EFFECTS OF VIRTUAL REALITY ROLE-PLAY ON SOCIAL COMMUNICATION SKILLS OF CHILDREN WITH AD/HD

[a]Alice G. Bote

[a]*Philippines*

[a]*alicebote@yahoo.com*

ABSTRACT

The study used mixed methods that aimed to determine the effects of Virtual Reality Role-Play (VRRP) on social communication skills. Purposive sampling was used to choose three male students diagnosed with AD/HD where in one with comorbid ASD, with ages ranging from 9-11 years old. Social communication skills of the participants were measured using Social Communication Score Scale where in scores were computed. Each participant was observed in two contexts such as virtual reality sessions and real-life setting. Field notes and a recording camera were used to capture the observations in both settings. Patterns of behaviors, activities and events were noted down. Specifically it sought to answer the two questions: What were the effects of VRRP on the social communication skills of children with AD/HD during intervention in VR and RL; and what were the effects of the VRRP on the SCS of children with AD/HD after the intervention in VR and RL. VRRP included teaching SCS through conversations with a virtual peer by role-play activities in a monitor-based 3-D environment. Human avatars represented students who were conversing in real-time. Social Communication Score Scale was used to measure the participants' SCS by retrieving video recordings used in all observations in the VR context and RL settings of each participant. Field notes were used to note down themes that emerged in the study. Results showed that children improved in social communication skills but they varied in terms background specifically, behavior, comprehension skill and an uncontrolled variable was also identified; structure is needed to develop and demonstrate the social communication skills in the classroom; skill in ending a conversation in the RL was not common; the presence and prompts of the teacher beside each child during was needed; explicit instruction design in different stages was beneficial; the role-plays with combination of scaffolding and 3-D features of the software promoted interest and was helpful; and repetitions of activities could lead to boredom and would affect the child's social communication skills. Recommendations included promoting and creating a structured environment to enhance SCS and creating a software for children and teachers.

Keywords: AD/HD, Social Communication Skills, Virtual Reality

1.   Introduction

The competencies identified for the new K to 12 curriculum have shifted its focus to 21st century learning and skills. Students these days are more familiar with technology use than in the previous generations. Connecting with friends through e-mails, instant messages and online chatting has become the norm. The use of virtual reality in educating children could be considered as a timely strategy in teaching this population of learners. Virtual reality could be a

communication means that would complement the present-day needs of learners since "to be effective in the 21st century, citizens and workers must be able to create, evaluate, and effectively utilize information, media, and technology" (Framework for 21st Century Learning - P21, n.d.). Communication and collaboration are integral parts of its framework as well. Basic interacting skill is fundamental in order to achieve excellent communication and collaboration which is the essence of this study.

Children with attention-deficit/ hyperactivity disorder (AD/HD) exhibit social skills difficulty such as interacting or establishing friendship with their peers. Literature reviewed indicate deficits in adaptive functioning (Ashwood, Tye, Azadi, Cartwright, Asherson, & Bolton, 2015) and impairment of social functioning (Ronk, Hund, & Landau, 2011; Staikova, Gomes, Tartter, McCabe, & Halperin, 2013). They are often characterized as having low self-esteem and presents difficulty executing appropriate behaviors when it comes to communicating or relating with peers. Additionally, as a result of communication problems related to expressive speech and language skills, individuals with AD/HD may display inappropriate pragmatic behaviors in conversational interactions (Kim & Kaiser, 2000). Even without diagnosed language disorders, children with AD/HD exhibit various kinds of communication difficulties (Väisänen, Loukusa, Moilanen & Yliherva, 2014). Pragmatic language difficulties which are connected with deficits in executive function is usual for these group of learners (Green, Johnson & Bretherton, 2014). Other than the apparent behavior challenges such as inattention and impulsivity in children with AD/HD, social skills particularly interacting with peers should become a target of intervention.

Role-playing has been widely applied as an intervention to improve social skills. It is viewed as an effective active learning strategy as it encourages participation among passive learners, adds dynamism to the classroom, and promotes the retention of material (Stevens, 2015). Role-play is often used to teach behavior and communication skills by simulating situations making language learning more relevant (Luiz Adrian, Zeszotarski & Ma, 2015). A different form of simulation may be through the use of virtual reality.

Virtual reality (VR) is defined as a three-dimensional (3-D) interactive program that immerses the individual in a computer-simulated world. The virtual immersive environments are now used as educational simulations in schools, colleges and universities (Ludlow, 2015). It is a potential teaching strategy for social skills learning to all students, including those with behavior and social dysfunction (Miller & Bugnariu, 2016; Muscott & Gifford, 1994; Rus-Calafell, Gutiérrez-Maldonado & Ribas-Sabaté, 2014). Freina and Ott (2015) and Chow (2016) noted that the features of VR such as images, sounds and other stimuli and spatial immersion are its essentials. It can further be used as a medium through which individuals express ideas, and learn about communication through guided training and rehearsal in simulated social scenarios (Cobb, 2007), thus, the concept of the intervention included communication, role-play and VR.

This research studied the effects of role-play using VR to teach social communication skills to children with AD/HD. Role-play activities were done in an environment using VR, which simulated a real world in the computer where human avatars represented people who were conversing in real-time. The environment served as a structure for avatar interaction. Conversations using voice chat was the main component of the intervention with another person in a human-child avatar form conversing with the focus children in real-time. A private 3-D online software called Edorble purposely built for online education was chosen as a platform to conduct the virtual reality role-play (VRRP). The intervention targeted social communication skills such as initiating, responding and ending the conversation, which are essential for daily interactions of children with their peers. The study determined how Virtual Reality Role-Play

(VRRP) affected the social skills of children with AD/HD particularly initiating, responding and ending a conversation. Specifically it sought to answer the following questions: What were the effects of virtual reality role-play on the social communication skills of children with AD/HD during intervention in virtual reality and real-life? What were the effects of the virtual reality role-play on the social communication skills of children with AD/HD after the intervention in virtual reality and real-life?

