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Application of Virtual Reality as an Educational Tool for Presentation Practice

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Abstract

The purpose of this research is to explore a non-traditional approach to help prepare education professionals through virtual reality technology. The targeted education professionals are students currently enrolled in interactive classroom environments that require teaching young children in local nearby elementary schools. This approach explores immersion within virtual reality as an educational tool to better prepare the aspiring educational professionals in the classroom setting. There is currently limited research publicly available utilizing virtual reality in this field and it is the hope of the researchers to explore what could become the standard in the future of the field of education regarding the impact of helping aspiring educational professionals. The advantage to conducting research amongst college students – the ability to measure the impact of virtual technology on their development of classroom teaching against other students with identical experience. Subjects would practice their lesson plan, which were prepared beforehand, in a virtual reality environment that models the identical gymnasium that the subjects will use to teach live classes. Immediately following their virtual reality session, the subjects would then go to that gymnasium, and teach that same lesson plan to elementary grade students. With the conclusion of the research, it was found that subjects became increasingly comfortable with teaching within the virtual reality environment. The results from the subjects scores were then compared with the scores of students in the same class that did not participate in the virtual experience. The comparison of results yielded insubstantial evidence to suggest direct influence from the virtual reality technology on the final scores of the subjects.

Keywords: Presentation practice, Virtual Reality, Kinesiology

1. Introduction

The purpose of this research is to find the basic application for virtual reality (VR) as an educational tool. Specifically, for students involved in the process of educating younger children as well as using immersion to help the students prepare themselves to teach those children. The goal of the research outside of this project is to encourage the exploration of VR technology as an educational aid. In an article describing a University of Nevada, Reno, (UNR) research study on the potential benefits of using VR in healthcare education, multimedia production specialist Michelle Rebaleati said, “It is important to get our academic research projects into the world so other groups or universities can

start asking similar or better questions[1].” She continued, “We’d like to see more studies conducted to help further evaluate the use of VR technology into the educational curriculum for nursing and medical students.[2].” While the UNR study did incorporate VR tech into their medical education curriculum, the UNR study also had the benefit of other subjects for the sake of interaction in order to analyze communicational accuracy with patients and other medical staff. The interaction would be between students and simulated patients, doctors and nurses. This, as well as the fact that the UNR study had over 100 participants in the study, highlights the limitations in this research project as this project had a very small size of participants and a lack of simulated elementary grade students for the sake of interaction.

In James E. Haywood’s research thesis, “Improving the Management of an Air Campaign with Virtual Reality,” Haywood assesses the viability and implication of the U.S. Air Force investing in a VR-enhanced air battle management system. On the need for further research and development of such a system, Haywood states, “VR display and rendering technologies will put the mission planner into the battlespace environment. This real-time, ongoing, dynamic picture will provide a better understanding of the enemy’s capabilities, intentions, and ambitions.[3.]”

Haywood posits that by putting the planner into the environment, the planners would have a better understanding of what exactly was happening as information comes in real-time. While the research presented in this paper involves analysis of processed data rather than real-time data from a VR environment, Haywood’s discussion of the immersive capability of VR technology is relevant for future design considerations.

Immersion is the idea of putting the user in an environment specifically to provide him or her with a better understanding and stronger connection to that environment. This can be credited to increased interaction resulting in comfort. A popular example is the use of immersion as a technique to teach students a foreign language. In this example, students participate in study abroad programs and attend their foreign country for a set period to better learn the language and culture. Because the student is surrounded by natives who speak that language, and practice that culture, the student is constantly reinforced with the language. In this experiment, immersion requires the participants to engage with a virtual model of a gymnasium. As mentioned before however, this project lacks a critical component that detracts from complete immersion which is the simulation of live elementary grade students in the VR environment. Since in the live presentation, there would be elementary grade students present and taught by the student teachers, this lacking component also inhibits the VR session from being as close of a one-to-one recreation of the presentation. Even still, the overall goal of the research project is to process immersion as a measurement for the practicality of using VR as an educational tool.

This experiment, which is conducted in collaboration with Northern Illinois University’s (NIU’s) Department of Kinesiology and Physical Education, was conducted with the help of anonymous aspiring educators as participants. For this study, participants first practiced their planned lectures in a virtual space modeled on a gymnasium located at Jefferson Elementary School in DeKalb, IL. Next, the participants were observed teaching the same lecture to students in the physical gymnasium. The experiment relied on a single-blind approach to minimize bias between participants and the scores later received. The control group consisted of non-participating students also enrolled in the class.

2. Experiment

Co-author Ivan Sanchez conducted a pilot version of this project in 2019 to explore effective techniques for this research project. This pilot was done to generate participant feedback and to make any necessary changes for the official run of the experiment. The pilot also led to further enhancements to the virtual environment used in the final study.

2.1. Setup

The setup was done in three phases. Phase one involved securing the use of NIU’s Data, Devices, and Interaction Laboratory (ddiLab), a supported student research environment overseen by Dr. Michael E. Papka that both contained the required technologies and was capable of hosting students. Phase two involved recruiting participants with similar teaching experiences. All the participants who volunteered for this study were enrolled in the same kinesiology course taught by Dr. Zachary Wahl-Alexander and had also given their consent to be a part of the study. Phase three involved producing an accurate virtual model of the gymnasium, which was developed using feedback from the pilot test and constructed to the nearest identical measurement.

The final model was developed to be accurate to the nearest half inch. The previous model included several pictures of real-world elements in the classroom, which were omitted from the final version to avoid creating unnecessary distractions. With the virtual environment made to scale, an authentic replication to what participants would interact in could be quickly modified to suit their individual lecture plan requirements.

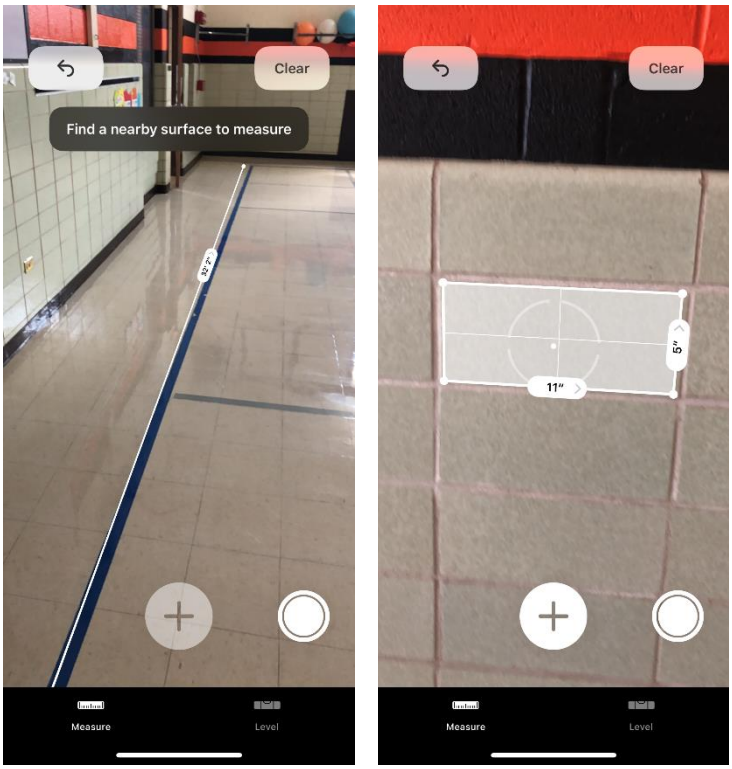

Figure 1. Snapshots of Jefferson Elementary School's gymnasium captured using the Measure iPhone application, which were used to develop the virtual gymnasium environment.[4]

