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Assisting Autistic Children Through Virtual Reality Systems

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ABSTRACT

This paper presents virtual reality (VR) and its impact on children with autism. It explores case studies that use virtual reality to teach children with autism. The project addresses challenges that children with autism face, as well as the means to which virtual reality can assist in accomplishing daily living skills. The paper highlights a VR game to create in the planning stage that can teach children safer ways to cross the street.

Keywords: Autism; Virtual Reality; Game; Video; Learning

360 DEGREES

Statistics indicate that the prevalence of Autism Spectrum Disorder (ASD) in the united states is approximately one in every 68 children (CDC, 2016). It means that the percentage of children with autism is very high, and educators must take their unique needs into consider. Since the world become connected through information technology, we need to apply this technology to assist students with autism so that they may better participate in this exciting global development. After searching the internet, I found that virtual reality is the best technology that we can use to teach students with Autism the skills that they need to participate fully. So, before we get deeper into the virtual reality function, let's define virtual reality. We will also look to Autistic children's characteristics. Virtual reality means "… computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors" (Freina & Ott, 2015). The developer of VR technology did not mainly develop it for children with special needs, but very rabidly VR was viewed by the specialist and education field as a promising area of assistive technology. Studies show that VR as assistive technology generally leads to positive results (Erdem, 2017).

Students with Autism have many characteristics, and no two children are alike, but there are common symptoms. One of them is having difficulties with the imagination, so we could assist them with the Virtual reality system to overcome this problem and many others like social skills deficits, fears, and phobias, and lack of fear of the danger. In this regard, I would like to share what a father published about "no fear of danger" and his experience with his child. Mr. Stuart Duncan said that children with autism have no fear, and that could lead them to do what comes to their minds without concerning themselves about the correct way to cross. Also, he has observed his child nearly falling off a mountain, for instance, and following a ball into traffic (Duncan, 2010). So, after these real situations, we have to avoid putting our children in harm's way. Rather, we must teach them the skills that they need through the appropriate methods. VR technology can help us reach this goal.

Research shows that researchers has been studying VR and its relationship to ASD for decades. Now we were in 2018, and the VR has begun since the 1960s "After 360-degree art through panoramic murals began to appear". Back in the 1960s, a movie has published on 3D immersive, which make the Spectator feel, hear, sense, and move with the movie's actions. Since that time, the VR technology became similar to the real world (Freina & Ott, 2015). Rather than focusing on the origins of the VR relationship to assisting children with autism, I am going to illustrate in my paper how VR can be applied to autistic children today. This research aims to show you how the VR technology is an efficient tool with which to teach children with Autism. One of the significant findings of this relationship between VR and Autistic children is how much the children are drawn to technological devices and enjoy computer-based activities. They seem to seek them out in ways that a teacher without assistive technology would be challenged (Goldsmith & LeBlanc, 2004).

The title of my paper is "360-degrees" because that is how children on the spectrum experience their daily life: 360 degrees. In a short movie called "The Party," the director helps educators experience what autistic children feel. In a 360-degree situation, as illustrated in this movie, autistic children are surrounded by 360 degrees of visual and auditory stimulation, and such intense environmental factors may distress people on the spectrum. The concept of 360 degrees shows how stressful the environment can be for Autistic children and how they respond to it. (Erdem, 2017). Research indicates that autistic children have either high sensitivity or low sensitivity to the objects and stimuli around them—sounds, touch, smells, colors, etc. Utilizing their weaknesses and turning them into strengths by teaching them through VR technology can be an effective intervention because educators can vary the VR applications depending on the ASD child's unique needs. Educators can design games tailored to the challenge that the child face, keeping in mind his/her concerns and special needs. For example, with a child afraid of the red color on the traffic light, the VR technology enables us to change it for him and modifies the process so that he learns the skill of crossing the street. Keeping in mind that this child challenge in crossing the street so, clinicians and software developers can create an avatar that matches the child's demographics to help him to learn that skill. (Kandalaft, Didehbani, Krawczyk, Allen & Chapman, 2012).

WHY VIRTUAL REALITY AND 3D SYSTEMS ARE USEFUL FOR AUTISTIC CHILDREN?