The study targeted the social communication skills of children with AD/HD through a VRRP intervention. Social communication skills were narrowed into steps in making a conversation such as initiating, responding and ending the conversation.

1.1. Attention-Deficit/ Hyperactivity Disorder

The definition of attention-deficit / hyperactivity disorder has evolved over time (Lougy, DeRuvo, & Rosenthal, 2007), however, what remains unchanging is how it is characterized as "chronic, neurologically based syndrome" (AD/HD Institute, 2016). In a population of children, 5% is affected while, 2.5 % in adult cultures (American Psychiatric Association, 2013). In the Philippines, an estimate of 3 to 5 % of the population of individuals age 0-14 are affected (AD/HD Society of the Philippines, n.d.). Deficits of the executive functions have been considered as root problems in AD/HD. Weaknesses in some of its domains are linked with AD/HD (Brown 2013; Dovis, Van der Oord, Wiers, & Prin, 2015; Vinson, 2007; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). In their study, Skogli, Teicher, Andersen, Hovik, and Øie (2013) distinguished participants with AD/HD from healthy controls through measuring executive function ratings and executive function measures. Ezpeleta and Granero's (2015) findings show that executive function problems are present at age 3 for children with AD/HD. Deficits on executive function result into difficulties in the life of children with AD/HD as it has been found to affect the students' strategic planning, goal setting, and persistence negatively (Johnson & Reid, 2011). It was also found to affect inhibition, working memory (Skogan et al., 2015), and self-regulation (Moore, 2010). Deficits in these may cause individuals to display impulsive and erratic behaviors that can be misinterpreted as incompetence. The DSM-5 (APA, 2013) stated that AD/HD is commonly diagnosed in the elementary years as inattention is recognizable in a child's everyday functioning. However, it may not be advisable to identify the disorder for children before 4 years of age as behavior they exhibit may be usual for their age.

Having considered the deficits in executive function, social communication skills can also be affected. Kofler, Rapport, Bolden, Sarver, Raiker, & Alderson (2011) specified that while there are different social cues happening in the environment, there is a problem in working memory to attend to all these. This results to deficit in social interaction. They further concluded that central executive impairment had an effect on social problems. Karasinski (2015) concluded that language ability was connected with attention problems in school-age children, not with internalizing and externalizing problems in behavior. Behavior problems however, are attributed to problems with inhibition. Bruce, Thernlund, and Nettelbladt (2006) concluded that pragmatic problems in majority of children are connected with some aspects of AD/HD symptoms, particularly inattention and impulsivity. With regard to language, Schuch, Utsumi, Machado, Thaís, Kulikowski, & Muszkat, (2015) mentioned that the areas of the brain of individuals with AD/HD for language and attention/ inhibition are impaired. Hawkins, Gathercole, Astle, and Holmes (2016) however noted that there is less evidence on the relationship of behavior and pragmatics despite the problems of behavior and pragmatics were evident in the study. They further interpreted that executive function impairments increases problems in behavior and

social communication, and problems with other cognitive abilities affect the development of structural language skills.

Mancil, Conroy and Haydon (2009) study on effectiveness of combining milieu therapy and functional communication training showed that there was an aberrant behavior decrease concurrent with an increase in total percentage of communication responses in preschool or elementary aged children with Autism Spectrum Disorders. Maintained communication and low rates of aberrant behavior were seen and communication was generalized from the home to the classroom.

1.2. Social Communication Skills

Communication is defined as a process (Berko, Bostwick, & Miller, 1989; Person, Nelson, Titsworth, & Hartern, 2011). Berko et al. (1989) emphasized the series of actions in sending the information, feelings and ideas. Person et al. (2011) highlighted this as using messages to generate meaning. This meaning may parallel to the statement of Berko et al. (1989) on mutual understanding and connectedness of two conversing partners. Person et. al (2011) noted communication as dynamic and active. This may be elaborated by looking into the different components of social communication. Social communication is the use of language in social contexts that includes social interaction (American Speech-Language-Hearing Association, n.d.). It is also defined as communicating and engaging in conversations (NHS Worcestershire Health and Care, n.d.). In a conversation, Person et al. (2011) noted the importance of messages in order to draw meaning delivered through messages as verbal and nonverbal symbols, signs, and behaviors. This is similar with the description of Loftin, Odom and Lantz (2008) definition of messages which are verbal and non verbals [*sic*]. Positive peer interactions in childhood advantageous to children in order to establish and improve friendships in their socialization with others (Biggs, Carter & Gustafson, 2017; Hadley & Schuele, 1998) For its effectiveness, Battaglia and Radley (2014) proposed a careful selection of peers to match the specific deficit of children with special needs.

1.2.1. Skills in Social Communication

The beginning and ending of a social interaction is marked by interaction begins, interaction continues and interaction ends (Jones & Schwartz, 2009). This can be done by the following social communication skills such as initiating, responding, maintaining and ending a conversation. Danby, Thompson, Theobald and Thorpe (2012) noted the importance of understanding or having social knowledge as there are many aspects involved in building relationships.

