 2017). Mixed digital reality can support a range of different learning experiences, depending on how the tools are used to enhance the field trip and which aspects of MR are being engaged with (MacCallum & Parsons, 2022). By promoting learner agency and creativity, MDR increases student motivation and deepens conceptual understanding, especially when learners collaboratively navigate both physical and virtual environments.

Moreover, MDR aligns with the pedagogical emphasis on integrating pre- and post-learning processes. In the context of social studies, the importance of contextualizing field trips before and after the experience is well established in the literature. “VR experiences can be used before or after a field trip for preparation or to support post-trip reflections”, thereby extending the instructional process beyond the physical classroom (MacCallum & Jamieson, 2017). When applied to social studies education, this model enhances reflective learning and enables students to synthesize theoretical content with sensory interaction. Particularly in historical reenactments or civic role-play activities, such a design enables students to internalize knowledge in a more meaningful way. As emphasized in the literature, “mixed reality can support a range of different learning experiences, depending on how the tools are used to enhance the field trip and which aspects of MR are being engaged with” (MacCallum & Jamieson, 2017); this makes it a flexible and effective approach for social studies educators.

In conclusion, Mixed Digital Reality technologies should be viewed as powerful tools enhancing the achievement of objectives and goals within the Social Studies Curriculum, deepening learning processes, and providing students with comprehensive, real-world-related learning experiences**.**

Mixed Digital Reality: Challenge

Although mixed digital reality is a technology that allows users to interact with digital content by combining it with the physical world, it also has some negative aspects.

Privacy and Security Risks

- Mixed digital reality devices are often equipped with cameras, microphones and sensors. This poses potential privacy and security risks. The continuous data collection of the devices may lead to the collection or monitoring of personal information without the user's consent.

- Furthermore, these devices may be targeted by hackers and users' security may be jeopardised.

Physical and Psychological Effects

- *Eye and brain fatigue:* Mixed digital reality devices can cause eye strain, headaches and even dizziness when used for long periods of time. The constant focusing of the eyes on the screen can be harmful, especially for young users.

- *Distortion of reality perception:* Prolonged use can lead to a sense of disconnection from the real world or difficulty distinguishing between the real and virtual worlds.

- *Risk of addiction:* Mixed digital reality has the potential for addiction, especially in teenagers and young adults, as it can create a strong sense of reality in users. Users may prefer to spend time in the virtual environment instead of making social connections in the real world.

Cost

- Mixed digital reality devices are often costly. Devices such as HoloLens require a significant financial investment in both hardware and software. Therefore, it may not be accessible to many organisations or individuals.

- In addition, the cost of updating or maintaining the technology can be a significant additional cost.

Technical Problems and User Experience

- Since mixed digital reality technologies are still in the development stage, technical problems may occur in the devices. Connection problems, software bugs or hardware failures may negatively affect the user experience.

- The use of mixed digital reality devices can be complex and challenging, especially for new users. Users may require training to use the device effectively.

Impacts on Education and Labour Force

- Mixed digital reality can lead to changes in the workforce in many sectors. Performing some jobs more efficiently with mixed digital reality technologies may cause job loss. Especially low-skill jobs can be automated with the widespread use of technology.

- Excessive use of mixed digital reality applications in the field of education may cause students to move away from traditional learning methods and reduce face-to-face interactions.

Ethical Issues

- Mixed digital reality technologies may also raise some ethical questions. Especially in sensitive areas such as education and health, the use of this technology should remain within ethical boundaries and the consent and safety of users should be considered.

- The risk of manipulation or misleading users in the virtual environment is also an issue that needs to be addressed ethically.

Environmental Impacts

- The production of mixed digital reality technology carries an environmental cost, especially in terms of hardware components. In terms of production and energy consumption, mixed digital reality devices can have negative impacts on the environment. In addition, the continuous introduction of new models may increase the amount of electronic waste.

Although mixed digital reality is innovative and useful in many fields such as education, health and industry, these potential negative effects should be taken into consideration and caution should be exercised in its use. In addition, Azuma et al. (2001) noted that although many research systems have been developed, only a few have progressed beyond laboratory-based prototypes and that social acceptance issues need to be addressed before wider adoption. Although proponents of MR claim many advantages for MDR, it has been noted that further implementation of MDR will require a better understanding of users' perceptions of the technology (Kirkley & Kirkley, 2005).

Conclusion

Mixed digital reality technology is an important tool that has the potential to transform the teaching of social studies. By providing students with interactive, experiential and in-depth learning experiences, social studies can be taught more effectively. MDR enables students to actively engage with course content, develop critical thinking skills and make sense of what is learnt in real-world contexts. By using MDR technology, educators can transfer social studies to students more effectively, enrich the learning experience and increase students' motivation.

Mixed Digital Reality plays an important role in social studies and enriches students' learning experiences. The virtual reality, augmented reality and mixed digital reality technologies offered by MDR combine elements of social studies with the digital world, providing students with a deeper understanding and experience. In addition, MDR supports the core values of social studies, such as the development of cultural awareness and empathy. However, issues such as inequalities in access to technology and technology addiction need to be taken into account and more work needs to be done on how MDR influences the core values of social studies.

Beyond social studies, MDR technologies also provide significant contributions to teacher education. When integrated into preservice teacher training programs, mixed reality simulations create safe and controlled environments where candidates can practice teaching, face classroom challenges, and build professional identity through reflective experiences (Piro & O'Callaghan, 2018).

Future Research Recommendations Based on the Current Study

- **Empirical Validation of Theoretical Propositions**

While this study provides a theoretical foundation for understanding the integration of mixed digital reality (MDR) in social studies education, future research should conduct empirical studies—both qualitative and quantitative—to validate the pedagogical, social, and cultural impacts proposed herein.

- **Design-Based Research in Real-Classroom Contexts**

Experimental and design-based studies should be carried out to implement and refine MDR applications in real educational settings. This would provide valuable insight into the feasibility, effectiveness, and challenges of integrating these technologies into social studies classrooms.

- **Teacher Readiness and Professional Development**

Research should investigate teachers' digital competencies, attitudes, and needs regarding the use of MDR technologies. This will help shape effective professional development programs and support the sustainable integration of technology in social studies education.

- **Ethical and Socio-Cultural Implications**

Studies focusing on the ethical dimensions of using immersive technologies—such as data privacy, identity representation, and cultural sensitivity—are essential to ensure that MDR applications contribute positively to inclusive and equitable education.

- **Integration with Curriculum Standards**

Future research should examine how MDR technologies can be aligned with national or international social studies curriculum standards and learning outcomes to ensure pedagogical coherence.

- **Student-Centered Innovation Studies**

Research emphasizing students' voices—through participatory design, feedback loops, or user-experience studies—can help develop more responsive and impactful MDR learning environments tailored to diverse learner needs.

Declaration of Contribution Rate of Researchers

Both researchers contributed equally to the overall article process.

Statement of Conflict of Interest

There is no declaration of conflict between the researchers.

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