

Immersive Learning in the Visual and Performing Arts: A Mixed Methods Study

Melissa Welz

EDTC 806

Research Methods in Educational Technology Leadership

Dr. Carnahan

May 3rd, 2023

Table of Contents

Chapter 1: Introduction2
Statement of the Problem2
Purpose Statement.....3
Research Questions3
Challenges and Limitations4
Chapter II. Literature Review4
Chapter III. Methodology9
Design of the Study.....9
Phase One: Collection of Quantitative Data10
Phase Two: Collection of Qualitative Data11
Conclusion12
The Potential of VR and AR in Visual and Performing Arts Education13
Appendix A:
Pre-Survey Questions for Music/Theater Teachers.....15
Appendix B:
Post-Survey Questions for Music/Theater Teachers17
Appendix C :
Interview/ Observation Survey Questions for Music/Theater Teachers19
Appendix D:
Survey Questions for Immersive Learning Students.....20
References21

Chapter 1: Introduction

The fast paced advancements in technology have been leading to an increased integration of immersive learning, particularly virtual reality (VR) and augmented reality (AR), in various educational sectors, including the visual and performing arts (VPA). The incorporation of immersive learning technologies in the visual and performing arts school subjects has numerous potential benefits for students, educators, and the educational system as a whole. Rouse (2018) defines immersive technology as the combination of virtual content and the physical environment, resulting in a seamless interaction that enables users to engage with the blended reality in a natural manner. This paper aims to examine the potential effects of VR and AR on the VPA curriculum and explore how these technologies can transform the teaching and learning experience for students and educators in the visual and performing arts.

Statement of the Problem

Technology has paved the way for innovative teaching and learning methodologies. Immersive learning has emerged as a promising approach to enhance the educational experience of students in the visual and performing arts subject areas. Research indicates that the use of immersive technologies to create realistic learning experiences has had a positive impact on student learning outcomes and retention, by increasing learner motivation to master the material (Bressler & Bodzin, 2013). However, there is a lack of research that explores the effectiveness of immersive learning in this context, particularly in terms of its impact on student engagement, motivation, and achievement.

This study seeks to fill a gap in the literature by examining the impact of immersive learning on students' attitudes towards learning, their level of participation in class, and their

overall academic performance in the visual and performing arts. The findings of this study will contribute to the existing body of knowledge on immersive learning and its potential as a transformative approach to teaching and learning in the visual and performing arts.

Purpose Statement

The purpose of this study is to investigate the effectiveness of immersive learning in the visual and performing arts. Specifically, this study aims to:

1. Determine the impact of immersive learning on student engagement and motivation in the visual and performing arts.
2. Examine the relationship between immersive learning and student academic performance in the visual and performing arts.
3. Explore the perceptions of students and teachers on the effectiveness of immersive learning in the visual and performing arts.

Research Questions

To achieve the purpose of this study, the following research questions will be addressed:

RQ1 : How does immersive learning impact student engagement and motivation in the visual and performing arts?

RQ2: What is the relationship between immersive learning and student academic performance in the visual and performing arts?

RQ3: What are the perceptions of students and teachers on the effectiveness of immersive learning in the visual and performing arts?

Challenges and Limitations

Despite the potential benefits of immersive learning in VPA education, there are some challenges and limitations that need to be considered. One of the main challenges is the cost of implementing these technologies. VR and AR technologies can be expensive, and schools may not have the financial resources to invest in them. Additionally, the integration of these technologies requires significant technical expertise, which may be a challenge for educators who are not familiar with them.

Another potential limitation of immersive learning technologies in VPA education is the potential for students to become too reliant on technology. This is especially aimed for performing students that rely too much on recorded performances instead of doing live performances. It is possible for students to disengage from the tangible world and depend on digital resources to produce their artwork or performances. This approach may restrict their creative and analytical thinking abilities (Bryman, 2016). Additionally, VR and AR technologies may not be able to fully replicate the experience of live performances or exhibitions, which could limit the overall learning experience for students.