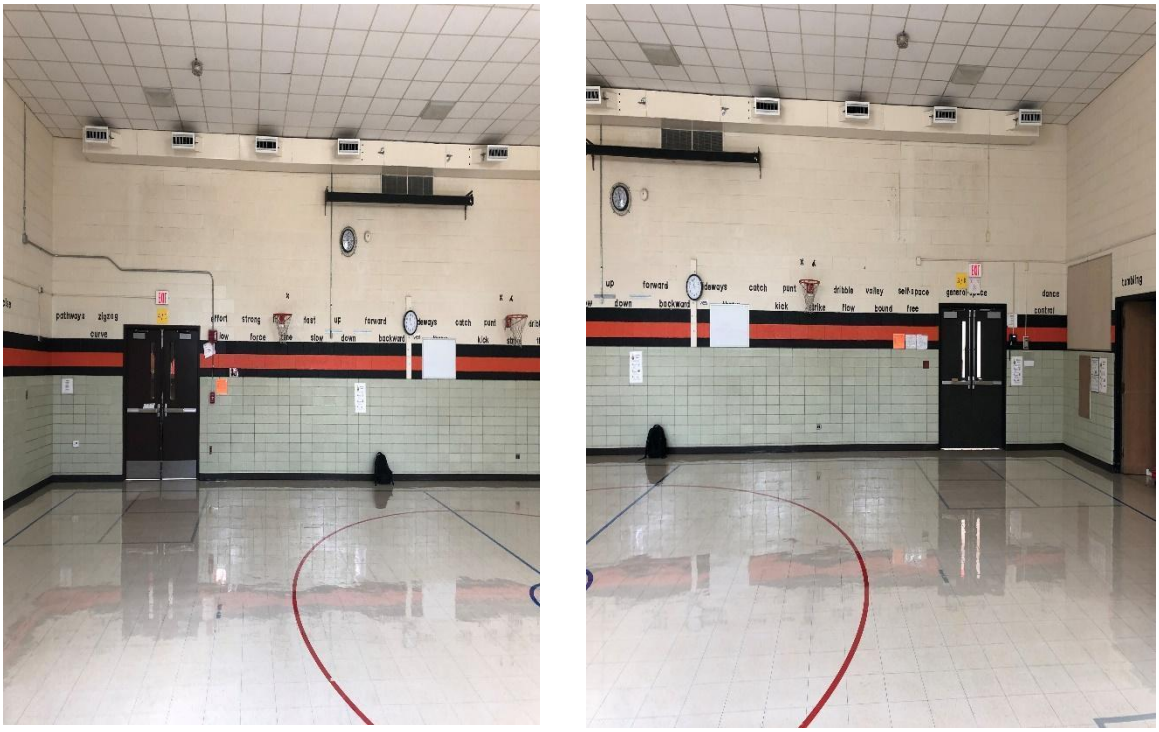

Figure 2. Side-by-side photo composition showing the gymnasium's west wall.[5]

The goal was to mimic the physical environment as accurately as possible—including creating proportionately scaled details that could be found on walls or the ground. Objects such as writings on the wall, clocks, cable management, etc., all of which could be found in figure 2 and were significant in creating an authentic experience.

This approach required an architecture modeling software capable of running in 3D known as Sketch-Up. Structural development of the virtual environment was constructed using Sketch-Up and would eventually be transferred into Unity3D, a VR development engine most commonly associated with VR gaming. Transferring the virtual environment was almost seamless and made the virtual gymnasium capable of running on the HTC VIVE – a VR headset and controlled kit with infrared tracking. The HTC VIVE was the equipment used during research.

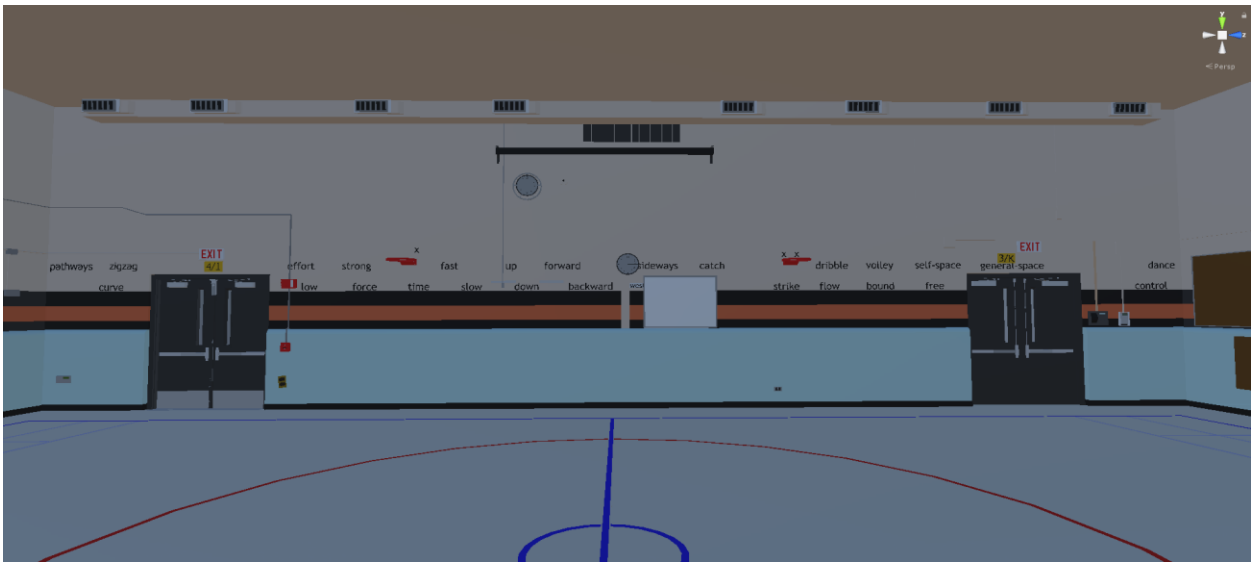

Figure 3. Model of the west wall of Jefferson Elementary School's gymnasium (Unity version)[6]

After thorough testing with the equipment and making small changes, the objective moved to planning for the rest of the project.

2.2 Method

In total there would be nine students that would be participating in the study, five of which would participate in utilizing the VR environment. As opposed to the participants, the non-participants would only go to their live presentation and not utilize the VR environment. All 9 students in this study, regardless in participation with the VR environment, had given consent to be a part of it. Also, random assignment was not used in deciding which student would be in the experimental or control group. Instead, students would be assigned to a group based on their availability. Each participant attended a 30-minute session in the VR environment where the presentation would be made and recorded. The participant would later go to Jefferson Elementary to present their lecture to students, where their professor, Dr. Wahl-Alexander, would observe and grade their performance. While also grading the performance of participants, Dr. Wahl-Alexander would be grading non-participants on an identical scale. This results in a potential to compare performance and development of the five participants against the four non-participants. This continued periodically for several sessions over the course of three months, from the beginning of October to the beginning of December, totaling six sessions with five participants who utilized the VR environment. Prior to each session, participants were provided a survey to assess their level of comfort with using VR technology. An additional survey was administered immediately after the session in reflection of the session. During each session, participants agreed to be recorded for the duration of their time in the virtual environment. The recordings were examined to help reinforce the results that would later be made by Dr. Wahl-Alexander after the conclusion of their sessions and the class.