VR technology is a simulation of the real world by using the 3D representation, which means representing the environment in three-dimensional (width, height, and depth). So, through the technology of the VR, we can offer children with ASD space and tools to simulate the real world through the gloves, screen, helmet, etc. VR technology practices can be an intervention that enables the child with ASD to better participate in their world. It can offer strategies to children so that they can avoid danger and stay safe (Newbutt, 2015). Moreover, VR technology is the best platform for improving the social skills and social cognition for children with autism compared to other tools (Kandalaft, et al, 2012). Also, researchers at Michigan State University (MSU) found that VR games are not just games for autistic children, they provide a space that they can learn from and then generalize what they have learned through the game to the natural environment. The study at MSU showed that 87% of the participants reported positive feedback (MSU, 2015).

Additionally, several researchers talked about the beneficial of Minecraft games. These games are a source of attraction to Autistic children, and they dive with their imagination through them. Minecraft is all about creating boxes to build your world with the 3D immersive. Minecraft games can help autistic children to create their world, and it makes them feel as they are in the real world (Kulman, 2015).

As a result, the assistive tools of VR technology and 3D games teach autistic children skills through their favorite type of learning. No matter what skill that they need to develop, they will love developing it, since gaming is something that many autistic children enjoy.

DEVELOPING A GAME

After searching on the internet about VR games for autistic children, I found that such games are relatively rare. There are just a few people who created games for them with VR technology. One of the organizations that created a game for them is Vanderbilt University. So, before talking about the game that I am planning to develop, I would like to share the study about the game that the university of Vanderbilt created. The research is about how to teach teenagers how to drive so that they can become independent adults. This VR game's set up is an Automotive seat, a steering wheel, paddles for the brake and the gas, a screen on the high-adjustable table, and a headset containing sensors to the brain, muscles, and heart. This headset records the electrical activity of the driver. The simulator designed to have different scenarios, districts, and towns. These scenarios require the driver to change the speed, zone, and street. Also, these scenarios require the driver to obey the traffic signs such as the stop sign and the yield sign. Also, the software can be changed depending on the level of the difficulty that the instructor's selection from the start (Vanderbilt University, 2017).

I am not a games developer or designer, but I do have plans for a game that I will create in the future. The game that I am planning to create for children with autism focuses on children who don't fear of danger. I want to teach them how to cross the street at the right time in which they follow instructions and obey traffic laws. This game also will

show them the consequences of not following instructions in ways that children with this disability can understand. For example, the child wants to cross the street, but he does not recognize the stop signs and the time that allows him to cross it. Also, the child does not fear of the fast cars, so he might go and cross the street at the wrong time; this raises the chances to be seriously injured or killed. Thus, a designed game with the support of the VR technology will enable the child to experience the feel of real traffic. I mean by using the VR equipment- gloves, helmet, screen, and the seat or the space that he occupies- the movement and vibrations will help him sense everything but without the threat of real injuries. All the progress, actions, and waves will be decided depending on the situation and the accident. So, he is going to experience precisely the real condition, and that is going to make him understand the real world through this technology.

Additionally, I want the consequence of any wrong in the game to be vivid enough that the child will view the training as training rather than as a game. To make sure this game is possible to be created and to make it flexible enough to make changes in the scenarios, colors, and movements, I am going to interview specialists from Sacred Heart University who have experience in gaming. These interviews will help me to ensure that the game whether will help students with autism to learn the skill of crossing the street safely or not.

INTERVIEWS

In this regard, I interviewed parents of children with autism to ask them basic questions about their children and to identify whether their children are good candidates to learn skills through VR technology. After interviewing four families who have children under ten years old, I found that the ages of the children ranged from 3 to 10. These children spend 2 to 4 hours a day with computers or another screen time with the parents limit so it doesn't expand to more than 4 hours a day. As well as, parents said their children learn through computer simulation, so they learn through mimic what they see on screens more than through mimicking actual people. Although I interviewed a small set of families, we can generalize that many other children with autism are also more likely to imitate what they see on the screen more readily that what they see through face to face interaction.

Also, to complete this paper, I interviewed a gaming specialist who has more expertise than I do in the VR games design. The expert I interviewed is Dr. Robert McCloud, who specializes in game design at sacred heart university. Dr. McCloud said that he sometimes has students with autism in his class, and they were young adults, and he did not use assistive technology with them. However, he believes that students with autism should be encouraged to work on their own because in solo work, they do not have to deal with classroom disruption and other background noises. Dr. McCloud believes that the most useful games for children with autism are once that has created a very compelling world. These are games that immerse the participants in realistic situations such as weather events or exploring new territories. As long as the game has well designed and immersive, it is going to work with students with autism. Dr. McCloud has tried VR games to students with autism, and he saw that the key advantage of doing VR games is in a safe space, so none of the students get hurt. So, VR games are more effective for students with autism when the students play as individuals rather than as multiplayer. He added that if the students with autism understood the rules of the game and the instructions very clearly, it is going to help them, and they will know how to play the game.

