An Affordable Aid to Teach Social-Emotional Skills to Individuals with Developmental Disabilities using 360° Video-Based Virtual Reality
Anika Mistry

Significance of Targeted Problem:
In the United States, over 7 million individuals are diagnosed with a developmental disability (DD) like Autism Spectrum Disorder (ASD) and Down Syndrome (DS). Individuals with DDs have deficits in social-emotional skills (SELs) which is the ability to identify an emotion in a social setting and regulate their own emotions and behaviors (Gresham & Elliot, 1987). It is crucial for individuals with DD to have SELs because they allow individuals to independently navigate social settings (Anderson, 2017). Not having SELs can be dangerous if an individual with a DD is alone in a social situation and requires assistance. Mastery of SELs guarantees safety, promotes independence and gives individuals the ability to work or go to school with others who do not have a DD.

Current Solutions and Their Insufficiencies:
The most common current intervention method for learning SELs are in-person treatments, but this method is not accessible. One reason is that in-person treatment caters to children, leaving adults and older teens with DD at a disadvantage and limited resources. Additionally, in-person intervention methods are found in more urban areas, so individuals with DD in rural locations do not have access to these resources. Another reason in person methods are inaccessible is because they are expensive and on average cost an upwards of $47,000 annually (Kageleiry et al., 2016, p. 627). In-person methods are also not flexible during times when in person communication is not safe, like during the COVID-19 pandemic. Some behavioral specialists may turn to video calling, but this presents new barriers for individuals trying to learn SELs.

Assistive technology is an alternative for in person treatments. Technology training is beneficial because individuals with DD gravitate towards technology as it is reliable, consistent and patient whereas humans are not (Anderson, 2017, p. 416). Technology intervention is commonly done through mobile and desktop games, but these methods are not as effective as in-person methods. This is because mobile and desktop games are not very immersive, so users do not feel like they are actually in the game. A lack of immersion makes it harder for the user to apply the skills in the game to their real life and therefore makes the training less effective. Even though technology is not as effective, it is still used by individuals with DD because of its low cost. Most families have access to a smart phone or computer, which makes mobile and desktop games accessible, especially during times with COVID-19. Virtual reality is another technological intervention method and is similar to augmented reality. The Ysgol Pen Coch School in Wales created a virtual reality room to teach SELs to students, which simulates real life situations. The virtual reality room gave children a 360-degree experience and was video-based, which means that videos were used instead of animations. The University of Haifa tested the effectiveness of the virtual reality room through the road crossing situation. After a month of training, seven out of the twelve student participants were able to cross the road successfully and all the participants were seen to improve their SELs (Anderson, 2017). The downside of the virtual reality room was the price and accessibility. Students were only able to use the virtual reality room when they were at school, which was only five out of seven days of the week. Additionally, not all children with DD have access to build a virtual reality room or find one in their location because of how expensive it is to build. For example, one form of a virtual reality room is the CAVE automatic virtual environment which costs at least $30,000 to build (Miller et al., 2020, p. 1). A cheaper form of virtual reality intervention is through using virtual reality headsets. The University of Texas at Dallas conducted a study that asked adults from the ages of eighteen to twenty-six with a DD to use Second Life™, a three-dimensional virtual world. The participants would go through the virtual world and go to locations in the software that they would go to in their everyday life. The participants were asked to interact with others in the location and make social decisions. In five weeks, 71% of participants improved in emotion recognition and social functioning, two major components of SELs (Kandalaft et al., 2012). The virtual reality intervention method is beneficial because of its low cost and virtual reality headsets can cost as low as $25. The main drawback with virtual reality headsets are factors that break immersion such as using 180-degrees instead of 360-degree and using animations rather than videos of real people.

Proposed Hypothesis and Solution:
Creating a virtual reality headset method with 360-degree video-based technology for teaching SELs to individuals with DD would be effective and affordable. Currently, the virtual reality headset intervention method is the best in both affordability and effectiveness. Since user immersion and effectiveness is correlated, I will be using a
360-degree instead of 180-degrees interface and a video-based opposed to an animated interface. The 360-degree interface allows the user to fully view their surroundings as if they were actually in that location. The video-based interface allows the user to communicate with “real” people, which gives them the confidence and ability to apply the SELs to their real life (Ray, 2017, p. 593).

The aid will have three levels, which each focus on a different part of SELs: emotion recognition, prosocial skills and social-emotional application. Each level will contain twenty-five video clips, which will be randomized for the user. When the user uses the aid, they will see five videos per run. The virtual reality will also feature data tracking, so users can track their progress. The aid will also feature tutorials on how to use the aid and settings that allow the user to change their preferences in the aid, which is essential for individuals with DD. The full system architecture can be seen in Figure 1.

![Figure 1: Flow chart for the system architecture](image)

The first level of the aid will be the emotion recognition portion, which will ask the user to interact with a person. The person will be portraying one of the 5 universal emotions: happy, sad, angry, nervous and neutral (Bänziger & Scherer, 2005, p. 252). The user will then be asked to identify the emotion being portrayed. For the second level, the user will see a situation occur in front of them and the situation will either be correct or incorrect according to societal norms. The user will then respond with if the action was correct or incorrect. Level 3 will combine both emotion recognition and prosocial skills. The user will be placed in a social interaction, will be presented with two options for what to do in a situation and asked to determine which action they should take.

To film the video-based interface, a 360-degree camera to film the situations. The camera will be placed five and a half feet above the ground using a tripod to ensure realism. Using scripts written and approved by behavioral specialists, the scene will be narrated from under the tripod to simulate the other user. The situations will be based on locations and actions that most adults with DD experience in their everyday life. The 360-degree videos will be tested for accuracy. Individuals without a DD will be asked to view the videos and then be asked to determine the emotion being portrayed (level 1), determine whether a prosocial skill is correct (level 2), or determine what action should be taken in a social setting (level 3) in the form of a survey. Videos with over a 90% correctness will be used. For the gamification of the aid I will use the game development platform Unity, which specializes in virtual reality. Unity is the best gamification option because it is the most professional and does not reduce the quality of the videos, buttons or other interface commands.

**Expected Results:**

User testing will be conducted by asking participants from a learning center that specializes in skill development for individuals with DD to use the aid for a period of 8 weeks. There will be a 2 week session before the start of the study that allows the users in the study to get comfortable with the VR headset. The hope is that at the end of the 8 week period, the users will be able to be placed in real-world social situations and use the SELs they learned to interact safely. The expected results of this study is that the users will significantly improve their SELs after the 8 week period. This is because in Anderson (2017), which used the VR room, over 50% of the users were able to accomplish the skill set out by the researchers and all users improved significantly in only a month (Anderson, 2017). In the Kandalaft et al. (2012) study, the VR animated game, 71% of participants improved in 5 weeks (Kandalaft et al., 2012).
Bibliography:


