

Virtual Reality Program to Help Mason LIFE Students Improve Social Skills and Situational Awareness

ECE 492 Literature Review on Educational Virtual Reality Programs

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The main purpose of this literature review is to understand as much as possible about how virtual reality (VR) can affect the social skills of people with intellectual and developmental disabilities. We will look into information that gives detail on all different factors of this investigation. For example, we will investigate how VR has been effective in the past for people with intellectual and developmental disabilities, and how it has helped them to learn in a different way than those without said disabilities. This will allow us to see both the positive and negative factors that VR has had on their education. We will also look into studies on the hypotheticals of how VR could help those with disabilities to improve their social skills. This will allow us to understand what to mainly focus on when creating our social skills interactions practice VR game. The most available resources we were able to find were geared more towards examples of educational purposes of VR, rather than practicing social skills ,or social skills with PC virtual reality games instead of virtual reality headsets. Even though we were able to use studies on how VR could help with social skills interactions, we did not find anyone who was able to do the exact study and explore the results. The following articles found proved that, overall, VR provides a positive outcome when used to help the lives of those with learning disabilities. The more research that can be done on this subject, the more lives can be made easier for those who would benefit from this technology.

On “The potential of Virtual Reality in Social Skills Training For People With Autistic Spectrum Disorder,” Parson and Mitchell defined autism as a diagnosis based on communication and socialization issue leading to learning impairments [1]. On “Virtual Reality for the treatment of autism,” Strickland also agreed that autism affects the learning outcomes of these individuals. Parson and Mitchell also stated that individuals with autism have prevalent difficulties with social skills. Therefore, the authors decided to review how virtual reality can be used for social skills training for people with autism. The teaching approaches of behavioral or ‘theory of mind’ are discussed. The article also studies how these two approaches can be combined through virtual reality. Although these approaches could help improve some social skills, there are some concepts that autistic individuals cannot learn as easy without repetition [1]. It was pointed out that the current methods of teaching social skills are not realistic enough leaving a small room for improvement.

Parson and Mitchell contradicted previous research studies by stating that natural settings would help autistic children have better behaviour and learning outcomes. This will provide autistic individuals with a more comforting space. Additionally, other effective approaches are repetition and reinforcement [1]. However, VR is still a preferable approach because repetition and reinforcement have been proven to be complex and high maintenance; sometimes leading to unsuccessful results. On “Virtual Reality Social Cognition Training for Young Adults with High Functioning Autism,” Kandalaft and Didehbani agreed with Parson and Mitchell that even the simplest form of a virtual reality game that helps students practice social skills shows a very positive impact on every student that uses it. This is another reason for Parson and Mitchell to restate that VR for social skills learning surpasses the teaching of ‘theory of mind’ and social behaviours.

Through VR environments, people with learning disabilities will have the chance to learn and gain better social skills. This is possible through a 3-D immersion where a person can interact with a virtual ‘avatar.’ VR environments can also have objects, which will give the user a realistic feel when using the headsets [1]. Virtual Reality also gives people with physical disabilities the opportunity to engage in everyday tasks. These tasks might not be possible in real life due to their disability.

Even though Parson and Mitchell have a strong point on how VR would help autistic individuals develop better social skills, they did not conduct an experiment that actually would prove their research. On the other hand, on “Virtual Reality Social Cognition Training for Young Adults with High-Functioning Autism,” Kandalaft and Didehbani conducted a study on social cognition with eight participants that held a diagnosis of Asperger Syndrome [2]. The purpose of this study was to allow these participants to interact with a virtual world through Virtual Reality in order to practice everyday situations. Additionally, on “Virtual Reality For The Treatment of Autism,” Strickland also believes that the abilities that Virtual Reality (VR) games have can help match up to the adaptations that need to be met in order to create a quality-learning environment for those with ADD and autism [3]. He believes that the use of VR can help those with Autism and ADD master the real world without having to initially interact with it.

On Kandalaft's and Didehbani's study, the participants were represented in the game by avatars that can be adjusted to look like them, however the avatars can only create arm/body gestures and mouth movement. The participants were able to control their avatar by using a standard computer keyboard and mouse. During the game, the user is instructed to move their avatar to a specific location in order to interact with a specific social scenario. The options for these social situations included negotiating with a salesman, a blind date, meeting a stranger, and many more [2].

During this testing, there were different categories that were assessed about the participant before and after the game. The categories included verbal and nonverbal emotional recognition, theory of mind (the ability to understand how someone else is feeling), and conversational skills [2]. Strickland also utilized categories on his study. For these two studies, using categories helped the authors accomplish their research goals. Strickland's categories were: First, VR games allow for Controllable Input Stimuli. This means that the game can be adjusted in order to accommodate the maximum amount and type of stimuli that the user is currently able to handle. Also, these games allow for Modification for Generalization, this means that it can help progressively teach the user how to understand the differences in common things. An example of this is showing two identical houses but one is red and one is blue, and then the number of differences can continue to increase. Another benefit of VR teaching is Safer Learning Situation, which means that the users can experience scenarios that may be scary and cause a negative reaction but in a safe environment where these reactions are allowed and understood and they will not get hurt. Another benefit is that VR can provide A Primarily Visual/Auditory World, meaning that there is no sensory outcome in scenarios. Also, Individualized Treatment means that the VR games can be adjusted based on the needs of the user. Preferred Computer Interactions gives the stability of structure of learning that many users with disabilities prefer, which is provided when using VR games. Finally, Trackers are an option that could be of positive use in VR learning games. These are physical sensors placed on the users bodies in order to get even further input from how the user is reacting to the VR game [3].

Although some of these two studies categories defer, the overall results of their studies show a positive effect on their participants. On Kandalaft's and Didehbani's study, the participants expressed that they had fun using the game and practicing the social skills and wanted to be able to do more sessions with more scenarios to participate in. Also, through the data taken before and directly after about the different aspects of the participants, the results showed that the average of every category increased. This means that almost every student did a better job with the categories listed above after having the experience of practicing social scenarios in the game used. Finally, when asked about how the game has affected their skills in the follow-up questionnaire 6 months after the study, every single skill that was asked about, except for Academic Functioning, had an average percentage of students who felt they improved in that skill of at least 57% [2]. Strickland's methods were slightly different; however, his goals were the same as Kandalaft and Didehbani. Strickland's study results showed that there was a high rate of adaptation for the students to be able to learn through technology. There was a range in the acceptance of use and interaction with the virtual reality headset, however, by the end of the study, all students involved were able to use it and show signs of learning from the virtual reality game they were tested with in the study. This means that the majority of students in the group had an increase in their skillset of almost everything asked about, simply because of their use of the virtual reality game. Both Kandalaft's and Strickland's studies agreed that even with the game being not as realistic as possible, there is still an important outcome and verification that through practice of difficult situations, people with intellectual and developmental disabilities can improve the ease of their lives.

Educational games aspired to reinvent learning through virtual reality (VR) devices [4]. According to Virvou and Katsionis, now that virtual reality games for educational purposes are becoming popular, game developers have to focus on the usability and likeability of their games. It has become a concern that not all students could be able to use or like this device, specifically in a school setting. The purpose of these games is for students to learn through the virtual reality. The authors added that there is a substantial difference between the video games students play at home versus the educational games they might get to play in the classroom. Additionally, the

fact that some students have no experience or might not even like video games, could affect the way these students see this new technology [4].

Virvou and Katsionis evaluate their game *VR-ENGAGE* in different aspects. First, they mention related works to their game. They choose to evaluate the JIGSAW model, which consist of three levels of game performance evaluation. These three levels emphasize the importance of the game integration between the learning and operational tasks. In an older article, the authors evaluated their educational software by trying to find out if their educational game environment accomplished positive educational effects when compared to that of a no gaming environment [4]. They also evaluated three different student groups, in order to see if they could all benefit from the educational game rather than from conventional educational software. It was noted that the results of the game evaluation might not have been as favorable if the students tested the game at home without their instructor's help.

VR-ENGAGE is a highly interactive virtual reality game. The game consists of different 'worlds,' meaning stages, where the user is able to explore through these virtual environments as they pass a level and go to the next one. This is an adventure game where players will have to find the book of wisdom [4]. The authors say their game falls into the educational category since the players will have to remember specific things in order to pass to the next level.

Ehrlich and Miller specifically target students with Asperger's syndrome (AS) or Autism Spectrum Disorder (ASD). Students with such disabilities can lack appropriate social skills, causing them to demonstrate lower social and emotional competence, including self-awareness, controlling impulsiveness, working cooperatively, and caring about others [5]. All are key factors in advancing through professional and educational scenarios.

Ehrlich and Miller researched that students with AS or ASD are visual learners, which prompted them with the idea of creating a virtual game AViSSS (Animated Visual Supports for Social Skills). [5] Their game would display real world graphic scenarios, where the student will have to choose from the options presented to them and each option would lead to a new scenario. In each scenario the student will either choose a behavior or choose an object. For example, if a student were placed in a classroom and didn't know what to do they would be presented with four options e.g. I will do nothing, I will get upset and cry, I will ask for help

from my mom, I will ask the teacher about what I should be doing. Here they would have to choose a behavior. In another case, if the student were placed in a bathroom and one stall says out of order and the rest don't, they would have to select which stall is the appropriate one to enter. Now if the student selects the wrong option, they will see and hear the reasoning of why it was wrong, then they will be presented back to the same scenario [5].

To develop their game, they chose to use Object-Oriented Graphics Rendering Engine (OGRE) due to its ability to be easily manipulated and used on different platforms such as Mac, Windows, and Linux. They were able to successfully address the different scenarios for the students and help them evaluate each of those scenarios. One key factor that they didn't mention is their physical device in which the students will be viewing the game. In addition to their game, they want to add more scenarios outside of the school setting, as well as eye-tracking to make sure students are focused on the task in hand [5].

Both of these studies show the positive impact that virtual reality and video games can have on the education setting. While there are still some errors to work out in order to make the games as helpful as possible, the progress that has been made in high-tech learning can be very beneficial for all students including those with mental disabilities. In fact, these studies prove that using games, such as virtual reality games, can help students with learning disabilities to learn educational and social skills in ways that traditional teaching cannot.

Due to society's expectations, individuals with disabilities are many times judged by their actions. Therefore, Standen and Brown agreed that Virtual Reality (VR) will provide people with intellectual disabilities the opportunity to have a safe environment to learn, but at the same time not be judged by their reaction to certain scenarios. Similarly, P. Standen and D. Brown believed that VR could reconstruct the way students with intellectual disabilities learn in the classroom. VR facilitates the ability to learn at your own pace and choose what makes you feel most comfortable. It also cuts the stigma of judgement toward these individuals if they were to fail or react poorly in the real world.

Standen and Brown described already existing rehabilitation interventions. These included: promoting skills for independent living, enhancing cognitive performance, and improving social skills [6].

Standen and Brown reviewed the advantages that VR has on rehabilitation for individuals with this disability. Many people with intellectual disability are excluded from certain activities and/or experiences by individuals that do not have a disability. This causes individual with intellectual disabilities to isolate themselves creating bigger issues such as severe social anxiety and depression. Using VR educationally will allow this group of individuals to acquire the social skills and learning there are often denied. Additionally, VR will allow them to make mistakes and react as they please without the judgment from people surrounding them. Virtual Reality games often have different levels of difficulty allowing them to learn at their own pace, which is not the case in the real world. They emphasized that VR will also help improve social skills [6]. However, most researchers are focusing on individuals with autistic spectrum disorder since they have shown the most deficit in their social and communication skills. It has been proven that students with intellectual disabilities are more prone to react positively to computer programs than to teachers. This is due to the minimum demands from the computer program and the little amount of real world social interaction while playing the VR program. The opportunity to repeatedly practice the VR scenarios gives these individuals the chance to fail and repeat social interactions before they go into the real world. There are non existing VR applications that directly teach social skills; however, there are studies which through computer videos, students with intellectual disabilities had been able to pretend and learn the given instructions.

According to Standen and Brown, the initial assumption of VR disappointed. This was due to the fact that the developed applications did not meet any of the early expectations [7]. However, the purpose of VR has been the same since the beginning. It is important for developers to keep in mind that the learning scenarios should be transferable from the Virtual environment into the real world. Therefore, it is important for educators to have an active presence when a virtual environment is being developed. The educator's presence is essential since they know the learning needs of their students. However, when students are utilizing the VR headsets, educators are there to facilitate any immediate need or question. When designing virtual environments, the developer has to keep them realistic, but simple. If the game is over complicated, then the user will get distracted and not get the point of that specific VR

environment. Also, it is important to keep in mind the age, needs, and likes of the targeted audience. Developers should also consider that one game is not going to be suitable for all [7].

Students and people, in general, depend on their social skills to advance in either professional or personal relations. The ability to recognize and address emotions is crucial for students, not only for their knowledge but for their future as well. Students with disabilities find it tough to gain such skills, with limited resources. Recently, virtual reality has become very popular to assist students in developing social skills. Tiffany Thang explored a virtual reality game with the use of an HTC Vive to support students with disabilities she states “ While the game supports the idea that virtual reality is a feasible method of providing such therapies, users found some discomfort with using the HTC Vive, and had slight difficulty translating what they had learned from the game in different situational contexts” [8]. Now the issue is no longer learning the skills but applying such skills to the real world. Thang believes including a 360 video in the game could help the student transfer those skills to the real world, by giving them a more realistic experience.

In Thang’s game she presented two iterations. The first iteration consisted of two levels: one where users learned how to recognize facial emotion expression through identifying specific facial features, and the other where users were tested on their knowledge and asked to identify characters with that particular facial feature in a park setting. [8]. From the input of her client, she could see that students had difficulty with the scenarios she presented, meaning they may have been too complicated for the students to evaluate. In addition, the students were not pleased with the graphics of the game. For her second iteration, she included a middle level, where the students reviewed what they learned in the first level before testing them on the last level [8]. This benefited the students greatly, they were able to understand the material more and progress through the game.

Although Thang has not finalized her product, we can see that students do need a more realistic game and possibly some intermediate steps between each scenario presented. Students may find it easy to recognize the emotion, but how-to assess the situation maybe more challenging. Thang suggests keeping up with the behavioral therapists, incorporate more realistic experiences and making sure the system itself is effective [8].

From these three authors we can see that students with disabilities struggle with incorporating themselves in social interactions, because of the pressure of others. So to provide the students with a safe environment, the three authors researched the effect of virtual reality on social skills.

Virtual reality has become the new trend to improve and implement social and cognitive skills for students with disabilities. It has provided students a fun and interact way to learn and practice their social skills. Each game allows the student to evaluate different scenarios in a controlled environment. Although each game has the ability to be improved in different aspects, more or less they each accomplish their purpose. One main concept that each game needs to improve on is the ability to help the students transfer their learned skills into the real world. Now we must develop a game that can incorporate all the standard attributes such as the scenarios, the options that come with each scenario, the emotional recognition, and a way in which the students can recognize similar situations and apply their skills in their daily lives.

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