On the other hand, if we used games that need the students to make the rules, they won't know how to play, and it is going to be more burdensome on them than learning a skill. So, for teaching children or students with autism through VR technology, we need to make changes that depend on the students' needs. Dr. McCloud said changing settings are technologically relatively simple. It is just changing the code and the GPU instruction and allowing the instructor to make changes through the program. It takes a little training for the teacher or the instructor to make these changes dependent on students' needs. In this interview, I asked about the expense of designing a VR game excluding the hardware, and it costs a minimum of 20,000 dollars.

The second interview is with Professor Pinto, who was a chairperson from 1987 to 2016 of the Computer Science Department, and he is now a Director of the School of Computing. He has taught 10 to 12 students with autism for the last ten years who are of college-age. Professor Pinto did not use assistive technology with students with autism, but he accommodates times for them and allows them to use their laptops if they are needed in the class, even if the others in the class are not allowed to use them. Professor Pinto thinks that visual stimulation is practical because the VR games enable the students to focus on the relevant tasks. Another advantage of VR gaming is that it authorizes the

students to repeat tasks until they are understanding is achieved. He suggests that in creating a game to help autistic children negotiate traffic/cross the street, it is most substantial for the game to features changing colors and sounds. The gamed showed also features street signs so that autistic children can understand their meanings. The best VR game that teaches the skill would also enable the student with autism to scan the streetscape with their eyes. He added that it is possible for the programmer to train the instructor so that the game may be quickly modified to match the students' needs.

VIDEOS

In what follows, I describe two videos that I find helpful in teaching with VR technology. I have recommendations on how to improve the VR games that are described in these videos. The first video is about teaching children with autism social interaction through VR games. First of all, one advantage of this game is that it helps children with autism understand other people's emotions. It links emotions such as sadness, happiness to situations that match the emotion. For example, the avatar would smile and say I am happy and then suggest to the child that they play a fun game. (CBS Boston, 2017)

Through this technology, they will have someone to talk with who can explain to them the association of emotions, facial expressions, and actions that match the emotion. Also, the game instructor is available to the student with autism if they need help. My concern about the VR game featured in this video is that it may not be effective with children who do not like to interact with people at all and who are easily distracted by outside stimuli. For example, an instructor giving directions from outside of the game would break the consecration of the child. So, it might be better for the instructor to direct the student from inside of the game. Also, I think that the game designer could improve the game even more by creating two avatars. One of the avatars is the instructor, and the other is the one that helps the student match emoting to appropriate situations. Another suggestion is to provide the student with choices as the avatar that they select, for example, a girl with autism might choose an avatar who is a girl.

The second video is about teaching children how to drive cars through VR games. I like how they set up the child by putting sensors on the boy to monitor his breathing, heart rate, directions of gaze, and emotional states. I also impressed that the game provided several scenarios of changing weather patterns. To improve the game, the chair where the child sit could be enhanced. They may make the chair to look like a real car which would provide a more realistic setting for the students. Another improvement is to record the student' driving sessions. So, the student could playback the session independently. Or at other times, the instructor could playback the session with the students. That would provide an additional learning opportunity. As well as I suggest that the game should have a variety of scenarios and several levels of difficulties because after all, in real traffic, it is not always perfect conditions as the game.

CONCLUSION

The world of virtual reality is global and cannot be limited to a single game or a program. The influence of virtual reality on education is just beginning. However, we have to utilize programs like this to our educational benefit. VR teaches children skills in a medium that they enjoy. VR games remove distractions that many children with autism face. Such distractions interfere with their learning. We can avoid These distractions in the VR world, and it is something that motivates students with disabilities to learn life skills.

After reviewing the literature and interviewing gaming specialists, my next step is securing funding so that I can implement my outline of the VR driving instruction game. Also, I am planning for my future studies by enrolling in courses in gaming design and special education with a focus on assistive technologies. My goal is to become more knowledgeable in designing games with VR technology for children with autism. To become an expert in my home country of Saudi Arabia is a career goal of mine that these further studies can fulfill. The field of VR is growing, but relatively little of that growth focused on children with special needs. Autism seems to be a disability that could especially benefit from virtual reality, and I want to be part of that development.

AUTHOR BIOGRAPHY

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