Chapter II. Literature Review

Machon (2013) provides an account of the development and evolution of immersive theater in relation with immersive learning in educational settings. Immersive theater became popular due to Punchdrunk Theatre, with their pioneering approach to dispense with traditional

theater norms. The Guardian Newspaper published an article in 2013 about Felix Barrett, the creator of Punchdrunk, which shed light on their vision for creating a new form of theater. One of the most remarkable achievements of Punchdrunk's, "The Drowned Man" was the sale of over fifty-thousand tickets, priced between \$39.50 to \$47.50, amounting to a total of \$2,375,000. The work attracted an impressive six-hundred people in a warehouse of approximately two-hundred thousand square feet. Machon emphasizes that the aim of immersive theater is to blur the boundaries between performer and audience and erase the fourth wall.

Berate (2019) proposed that VR/AR technology has the potential to enhance the audience's experience by providing them with the ability to explore specific elements of the portrayal. This includes providing insights into the plot, displaying subtitles for the lyrics, labeling the name and role of characters on stage, and tracking the score for a particular theatrical production. Berate also suggests that VR/AR can enable remote involvement in these live theatrical performances, allowing online viewers to listen to the music in real-time over the internet while simultaneously providing them with the option to move around or change their viewpoint. To accomplish this, customized multimedia streams must replicate the remote environment using 4K spherical video and high-quality spatialized audio, thereby enhancing the overall viewer experience. These elements for immersive learning in theatrics and music can be taught in high school classes which can then be brought out in given school plays/musicals.

Liono et al. (2021) explored that integrating digital and physical environments can enhance the enjoyment of studying for students. The study investigates the correlation between authentic learning and augmented reality (AR), which then concludes that using AR as a learning tool can improve students' learning outcomes for their designated subjects. This is achieved by representing abstract concepts as 3D objects, making it easier for students to grasp the structure

of these concepts concretely. The study also found that students find AR interesting and it motivates them to study more. The engaging experience also helps students to remember and recall information more easily. Generally, AR is a more effective medium for learning because it allows students to interact with virtual objects while learning and practicing. Future research and development in AR will continue to improve its potential as a valuable learning tool.

Luursema (2006) suggested that interactivity in virtual environments helps learners to use their own bodies as reference points, making it easier for them to maintain their orientation. In the absence of interactivity, learners must rely on their spatial skills to maintain their orientation, which can be difficult. As a result, interactivity can make learning tasks easier, especially for learners with low spatial ability. Another reason why interactivity can be beneficial is that it allows learners to explore virtual 3-D objects in real-time, which reduces the cognitive load on learners with low spatial ability, leading to improved learning performance.

Klopfer and Sheldon (2010) stated that AR technology enables the fusion of the real and virtual worlds by transferring image information to an electronic device. This enables students to explore theoretical solutions and problem-solving techniques in a contextually accurate environment. As a result, AR facilitates the integration of theoretical knowledge in real-world contexts and vice versa. By contextualizing abstract concepts in a real-world setting, AR promotes critical thinking and problem-solving in a learner-centered environment. The broad range of potential applications to learning is a testament to the value of AR technology in education.

Gonzalez's (2020) study, which identifies the four motivational factors that influence student engagement in visual and performing arts courses. The study revealed that students were highly motivated by four variables, namely attention, relevance, trust, and satisfaction.

Gonzalez's study also found that the use of an augmented reality (AR) module in these courses enhanced student attention and understanding of challenging concepts, facilitated object creation and manipulation, and revealed environmental processes and elements. The study concludes that incorporating VR technology in arts education is appropriate due to its significant potential in introducing students to the use of virtual 3D objects and models. Gonzalez argues that this technology is based on state-of-the-art techniques for representing reality using computer software, which can help students develop a deeper understanding of the subject matter.

Georges (2022) conducted a study that involved two different theatrical experiences for the test subjects. One experience was presented in 2D to simulate the view of a typical audience member, while the other experience was delivered through virtual reality (VR). The study showed that the VR experience resulted in a better sense of presence, higher engagement, and stronger emotional response from both the audience and the performers, as reported both subjectively and measured physiologically, compared to the 2D experience. However, the study also found that while VR technology can allow audiences to empathize with other people's perspectives, it does not necessarily make it easier for them to fully imagine other people's points of view, which would require cognitive empathy. Georges suggests that active participation, such as conversing with others while engaging in an immersive experience, can help people use their imagination to more actively construct and understand another person's experience.

Kokx (2017) conducted research on a technology that is gaining popularity among theatrical designers, known as Mixed Reality (MR). This term, coined by Microsoft, enables augmented graphics to appear as if they are interacting with real objects. In 2017, "Cirque du Soleil" and Microsoft collaborated to create a new program that is rapidly expanding the AR design methodology. Using simple geometric forms and Microsoft's HoloLens, a theatrical

production team can work together to create a virtual set in actual physical space. This application's AR capabilities allow a stand-in performer to enter the scene for scale. Kokx concludes that virtual models can be used to experiment with designs and find the optimal solution before spending too much time and money on a real model.

This is particularly useful for high school musicals that operate on a budget. Designers can solve complex problems in three dimensions at the early concept stages, providing them with a better direction for their design. This technology can also be taught to high school students, who can learn and apply it in their future careers. Although emerging technology is not always reliable, it provides a roadmap for future developments. The potential applications of XR technology for theatrical design are just beginning to be explored.

Guera (2023) conducted a study of 200 students in virtual reality sessions who had no prior experience with the technology. The study was conducted at the University of Monterrey Autonomous University of Nuevo Leon. They were given a 30-minute training session. During the sessions, the students used the Spatial Virtual Reality software to view and present their classmates' work interactively and collaboratively. This session helped students practice their skills digitally with no need for physical resources. The grade obtained by each student was determined by rubrics that evaluated both their physical work and their virtual presentation.

Computer screens have become pervasive in modern life, dominating a wide range of activities including business, shopping, communication with friends and family, and entertainment. People who use social media platforms are not satisfied with simply looking at pictures on their screens; they want to interact with the people and brands they follow by using features like “liking”, double tapping, or tapbacks. Although immersive productions offer an opportunity to disconnect from screens, they still engage the audience in a meaningful and active

way. According to Machon (2019), these kinds of experiences can help combat the sense of isolation from real intimacy that many people experience in their daily lives by requiring bodily engagement, stimulating the imagination, and engaging the senses. Despite the availability of virtual reality, audiences still crave lived experiences. The popularity of immersive experiences like Renaissance festivals, Burning Man, and escape rooms, as well as successful theatrical shows like *Sleep No More* and *Then She Fell*, demonstrate that digital media is not the only thing that occupies audiences' time.

Chapter III. Methodology

Design of the Study

The research design for this mixed methods study will involve collecting both quantitative and qualitative data through surveys, interviews, and observations. The study will focus on identifying the types of immersive technology being used and how they are being integrated into the curriculum in visual and performing arts school departments. The study will be conducted in two phases. This research design will consist of four instruments: two surveys and one questionnaire for music and theater teachers (Appendix A, B and C) and one questionnaire for students (Appendix D).

To screen music and theater teachers, the researcher will administer a pre-survey (Appendix A) to identify which music and theater teachers are incorporating AR and VR in their instruction or have an interest in immersive learning. The second survey (Appendix B) will be a post-survey focused on examining how immersive learning was used to engage and motivate students in the learning environment. Appendix C consists of observatory/ interview questions designed to further explore music and theater teachers' engagement, motivation, and usage of

immersive learning. Finally, Appendix D contains open-ended questions aimed at the students who have experienced immersive learning in their classroom environment.

Quantitative and qualitative data will be integrated to provide a comprehensive understanding of the types of immersive technology being used in Visual and Performing Arts classes and how they are being used to enhance student learning experiences. The data will be analyzed using an explanatory sequential mixed methods research design, which involves comparing and contrasting the quantitative and qualitative data to identify patterns, themes, and relationships between the data.

Phase One: Collection of Quantitative Data

In the first phase, quantitative data will be collected through a pre-survey and post-survey (Appendix A and B) design to measure the impact of immersive learning on student engagement, motivation, and academic performance. The researcher aims to target school districts that have integrated immersive technology into their high school musicals, plays, concerts, and exhibits. Participants will be gathered through purposive sampling and will consist of 100 students and educators that are teaching/enrolled in a high school visual and performing arts class in New Jersey. Purposive sampling is a non-random sampling technique that involves selecting participants who meet specific criteria relevant to the research objectives (Bryman, 2016). Participants will be selected based on their involvement in high school visual and performing arts classes and exposure to immersive technology.

To collect quantitative data, surveys will be administered to teachers and students in Northern New Jersey schools that are utilizing immersive technology being in their visual and performing arts classes, their frequency of use, and how they are being integrated into the curriculum. The researcher will also seek information if the school conducts plays/musicals which also incorporate immersive technology. This survey will be distributed electronically and responses will be collected and analyzed using statistical analysis software to generate descriptive statistics such as means, standard deviations, frequencies, and percentages. These descriptive statistics will provide a quantitative summary of the survey results, allowing the researcher to identify patterns and trends in student engagement, motivation, and academic performance before and after the immersive learning intervention.

Phase Two: Collection of Qualitative Data

In the second phase, qualitative data will be collected through a questionnaire (Appendix C) and semi-structured interviews with 25 students and 10 teachers who participated in the immersive learning intervention (Appendix D). The semi-structured interviews will be designed to allow participants to share their experiences, opinions, and perspectives on immersive learning in the visual and performing arts, as well as its potential benefits and challenges. The qualitative data will be analyzed using thematic analysis to explore the perceptions of students and teachers on the effectiveness of immersive learning in the visual and performing arts. Thematic analysis is a rigorous method for identifying patterns, themes, and categories in qualitative data, which will enable the researcher to generate meaningful insights into the effectiveness of immersive learning in the visual and performing arts (Braun & Clarke, 2006).

The questionnaire will aim to evaluate students' engagement, motivation, and academic

performance before and after the immersive learning intervention. The second survey instrument will focus on the impact of immersive learning. The survey will measure four key constructs: attention, relevance, confidence, and satisfaction. These constructs will enable the researcher to explore the motivational factors that influence students' engagement in immersive learning and the perceived benefits and challenges of this approach.

To collect qualitative data, semi-structured interviews will be conducted with music/theater teachers and visual and performing arts students to gain insights into their experiences using immersive technology. Interviews will be conducted either in person or virtually, recorded, and transcribed for analysis. Additionally, classroom observations will be conducted to gather data on how immersive technology is being used in practice.

The first open-ended questions will consist of observatory/interview questions that will ask the specific teacher on how immersive teaching has had a positive or negative impact on their lesson design experiences. The second open-ended question will ask for information regarding students' engagement, motivation, and perceptions of immersive learning. The researcher will also be observing various visual and performing arts classes that incorporate immersive technology learning. The researcher will also observe a few play/musical rehearsals that are incorporating immersive technology.

Conclusion

VR and AR technologies provide learners with an opportunity to immerse themselves in a three-dimensional virtual environment, which is often modeled after real-world scenarios, enabling them to interact with digital objects and experience simulations that mimic real-life situations. With the use of immersive technologies, the traditional approach to VPA instruction can be transformed into an interactive and engaging experience. Students can actively participate

in virtual simulations, where they can experiment with various art forms, such as painting, sculpture, and music. VR and AR technologies can also enable students to experience performances and exhibitions that they may not have access to otherwise.

The Potential of VR and AR in Visual and Performing Arts Education

The integration of VR and AR technologies in VPA education presents numerous opportunities to enhance and revolutionize the traditional teaching methods. One of the most significant benefits of immersive learning in VPA education is the ability to provide students with a more engaging and interactive experience. With the use of VR and AR technologies, students can interact with digital objects in real-time, allowing them to experiment with different mediums and techniques.

VR and AR technologies can also enable students to participate in collaborative projects, where they can work together in a virtual space, creating artwork or performances together. This can help students develop critical teamwork and communication skills, which are vital in the creative arts industry. Immersive learning technologies can also be used to provide students with real-world experiences, such as participating in virtual exhibitions, visiting museums, and observing performances from anywhere in the world.

Immersive learning technologies, particularly VR and AR, have the potential to transform the traditional VPA education approach into a more interactive, engaging, and personalized experience. These technologies can provide students with opportunities to experiment with various art forms, collaborate with peers, and participate in real-world experiences. Nonetheless, the integration of these technologies requires significant financial and technical resources, and educators must carefully consider the potential limitations and challenges associated with their use. In conclusion, VR and AR technologies have the potential to revolutionize the VPA

education sector and provide students with a more comprehensive and interactive learning experience.

**Appendix A:
Pre-Survey Questions for Music/Theater Teachers**

1. How would you describe your teaching style?
 - a) Traditional, lecture-based instruction
 - b) Hands-on activities with some lecture-based instruction
 - c) Fully immersive experiences where students are actively engaged

2. Do you believe that immersive learning is an effective way to teach music and theater?
 - a) Yes
 - b) No
 - c) Not sure

3. Have you ever incorporated immersive learning in your classes?
 - a) Yes, frequently
 - b) Yes, occasionally
 - c) No, never

4. Which of the following immersive learning techniques have you used in your classes?
(Select all that apply)
 - a) Role-playing
 - b) Simulation games
 - c) Virtual reality experiences
 - d) Site visits
 - e) Other (please specify)

5. In your opinion, what are the benefits of immersive learning in music and theater classes?
(Select all that apply)
 - a) Increased student engagement
 - b) Improved understanding of complex concepts
 - c) Greater retention of knowledge
 - d) Better teamwork and collaboration skills
 - e) Other (please specify)

6. What challenges have you faced when incorporating immersive learning in your classes?
(Select all that apply)
 - a) Limited resources
 - b) Lack of support from administration
 - c) Difficulty in finding appropriate immersive learning activities
 - d) Resistance from students

IMMERSIVE LEARNING IN THE VISUAL AND PERFORMING ARTS

16

e) Other (please specify)

7. How do you assess student learning when using immersive learning techniques in your classes?

- a) Traditional tests and quizzes
- b) Observation of student participation
- c) Performance assessments
- d) Other (please specify)

8. Have you noticed any differences in student outcomes (e.g. grades, performance skills) when using immersive learning techniques?

- a) Yes, students perform better
- b) No, there is no difference
- c) Not sure

9. How do you stay up-to-date with new immersive learning techniques and resources?

- a) Professional development opportunities
- b) Conferences and workshops
- c) Online research
- d) Other (please specify)

10. Would you be interested in collaborating with other teachers or organizations to develop immersive learning experiences for your students?

- a) Yes
- b) No
- c) Maybe

**Appendix B:
Post-Survey Questions for Music/Theater Teachers**

1. Which of the following immersive learning tools have you used in your classes? (Select all that apply)
 - a) Virtual reality headsets
 - b) Augmented reality applications
 - c) Interactive whiteboards or touchscreens
 - d) Online simulations or games
 - e) Other (please specify)

2. How do you integrate immersive learning tools into your lesson plans?
 - a) They are used as standalone activities
 - b) They are incorporated into larger projects or performances
 - c) They are used to supplement traditional teaching methods
 - d) Other (please specify)

3. Have you noticed an improvement in student engagement and motivation when using immersive learning tools?
 - a) Yes, significantly
 - b) Yes, somewhat
 - c) No, there is no difference
 - d) Not sure

4. What are some of the challenges you have faced when using immersive learning tools in your classes? (Select all that apply)
 - a) Technical difficulties
 - b) Limited access to equipment
 - c) Time constraints
 - d) Resistance from students or colleagues
 - e) Other (please specify)

5. How do you evaluate the effectiveness of immersive learning tools in your classes?
 - a) Student surveys or feedback
 - b) Observation of student engagement and performance
 - c) Traditional assessments (tests, quizzes)
 - d) Other (please specify)

IMMERSIVE LEARNING IN THE VISUAL AND PERFORMING ARTS

18

6. Have you received any training or professional development to effectively use immersive learning tools in your classes?
 - a) Yes, extensive training
 - b) Yes, some training
 - c) No, but I would like to receive training
 - d) No, I am self-taught

7. How do you ensure that immersive learning tools are accessible to all students in your classes?
 - a) By providing multiple options for accessing the tools
 - b) By providing alternative activities for students who are unable to use the tools
 - c) By working with school administrators to ensure equitable access to technology
 - d) Other (please specify)

8. Do you collaborate with other teachers or professionals in the field to develop immersive learning experiences?
 - a) Yes, frequently
 - b) Occasionally
 - c) No, not at all

9. How do you incorporate student feedback into the development and implementation of immersive learning experiences?
 - a) By regularly soliciting feedback from students
 - b) By using feedback to modify and improve future activities
 - c) By incorporating student suggestions into future activities
 - d) Other (please specify)

10. Would you recommend immersive learning tools to other music and theater teachers?
 - a) Yes, definitely
 - b) Yes, with reservations
 - c) No, not at all

Appendix C :
Interview/ Observation Survey Questions for Music/Theater Teachers

1. How would you define immersive theater and what makes it different from traditional theater performances?
2. Have you ever attended or participated in an immersive theater performance? If so, can you describe your experience and how it differed from traditional theater performances?
3. In your opinion, what are some of the benefits of immersive theater performances for audiences and performers?
4. How do you believe immersive theater performances can enhance the educational experience for students in music and theater classes?
5. What are some of the challenges that come with creating and performing in immersive theater productions, and how do you address them?
6. How do you think immersive theater performances can be used to address current social and cultural issues?
7. What role do you believe technology should play in immersive theater performances, and how do you integrate it into your productions?
8. Have you noticed any changes in audience engagement and participation in immersive theater performances compared to traditional theater performances?
9. How do you approach designing and creating immersive theater productions, and what factors do you consider in the process?
10. What advice would you give to music and theater teachers who are interested in incorporating immersive theater experiences into their curriculum or productions?

**Appendix D:
Survey Questions for Immersive Learning Students**

1. In what ways has using immersive technology in your music/theater classes changed the way you engage with the material?
2. Can you describe a time when you felt particularly motivated to learn because of the immersive technology used in your class?
3. Do you think that using immersive technology has improved your academic performance in these classes? If so, how?
4. How has working with immersive technology affected your ability to collaborate with classmates?
5. Have you noticed any differences in the way you retain information when you are using immersive technology versus more traditional methods of instruction?
6. In your opinion, what are some of the biggest advantages and disadvantages of using immersive technology in music/theater classes?
7. Do you feel that immersive technology has helped you to better understand the material you are learning? If so, can you give an example?
8. Have you noticed any differences in the way you approach problem-solving or creative tasks when you are using immersive technology?
9. How has your teacher incorporated immersive technology into your music/theater classes?
10. Based on your experiences, do you think that immersive technology should be used more widely in education? Why or why not?

References

- Baratè, A., Haus, G., Ludovico, L. A., Pagani, E., & Scarabottolo, N. (2019, June). 5G technology for augmented and virtual reality in education. In *Proceedings of the international conference on education and new developments*(Vol. 2019, pp. 512-516).
- Bressler, D. M., & Bodzin, A. M. (2013). A Mixed Methods Assessment of Students' Flow Experiences during a Mobile Augmented Reality Science Game. *Journal of Computer Assisted Learning*, 29, 505-517. <https://doi.org/10.1111/jcal.12008>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.
- Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.
- Gagneré, G., & Anastasiia, T. (2021, October). Keeping the living bond between actors and remote audiences in distributed virtual theater. In *10th International Conference on Digital and Interactive Arts* (pp. 1-12).
- González-Zamar, M. D., & Abad-Segura, E. (2020). Implications of virtual reality in arts education: Research analysis in the context of higher education. *Education Sciences*, 10(9), 225.
- Guerra-Tamez, C. R. (2023). The Impact of Immersion through Virtual Reality in the Learning Experiences of Art and Design Students: The Mediating Effect of the Flow Experience. *Education Sciences*, 13(2), 185.
- Klopfer, E., & Sheldon, J. (2010). Augmenting your own reality: Student authoring of science-based augmented reality games. *New Directions for Youth Development*, 85-94.
- Kokx, K. (2017). *Effects of Musical Theater Education on the Self-Esteem of Middle School Students*. <https://core.ac.uk/download/pdf/327228519.pdf>

- Liono, R. A., Amanda, N., Pratiwi, A., & Gunawan, A. A. (2021). A systematic literature review: learning with visual by the help of augmented reality helps students learn better. *Procedia Computer Science*, 179, 144-152.
- Luursema, J. M., Verwey, W. B., Kommers, P. A., Geelkerken, R. H., & Vos, H. J. (2006). Optimizing conditions for computer-assisted anatomical learning. *Interacting with Computers*, 18(5), 1123-1138.
- Machon, J. (Ed.). (2018). *The Punchdrunk Encyclopaedia*. Routledge.
- Machon, J. 2013. *Immersive Theatres: Intimacy and Immediacy in Contemporary Theatre Performance*. Hampshire; Palgrave Macmillan.
- Rouse, R., Engberg, M., JafariNaimi, N., & Bolter, J. D. (2015). MRX: an interdisciplinary framework for mixed reality experience design and criticism. *Digital Creativity*, 26(3-4), 175-181.