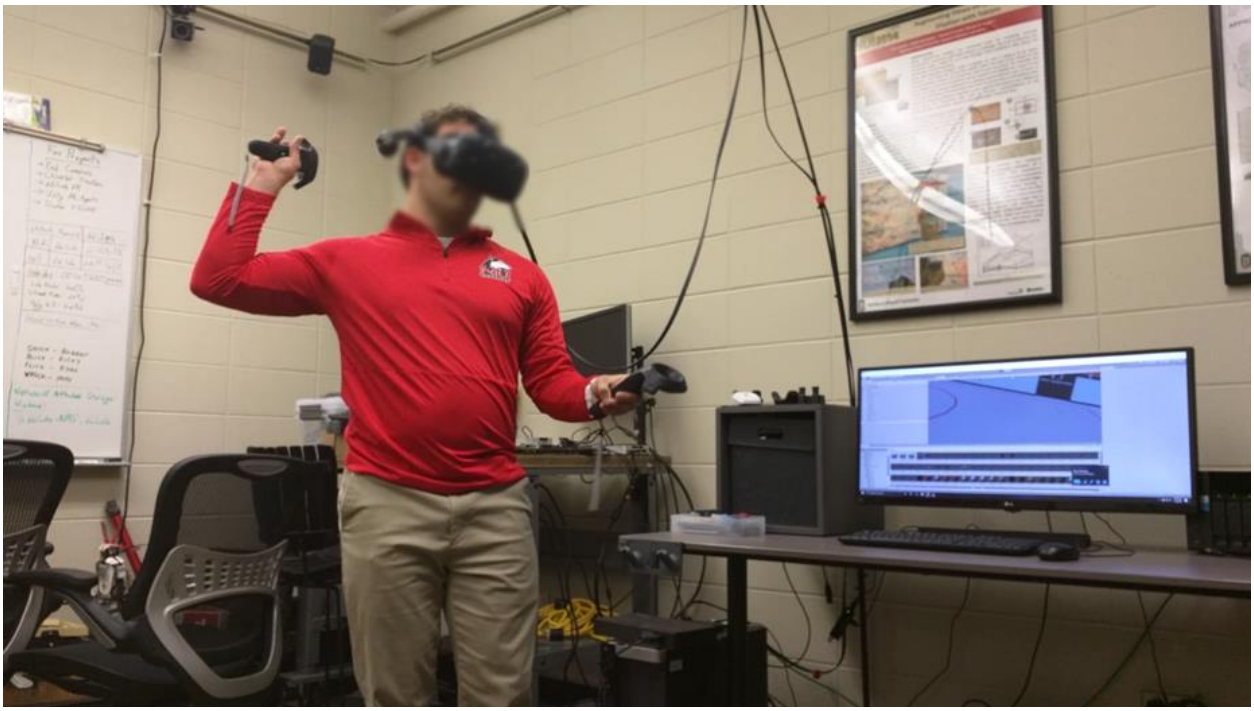

Figure 4. Snapshot of a participant interacting with the VR environment[7]

Some participants had little trouble using the VR equipment straight away, while others initially found the technology to be foreign. With the recordings, the ability to look at an individual's previous sessions allowed the research team to correct user issues in future sessions.

3. Results

The results given by Dr. Wahl-Alexander was later compiled into the graphs shown in Figure 5 and Figure 6 for a clearer picture of the results. The evaluations score is out of a total of 40 points. To iterate, there were two groups of students in the experiment that were observed. The first group consisted of five students and the second group had 4 students. One group went to the VR sessions and used it as practice for their presentations later in a Jefferson Elementary class. The other group of students did not use VR as practice before going to present in the class.

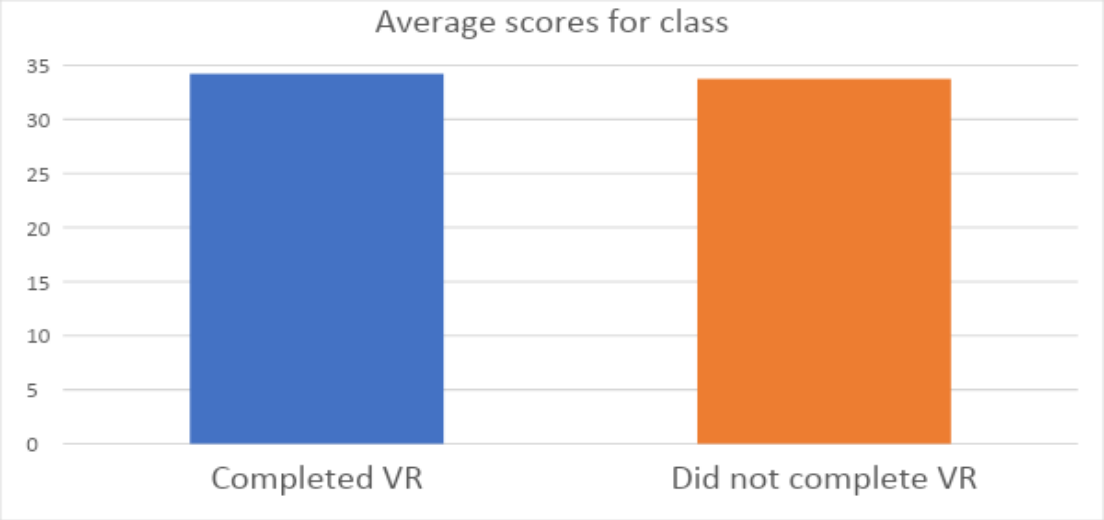

Figure 5. Average scores of participants who completed the VR sessions and those who did not.[8]

The results given between those that utilized VR and then presented to the Jefferson school children and those that did not utilize VR as a form of practice, showed a negligible difference in average scores. Specifically, the group that had used VR got an average score of 34.2 while the group that did not use VR got an average score of 33.75. The group that used VR had a higher average score than the second group, it would not be fair to state whether the VR practice had any effect on the scores since the difference is very small. Even when taking a closer look at individual scores to see if the three could be a trend, the story is hardly different.

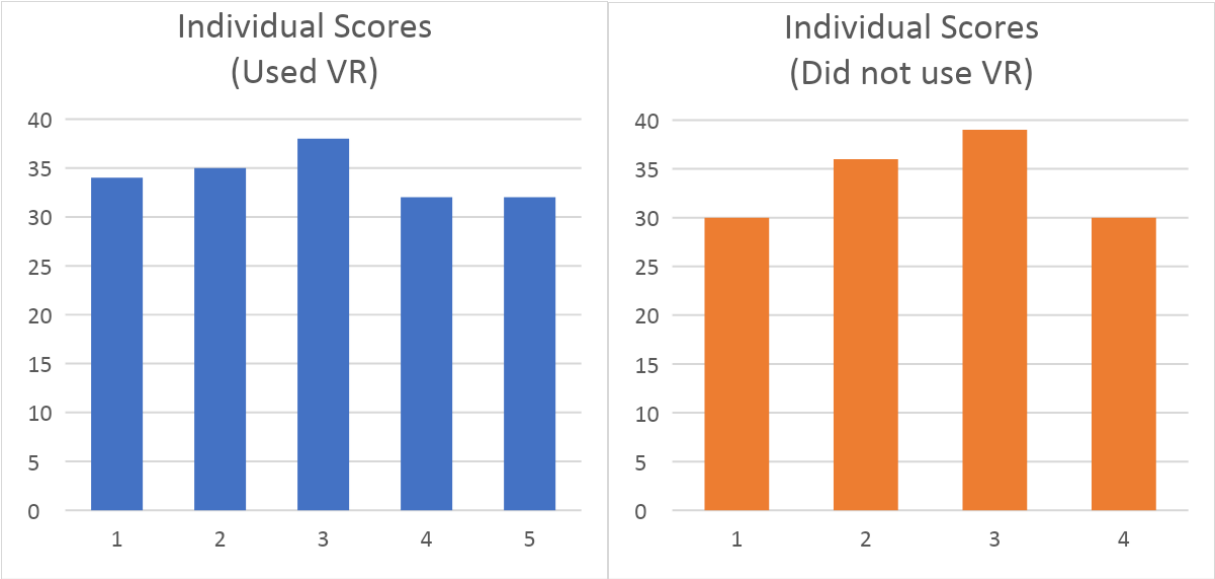

Figure 6. Graphs showing the individual scores of participants who used VR (left) and who did not use VR (right). [9]

In figure 6, while the data in 'used VR' trends a little more consistently than the other graph, the differences between the two groups is too small. The scores for the group on the left are 34, 35, 38, 32, and 32. The scores of the group on the right are 30, 36, 39, and 30. The small difference between the groups' results could be due to VR not being beneficial in this particular use case or other things in the experiment that distracted from getting clearer results. As to not just report the means, an unpaired two tailed t-test was also performed. The 5 participants who utilized the VR environment ($M = 34.20$, $SD = 2.49$) compared to the 4 participants within the control group ($M = 33.75$, $SD = 4.50$) showed an insignificant change to presentation scores, $t = 0.1919$, $df = 7$, $p = 0.86561$. With that said, the results from the post survey were much more positive. All the participants said that VR could impact the teaching of their curriculum and would also recommend to colleagues to use VR to practice lessons. One participant seemed to really like the VR sessions writing the following:

> I would highly recommend using VR in preparation of a lesson. You are allowed to run through lessons in the actual space to practice where you will stand and teach during instruction. You also get to plan for how much space you will actually have. In addition to this you go through your script and intentions of what you will say to your students, so it's a great real time practice scenario. Overall, I had a great experience and would recommend this to colleagues.[10]

The possible positive benefits given by the virtual model is reinforced by other responses given in the survey as most participants had felt more immersion than not. The statement mentions some of the VR gym's stronger points found in cultivating immersion, in how it allowed the user to put themselves in Jefferson's gym while still at NIU. It also allowed for more thorough practice while using VR as the participant praises the ability to plan out where they would physically be in the gym while practicing the lecture. However, since the results in this situation are not positive it cannot exactly be due to the VR environment itself. Even so the results were inconclusive so it would not be right to say either way about VR's place in helping support aspiring educators. With that said, there were possible points of failure in the experiment that may have led to the inconclusive results.

3.3 Things to improve

One failure was the participants' misunderstanding of the VR controls, and may have hindered the results of the experiment as the learning curve would have distracted from the objective. Unlike the participant shown in Figure 4 who took little time to get adjusted to the VR interactivity, some were visibly uncomfortable while interacting with the environment and were stiff while interacting with the VR. This is reinforced by the survey given before the beginning of the experiment which had nearly all of the participants state that they had little experience with and little knowledge of VR.

Another possible point of improvement to the VR environment itself would be to add interactive elements, like soccer balls and baseball bats, to help demonstrate lectures or orange street cones to mark certain positions in the virtual environment. This type of interaction was planned for the VR environment, at one point the VR gym was thought to have a closet that would be full of equipment typical of a gym closet. As mentioned before, another critical component that was missing was the simulation of elementary grade students within the VR environment an aspect that would heavily impact immersion for any user. Unfortunately, due to a lack of time and lack of experience with Unity, the idea of interactivity outside of just the VR environment was scrapped. One participant had put it best, stating, "I would say to find a way to add equipment that we could set down to better visualize the space that we have[11]."

The VR environment lacked interactivity which could have led to a loss of immersion for the participants as a result. That previous statement was made by someone who felt little immersion in the VR environment, at least for that participant, this means that the VR environment was ineffective in helping in preparations for the lecture in Jefferson. While not explicitly stated by the participants, the fact is, this specific weakness in the VR environment is something inherent to VR. Inherently VR is not able to replace reality, at least not at this point of time, and the VR environment's simple visual aesthetic and lack of interactivity pales to reality, which could also have contributed to the disruption of immersion in the VR sessions as well as the inconclusive results from the evaluations.

Another limitation would be the extremely small sample size as it limits what the conclusion can really say. On top of this, the students in the experimental group could've differed from the control group in some way that could've affected the findings. This is especially true when it's considered that random assignment was not used to assign students to the different groups.

These are the main points in major need of improvement as these could have significantly impacted the results received. With that said, while the project's main goal of proving immersion's ability to positively affect teaching did not produce satisfying results, the research made is still very beneficial for the field for further research.

4. Summary

This study explores a potential application of virtual reality in the field of education. While most applications of virtual reality and education are traced to creating programs and games for students by direct interaction, this study explores the potential of helping prepare aspiring teachers using the technique of immersion via virtual reality technology. In addition, relevant pieces of literature that explored similar approaches to integrating virtual reality among the medical community and the United States Air Force was reviewed. This study establishes the potential of a new application of virtual reality technology and encourages further research to determine whether such integration would be beneficial to pursue.

This study utilized voluntary participants from Northern Illinois University's KNPE 344 and was designed to allow for a control group of anonymous students and an experimental group of anonymous students graded using identical criteria. Following the course over a period of six weeks, the experiment proved to be inconclusive and was unable to support the thesis behind research without requiring additional research. The approach of immersion as a tool for training educational professionals can be further explored to examine a potential relationship; this study was unable to find significant correlation between scores of the experimental group and the use of the technology that would determine direct causation.

Therefore, the impact of virtual reality on preparation for presentations remains a theory that requires further exploration. We hope this study encourages other researchers to explore the application of virtual reality in education as this technology continues to develop further each year.

5. Acknowledgements

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4. Snapshots of Jefferson Elementary School's gymnasium captured using the Measure iPhone application, which were used to develop the virtual gymnasium environment

5. Side-by-side photo composition showing the gymnasium's west wall

6. Model of the west wall of Jefferson Elementary School's gymnasium (Unity version)

7. Snapshot of a participant interacting with the VR environment

8. Average scores of participants who completed the VR sessions and those who did not

9. Graphs showing the individual scores of participants who used VR (left) and who did not use VR (right)

10. Participant's positive testimonial at end of experiment taken from post-survey
11. Participant's negative testimonial at end of experiment taken from post-survey