1.2.1.1.   Initiating

Beginning an interaction can be through initiating. Stanton-Chapman, Kaiser, Vijay and Chapman's (2008) study showed initiating were frequently more evident than the remaining social communication strategies. In an ongoing conversation, initiation is distinguished when the utterance was made after a minimum 3-second pause after a peer's previous statement (Spohn, Timko & Sainato, 1999; Thiemann & Goldstein, 2004). Requesting attention can also be made in initiating. In the study of Thiemann & Goldstein (2004) securing attention means

indirectly requesting attention or acknowledgement from peers (e.g., "Hey!" "See this?" "Look"). Craig-Unkefer et al. (2002) identified this as requests – yes-no questions, which are requests that require acknowledgment response (e.g., "Did you see that?"). Calling the name of the peer or tapping a peer on the shoulder are also examples (Thiemann & Goldstein, 2004).

1.2.1.2.   Responding

Response is a verbal statement related to some prior initiation and served to sustain the topic of conversation (Spohn et al., 1999). An indicator of response is a contingent utterance. Some examples are simple contingent, back channel, fillers and compliments. Simple contingent was defined as an immediate utterance without additional information, typically a response to a question or "personalization" (e.g., "I have a green house; mine is blue.") (Mathinos & Wypych, 1988) while a back channel response is an agreement to what was previously uttered and used as a mechanism for not taking a turn (Turkstra, Ciccia, & Seaton, 2003).   Fillers, false starts and compliments are defined in the previous section. Another kind is an elaborated response, defined as giving an on-topic response to the partner's question and expanding by adding relevant on-topic information. This is for the purpose of maintaining a conversation (Koegel, Park & Koegel, 2014; Mathinos & Wypych, 1988). Mathinos and Wypych (1988) defined this as contingent response with expansion wherein the utterance goes beyond the minimum expected response by adding information about the topic. On the contrary, reject is different. Reject is a refusal to acknowledge a *bid* or doing the opposite of what was asked even though it was clearly heard. Often, it is in a nonverbal form. Ignore is ignoring the initiator and not doing what was asked. Ignore or no response on the other hand is when there is no response from the partner even though it was heard and a statement was uttered with a new topic (Jones & Schwartz, 2009).

1.2.1.3.   Maintaining Conversation

Maintaining conversation is described as reciprocal conversation with another peer or group of peers with knowledge of the topic (Sansosti & Powell-Smith, 2006). Krebs, Mcdaniel, & Neeley (2010) included the importance of maintaining eye contact or directional gaze, maintaining close proximity to peer while interacting, directing or initiating conversation with the peer and maintaining the topic while keeping the conversation going. Commenting can be done to provide opportunity to continue the interaction by giving statements connected on events that happened during the interaction (Jones & Schwartz, 2009; Morrison, Kamps, Garcia, & Parker, 2001; Stanton-Chapman & Brown, 2015) (e.g., "This game is hard, right Erin?" "Melissa, I have this game at home.") (Morrison et al., 2001). It can be by giving personal observation (e.g., "Sammy is in kindergarten") (Jones & Schwartz, 2009). An on-topic comment can be an utterance about the topic but is not contingent on the preceding utterance which often happens when the interaction is shifted to a new sub-topic or theme (Mathinos & Wypych, 1988).   While effective commenting indicates engagement between the conversing partners, the lack of commenting shows ineffective turn-taking skills (Jones & Schwartz, 2009). Another way to maintain a conversation is by asking a question. Reciprocal *question-asking* was defined as asking a question that was related to a previous response or initial question by the partner (Koegel et al., 2014; Peters & Thompson, 2015). Peters and Thompson (2015) considered using questions to regain interest if the conversing partner lost the interest. It also gives the conversing partner to

have the floor in the conversation. In maintaining a conversation, changing topics can be done. It can be by making a statement regarding something different by giving compliments (Peters and Thompson, 2015). Another way is through an utterance that is not contingent on a peer's previously mentioned statement (Thiemann & Goldstein, 2004). An example is asking an off-topic question which opens possibilities for an alternative topic of interest (Peters & Thompson, 2015). Acknowledgement can also be used. It is referred as with a turnabout. It is similar to acknowledgement but the *bid* elaborates the same theme, or a new conversation may start (Jones & Schwartz, 2009). Peters and Thompson (2015) identified this as acknowledgment to change the topic for the purpose of making possibilities for the partner to become more interested. It is not intending for the speaker to own the floor. Reject with turnabout is a refusal to acknowledge but offers another *bid* that elaborates the same theme or starts a new interaction (Jones & Schwartz, 2009).

1.2.1.4.   Ending the Conversation

In contrary to maintaining a conversation, no further interaction made despite a response given means end of the interaction with an indicator of 5 seconds wherein no response is made (Jones & Schwartz, 2009). Non-examples of ending the conversation are walking away from an ongoing conversation and not responding to his or her name being called by another peer (Sansosti & Powell-Smith, 2006).

Table 1. Conversation Skills and The Descriptions

Skills	Descriptions
Making a conversation	1. Go up to a person 2. Say "hello" 3. Smile 4. Listen to what the person says 5. Respond
Turn-taking	1. Pay attention 2. Wait until the person pauses 3. Say something in return
Listening	1. Keep quiet 2. Listen to what the person says 3. Look at the person
Maintaining a conversation topic	1. Listen carefully 2. Think about what the person says 3. Talk about the same thing
Changing a conversation topic appropriately	1. Keep quiet and listen carefully 2. Wait until the person pauses 3. Say, "Let's talk about something else. 4. Let's talk about _____.

Source: Hsiao & Bernard-Opitz, 2000

Various studies have also used breaking down of skills into steps in order to teach social communication as an intervention. (Beilinson & Olswang, 2003; Brinton, Robinson, & Fujiki, 2004; Koegel et al., 2014; Laugeson & Park, 2014; Spohn et al., 1999; Stanton-Chapman & Brown, 2015).

1.2.2. Social Communication Difficulties of Children with AD/HD

There have been evidence that children with AD/HD have communication related problems. Looking at Table 1, it would seem that some areas such as making a conversation and maintaining a conversation point to additional areas such as responding, aggression, pragmatics and attention.

1.2.2.1.   Responding

One of the common difficulties of children with AD/HD is how they respond during conversations. In an assessment by Mikami, Huang-Pollock, Pfiffner, McBurnett, and Hangai (2007) using novel computerized chat room task, with computer-simulated peers, participants were encouraged to converse by typing messages. Interaction was done by freely responding to four computer-simulated peers. Children with AD/HD-inattentive type produced the fewest number of responses and the least memory of conversation. They do not participate or do not attend to the conversation due to their poor memory in conversation content. This type of children are slow-to-warm up, and commonly withdraw at first but may join after watching their peers. AD/HD-combined type gave more hostile responses. Both groups show that responses are off-topic in nature. This is similar to a personal conversation, a video analysis Blomqvist, Augustsson, Bertlin, Holmberg, Fernell, Dahllöf, & Ek (2005). Children with AD/HD were compared to a control group and it was revealed that they had more missing and fewer verbal responses. The interaction showed by children with AD/HD was less two-way communication.

1.2.2.2.   Aggression

Problem with aggression and impulsivity were also observed in their conversations. According to Grskovic and Zentall (2010), girls with AD/HD were more verbally impulsive and hyperactive. They were faster in conversations and school related activities. DuPaul, Weyandt, and Janusis (2011) explained that children with AD/HD compared to their classmates responded in an aggressive manner when dealing with interpersonal problems. They raised the need to implement interventions that address peer relations to avoid these communication issues.

1.2.2.3.   Maintaining conversation

When it comes to maintaining a conversation, problems are also exhibited. Children with AD/HD have problems with associative control that allows to maintain a conversation by giving relevant statements in a conversation. For a child with ADD or AD/HD, free and erratic ideas are stated in the conversation (Vinson, 2007).

1.2.2.4.   Pragmatics

Not only in the communication in general but, different researches have also shown that most AD/HD cases have problems in social communication pragmatics. Literatures state that children with AD/HD commonly possess poor pragmatic skills.

They typically do not respond to environmental cues that serve as regulators for pragmatic interactions with other individuals. They frequently ignore social rules, which further impedes their social adaptations and can result lowered self-esteem owing to the lack of friends.

Therefore, it is important to assess the child's pragmatic skills, looking at sub areas such as topic maintenance and topic switching. (Vinson, 2007, p. 308)

Geurts (2010) showed studies that present pragmatic language problems in children with AD/HD. A pile of studies presented by Green et al. (2014) also confirmed that children with AD/HD match in terms of pragmatic language impairment that includes excessive talking, poor conversational turn-taking, and lack of coherence and organization in elicited speech.

Geurts and Embrechts (2008) noted that there are similarities between school-aged children with ASD and AD/HD in terms of language profile. More problems in pragmatics are shown rather than in language structure. Green et al. (2014) added that pragmatic language abilities should be included in the clinical assessment and a focus for intervention since pragmatic language ability is crucial in social and academic functioning of these children.

1.2.2.5.   Attention

In terms of attention, Rasha, Asmaa, Abdel, Amr Abdel, Omnia Raafat, Akmal, & Hany (2013) concluded that impairment in intentional communication is because of their short attention span. According them, these communicative intentions and engagements relies on shared attention to an object, topic or person, initiating verbal exchanges and responding to initiations by others.

1.2.2.6.   Figurative Language

Bignell and Cain (2007) mentioned that children with poor attention and those with poor attention with high hyperactivity showed impairment in comprehension of figurative language and communication skills. However the study affirmed that there was no impairment in communication for high hyperactivity group.

1.3. AD/HD and Computer Technology

Computer technology can be a solution for difficulties of students with AD/HD pertaining to academic, behavioral and social problems. In their review, Xu, Reid and Steckelberg (2002) grouped the different researches that show variety of applications of computer technology to AD/HD as follows: computer-assisted instruction, computer-based training, biofeedback training, assessment and behavior modification. Applying virtual reality in cognitive training showed better results. Using the training to subjects with social and behavioral problems but not formally diagnosed with AD/HD, cognitive training with the use of HMD and headtracker showed effectiveness in sustaining attention and they distinguish target stimuli more sensitively. (Solomonidou, Garagouni-Areou, & Zafiropoulou, 2004). Drigas and Tourimpampa (2014) noted that given multimedia applications results ease in AD/HD investigation, evaluation of its efficacy still remains challenging for researchers when applied to assessment, intervention and training of attention.

1.4. Virtual Reality

Virtual reality is an environment or computer-simulated physical space which is replicated by information technology. Interactions are described in computer-mediated social space (Virtual

Reality, 2008). The immersion happens in an artificial image or environment, which seems real. It projects actual situation that gives the user a feel of a real experience. It provides an experience where the user encounters a more dynamic way of interacting (Aikat, 2007).

In the 1980's, VR was popularized by Jaron Lanier, its proponent. However, the name, "virtual reality" was not yet determined (Sala, 2009). The recognized pioneers were Myron Krueger and Jaron Lanier who introduced it even though there was an evolution of this concept. In a 1965 paper, "The Ultimate Display," Ivan Sutherland introduced the fundamental concepts of virtual reality. He envisioned that computer is a "looking glass to a mathematical wonderland." This signifies that functions of objects will not abide in accordance to nature's physical properties. Even though, the occurrence is an entire sensory experience that includes all the senses (Virtual Environments, 2008). At present, virtual reality it is widely used as its applications assist the needs in the different fields with more developed features. Freina and Ott (2015) described the evolution of virtual reality where modes change into something close to the real physical world.

There are classifications of VR based on its methods of display. The first one is the Immersive VR which is described as a high degree of interactivity. This includes high cost peripheral devices. One example is the head mounted display. This method uses an avatar which can be in a form of three-dimensional model. This virtual body represents the user (Sala, 2009). The Cave Automatic Virtual Environments (CAVE) uses a room with walls and the floor to display the replicated environment. The user wears 3D glasses which helps him to feel floating and move freely. The Head-Mounted Display (HMD) with headphones helps to create an inward feeling of being in the artificial environment (Freina & Canessa, 2015). The second type of virtual reality is non-immersive VR or the "desktop VR." The computer monitor displays the environment which serves as the window into a virtual world (Sala, 2009).   Both immersive such as a CAVE-like environment and or non-immersive, such as desktop-like displays' primary aim is to reproduce an imitation of a real environment (Romano, 2005).

Virtual reality can be described as distinctive from other mediums of communication. This human-computer interactions offer qualities such as engagement, immersion, or presence. There is a sensation described as the real experiences in the real environment are similar as replicated in the virtual. This characterizes a successful virtual environment (Virtual Reality, 2005). These can be postulated as primary features VR experience.

VR is always attached with the term "immersion" which is also called "spatial immersion," the perception of existing in the non-physical environment. Because of the images, sounds and other stimuli, they create an effect of being present in the absorbing environment. Spatial immersion takes place when the simulated world is convincing and looks genuine and authentic. The effect is perceiving that the user is really there in the artificial environment (Freina & Canessa, 2015). Robie and Komar (2007) describe this feature as telepresence. It is the feeling of being present in the computer-generated environment while the user is immersed in the multisensory environment. Telepresence takes place when the user is completely focusing in the virtual world and ignores the idea of having a human-computer interface.   The perception of being present in the simulated computer environment is also termed as presence. A universally accepted meaning of presence has not yet been established, however, the descriptions are all directed towards identical conceptions. In consideration of the design and evaluation of a computer-mediated products and interfaces in the wide range areas such entertainment, education, and telecommunication, presence has already been the primary component in the study of virtual reality (So-Yeon & So-Hyang, 2010). Presence in virtual reality is a

phenomenon. The virtual environment is a place that is fictitious however it creates an illusion. There is an awareness that the events, what is seen, heard and felt are all artificial however, the user behaves and feels as if incidences really are occurring (Sanchez-Vives & Slater, 2005). In their study on computer games Scoresby and Shelton (2011) stated that the visual and audio aspects greatly contributed to the feeling of presence however presence can be conditional. Those with higher level of immersion, its multimedia feature affect the motivation of users and captures attention for the users (Sampaio, de Freitas, & Cardoso, 2009). Sanchez-Vives et al. (2005) enumerated the contributors to presence: visual realism (graphical representation of the environment), sound, haptics (the sense of being with another person in a virtual environment), virtual body representation and body engagement (includes body movements). According to Chow (2016), presence is determined depending on how well we are connected to or involved in a virtual world. On a different note, Scoresby and Shelton, (2011) perspective of presence is not only confined in the fully immersed experience. Whether the user is engaged in a real environment, a virtual or a mixed-reality, the user may also be at the level of presence. This means presence manifests in different kinds of environment, real or virtual. It is pertinent that this feature of virtual reality can be maximized depending on appropriateness of application, any simulation whether virtual or a real one.

In application to education, there is evidence that feeling present in virtual environment is one of the factors that aids effective learning (Chow, 2016). A number of studies documented results that show virtual reality is exciting and challenging as perceived by students, for activities that allow them to walk through and interact with the environment and create their own world (Pantelidis, 2009). The interactive graphic technology and the lucidity of sounds can be attractions to children with AD/HD. Because of the feature, presence has been an interest of psychologists (Sanchez-Vives & Slater, 2005). Moreover, not only in the field of psychology, attentions have been drawn to the study of presence from in computer science, psychology, and communication as virtual reality technologies are progressing (So-Yeon & So-Hyang, 2010). Due to the different features of virtual reality, including presence, it provides many advantages both in education and therapies.

1.4.1. Advantages of Virtual Reality and its Educational and Therapeutical Applications

Virtual reality has been widely used in the different fields of study. It offers features that have been utilized in the military training, training pilots, in the medicine, engineering and numerous studies affirm of its advantages in the variety of fields. It is because the immersion can be described as effective while the interaction and control of the virtual world is dynamic (Aikat, 2007). With this feature, it is therefore, beneficial if maximized as a tool in education.

According to Psotka, (2013) we are in the age where the use of VR environments, games and entertainment offer creative output and a new Renaissance in learning. In line with this, the use of VR in education has naturally evolved (Pantelidis, 2009). The properties of VR may be utilized as it offers propitious benefits. Freina and Ott, (2015) stated the advantages of using of immersive VR in education. It greatly benefits those practices and trainings that are too risky and dangerous. In this manner, the exposure towards crucial components in the training is not compromised. Those events that are not feasible to conduct are still possible through VR. Learning occurs by participating and doing in the virtual worlds (Chow, 2016). Avatars can be used to perform learning activities that are not feasible in the real world. The gaming approach targets the learner's involvement and motivation as well. It also offers support as different learning styles are seen through virtual experiences (Freina & Canessa, 2015). With the

accessibility of computers and Internets by teachers and students, online education has become a preference in education. Virtual reality serves best by utilizing collaborative learning environments combined with multimedia (Monahan, McArdle, & Bertolotto, 2008). When compared to traditional face-to-face conversation or videoconference, virtual environment with manners such as verbal and nonverbal with the real-time and multi-user environment is engaging and cost-effective (Tapsis & Tsolakidis, 2015).

A very effective application of virtual reality application is in therapy and people with special needs. With stimuli modified in a controlled virtual environment fit for therapeutic gains, patients are stimulated to respond parallel with real-life. This may be done to whatever types of virtual reality, immersive or non-immersive. Motivations are found from the amusing features of the virtual environment. This results to engagement and compliance to the therapy (Romano, 2005). A controlled environment can be created in the virtual world which is critical to any therapies. (Hadley, 2011). The most common application of virtual reality is in communication. It lessens communication apprehension anxiety and increased self-confidence. Engagement in their interactions and presentation were shown (North, Hill, Aikhuele, & North, 2008). Comparing interactions using face to face online communication and VR, those who manifest shyness had decreased communication apprehension using VR (Hammick & Lee, 2014).   It is also effective for patients with anxiety. In a study conducted, after three months of interaction sessions in VR, lower levels of anxiety were recorded. It confirmed how effective its application is for social interaction therapies (Morina, Brinkman, Hartanto, Kampmann, & Emmelkamp, 2015). According to Riva et al. (2007) it is a very effective interaction medium. Interaction done in an anxious environment creates anxiety, on the other hand, relaxation is drawn from an environment that is relaxed. Using virtual reality role-plays for those with schizophrenia, conversational and assertiveness may show progress (Park et al., 2011). Addressing communication problems, according to Garcia, Rebolledo, Metthe, and Lefebvre (2007), interventions with the use of VR can treat aphasia and other cognitive-linguistic impairment of adults. This may assist also those specializing on deaf as it addresses difficulty in hearing (Zirzow, 2015). To add more in special education application, in VR, a specialized environment can be created for children with disabilities who have limited opportunities in the real world. The manipulation stimulation would allow these children to do specific activities (Reid, 2002). Using VR for social interaction training, the result shows that there were developments in responding, initiation, greeting, and positive conversation-ending which showed improved social competence in children with high functioning autism (Ke & Im, 2013). The study of Didehbani, Allen, Kandalaft, Krawczyk, and Chapman (2016) showed that autism spectrum disorder had improvements on their social skills through VR. This indicates that it may affect their emotion recognition, social attribution and executive function of analogical reasoning. It is proven that the different features of VR have been maximized in the different fields, on the other hand, there are also noted drawback of using this application.

1.4.2. Disadvantages and Dangers of Virtual Reality

Despite the many advantages and efficacy of VR, there are expected downsides to this technology. For immersive type of experience, the cost of the facilities are too costly. The CAVE-like equipment is very expensive (Romano, 2005). The technology is restricting to a lot of facilities (Reid, 2002). Using the VR equipment for a long time also causes VR sickness, the feeling of vertigo, motion sickness, flashbacks, spontaneous seizures, excessively nervous and antisocial behavior (Romano, 2005). A more accessible type for immersion is the use of HMD which according to Freina and Ott (2015) is also tiring and causes sickness to some learners.

For activities that allow students to manipulate and create, there is a need to be familiarized and learn the software which will require time and mastery (Pantelidis, 2009). In application for students with special needs, a lot of researches have been published on how it can teach social skills to those with autism spectrum disorder, however, there are found studies that tell the inability to generalize the learned skills obtained from virtual environments in real-life social situations in K-12 settings (Vasquez III et al., 2015). For using virtual worlds for training like medical, drawing clinical learning and practice can still be limited. Because of a big number of students who are participating, it requires longer amount of time for students exposure to patients, emphasis on patient safety, medical errors, ethical considerations, pandemics; and crisis situations (Chow, 2016).

VR games have drastically attracted the interest of many computer users. A longitudinal analyses showed that teamwork and computation-oriented motives are precise contributors to its quick progression in a game. However, link between problematic use and certain motives like advancement and escapism have been shown (Billieux et al., 2013). Users need to be mindful of other effects that may result like computer addiction due to prolonged use of VR specifically games oriented. There were also results that show excessive games playing (ECGP) that may be connected to cognitive deficits (Sun, Ning, Min, Chen, & Zhang, 2008).

The massively multiplayer online role-playing game and other environments intended for collaborative communication allow different individuals to access the virtual environment in real-time to hold live conversations and chat. This may be vulnerable to online stranger dangers. Parents are in the best place to protect and monitor children's usage of this applications (Willett, 2015). Internet use is one considerable element in VR applications. Because it is an online activity, there are also studies that show there are users who manifest Internet addictions. There is a prevalence rate between 1.5% and 8.2% survey in US and Europe (Weinstein & Lejoyeux, 2010). Internet addictions are linked to other complications. There is a connection between Internet addiction and affective temperament profiles, especially with anxious temperament. In addition to this, more emotional and behavioral problems occur in adolescents who have problematic Internet use (Ozturk, Ekinci, Ozturk, & Canan, 2013). Reports have shown that Internet addiction is comorbid with other psychiatric disorder, especially affective disorder that includes depression, anxiety disorder (generalized anxiety disorder, social anxiety disorder) and AD/HD (Weinstein & Lejoyeux, 2010). For users with AD/HD, Internet addiction in adolescents shows more impulsivity. They have several comorbid psychiatric disorders were seen which can be connected to psychopathology of Internet addiction (Cao, Su, Liu, & Gao, 2007). It was suggested that AD/HD symptoms such as inattention and hyperactivity and hyperactivity-impulsivity domains were linked to Internet addiction severity in children. It can be risk factors of Internet addiction, since AD/HD group was seen with higher Internet addiction scores than non-AD/HD group (Hee Jeong et al., 2004). In adults with AD/HD, the most associated symptom of Internet addiction is deficit in attention, second is impulsivity in adults. It is more significant among female college students (Ju-Yu, Cheng-Fang, Cheng-Sheng, Tze-Chun, & Chih-Hung, 2009). The Internet as well is very prone to cyberbullying. A study of students with AD/HD by Heiman, Olenik-Shemesh, and Eden (2015) showed that girls were more cybervictims than boys, on the contrary, boys were more involved with cyberperpetrators than girls.

1.4.3. Edorble

It is created as a 3D virtual world to best serve online learning, meeting and webinars with its mission to create a more personal, playful and powerful online learning environment for personal computers, mobile devices and virtual reality headsets. It is a multi-user virtual environment (MUVE) that fosters synchronous communication and online learning that will suit the needs of teachers (Baker, 2015).

1.5. Role-play

Role-play is very known for its effective way to impart learning because simulation is one of its distinctive attribute. According to Lazar (2014), it gives students an experience that can be defined "almost real" and it that can enhance group work practice. Role-playing is an experience outside the classroom. It is an effective strategy where students can be brought in another place or time. Learning is established in scenarios that are believable and the response of participants are necessary in their roles. Simulation takes place with complex interpersonal interaction. This is where valuable lessons are drawn, not just to teach a topic, but more on how it can be used and how other participants may respond to it (Fanning, 2011).

"Role-play is a type of communication. Like other means of communication, it can be used for messages, expressing or arousing emotion, negotiation and persuasion, or for a variety of other purposes" (Van Ments, 1989, P. 51). Play is a component because students are in "inventive and playful as possible" in partaking their roles (Ladousse, 1987, P. 5). "Engagement to each other through roles" (Tolan and Lendrum, 1995, P. 26) is its distinctive characteristic that makes it effective to teach communication.

Role-playing has been widely applied in the different teaching or training fields. Using role-playing as an approach to affective education, Gumaer, Bleck, and Loesch (1975) mentioned that it helps students in understanding themselves and their classmates more. In teaching legal ethics in law schools, Schrag (2009) noted that role-playing exercises give meaningful ethics instructions concerning doctrinal courses. Role-playing was also used in an English classroom that utilized the teaching tool called "cultural and political vignettes." Imaginative or situational problems were posed as students were asked to respond by role-playing. In this way, they practiced creative and essential decision-making skills which are essential in the classroom and communities. This may also help in addressing student's specific need (Darvin, 2009). Through mock interactions, students learned social psychology and ways to address social problems (Plous, 2000). Kipper (1988) stated that in psychotherapy, the use of role-playing is in the area of skill development, one example is social skills.

Role-play is also used to teach content lessons. Resnick and Wilensky (1998) applied it as activities in mathematics and science to aid students in exploring behaviors of complex system in order to develop better intuitions on how complex phenomena can arise from simple interactions, and predictable patterns from random events. Harth (1966) used role-play in the character as school personnel to show that there is a positive transformation in the school behavior, reaction to frustration and attitudes toward school. He also mentioned of the positive effect towards literacy skill such as speaking, writing and listening of having the art of drama in the classroom. When used in teacher-centered discussions and lectures, their study showed better result in evaluation for those who participated in the role-play and collaborative exercises than those in the group of traditionally instructed peers (McCarthy & Anderson, 2000).

Craciun (2010) mentioned that fusing role-play can boost motivation in learning and can actively and consciously engage learners. It can allow the teachers to be aware of the student's temper, learning style and intellectual level. It helps in evaluating what has been learned. Role-playing is also described as interesting, fun and makes learners interact. Skills that are hard to develop using traditional teaching strategies like responsibilities and leadership in learning, peer learning/teaching, group work, confidence or creative problem solving can be targeted and may result progress in this method. Balch (1983) used role-playing in a therapy situation, where audience and participants had more direct emotional dynamics. He explained that enthusiasm and class participation arise when students are included in an actual demonstration. In this manner, the students volunteer to participate in roles in front of the class. As enumerated above, role-play is a very useful strategy that does not only enhance academic, rather it is effective to teach communication and train interpersonal skills as well. One factor that may create a meaningful role-play experience is incorporating explicit instruction in the strategy.

1.6. Explicit Instruction

Explicit instruction is distinguished for providing different sequence of supports or scaffolds. In this manner, the learner is guided as he goes through the learning process with coherent statements on purpose and rationale on learning the new skill, concise explanations and demonstration, guided practice along with feedback until mastery has been attained with self-sufficiency (Archer & Hughes, n.d.). Another term for explicit instruction is explicit direct instruction, defined as a collection, where different instructional strategies are integrated (Hollingsworth &Ybarra, 2009). Systematic is also synonymous to the term. Smith, Sáez, and Doabler (2016) used the term explicit and systematic teaching which is an evidence-based execution of lesson where the strategies incorporated are best to enhance the working memory of students. The structure on how tasks are sequenced, leveled and executed may affect the working memory to perform initial tasks. In this fashion, it may be beneficial to students with learning disability despite their condition of difficulty to handle overload of instructions.

Components of explicit direct instruction are: learning objective, activate prior knowledge, concept development, skill development, lesson importance, guided practice, lesson closure, independent practice, checking for understanding, explaining, modeling and demonstrating (Hollingsworth & Ybarra, 2009).

Madeline Hunter's direct instruction model (Bushman, 2004) contains essential elements in delivering the lesson.   The sequence of giving the lesson is as follows: (1) teacher initiates anticipatory set; (2) teacher determines objective: (3) teacher gives input; (4) teacher models; (5) teacher checks for understanding, (6) teacher guides practice; (7) teacher assigns independent practice; and (8) teacher offers closure (Steiner & National Council of Teachers of English, 1993).

2. Methodology

2.1. Methods

The study examined the effects of VRRP on social communication skills of children with AD/HD. VRRP was an intervention that aimed to teach social communication skills such as initiating, responding and ending the conversation using Edorble, a 3-D software.

Initiating skill included sub-skills or steps such as approaching by walking towards the person or peer, greeting the person or peer, calling the person or peer by name, waiting quietly for the person or peer to finish his or her response, uttering the statement not later than 3 seconds after the person's or peer's response, initiating by giving information or asking a question, giving information or asking a question in context, using appropriate words or statements and speaking in a friendly manner or with appropriate voice.

Responding skill included sub-skills or steps such as waiting quietly for the person or peer to finish his or her statement, responding not later than 3 seconds after the person's or peer's utterance, uttering an on-topic response, using appropriate words or statement and speaking in a friendly manner or with appropriate voice.

Ending the conversation included sub-skills or steps such as waiting quietly for the person or peer to finish his or her response, uttering the statement not later than 3 seconds after the person's or peer's response, uttering a statement that ends the conversation, using appropriate words or statement and speaking in a friendly manner or with appropriate voice.

Social communication skills were taught by following the components in an explicit instruction lesson design by Madeline Hunter. A teacher was facilitating the lesson side by side with the child with AD/HD. The major features of VRRP was conversations modeled by playing a clip that showed two conversing partners in 3-D avatar forms talking to each other. Incorporated in their conversation was the sub-skills or steps of each social communication skill. To practice the skill, series of role-plays were done by conversations between the participant with AD/HD and the virtual peer in the 3-D world. Each conversing partners were in avatar form and participated in the role-play activities with provided support such as a script with a complete written dialogue flashed on the multimedia screen in the virtual world. Decrease of support was done by taking away the written dialogue of the child in the second and third role-plays. The last role-play was the evaluation conducted without a script on the screen to determine if the child was able to learn the skill.

The effects of VRRP in social communication skills were determined by measuring the skills in the last role-play in the VR context. It was also explored in the RL setting by observing the child in his natural environment in the SPED class mostly during recess. Other settings included during self-care activity, book activity and circle time.

Figure 1. Conceptual framework. The figure shows a diagram that illustrates the effects of virtual reality role-play on social communication skills of children with AD/HD
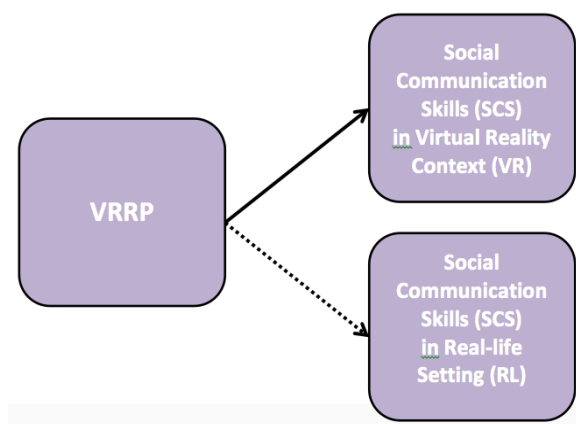
2.2. Design

The study used a mixed methods design, a quantitative and a qualitative research that investigated the effects of virtual reality role-play on social communication skills of children with AD/HD. It is a quantitative study as the social communication skills of the participants were measured using a Social Communication Score Scale. Each participant was observed in two contexts such as virtual reality sessions and real-life setting. A camera was used to record the observations. By watching the recordings, all social communication skills observed in all opportunities were rated using the SCSS. Each skill in the scale was composed of sub-skills wherein each one was given a score. The sum of these scores were computed. 1-3 opportunities with the best total scores were chosen for the computation of the average that was plotted in a graph for VR and RL for visual presentation. The scores per sub-skill before intervention and after intervention were also compared to determine the social communication skill of participants after the intervention.

The study is qualitative. Field notes were used to write down observations in the VR and RL. A recording camera was used to capture the observations in both settings. While watching the video recordings, patterns of behaviors, activities and events were noted down.

2.3. Participants

The following criteria were set to purposively choose the participants of the study: children diagnosed of AD/HD who were enrolled in a school, age group ranging from 8 to 12 years assuming that children who belong to this age group could easily learn to manipulate a computer. Having comorbid disorder could be included, however, they must not be undergoing speech therapies or medication that treat attention or behavior to control variables. Profiles of children were generated from the special education department of the school and were referred by the SPED coordinator. A list of six children diagnosed of AD/HD with indicated ages and SPED programs was prepared and provided by the SPED coordinator. Upon checking the list, only three children qualified as participants of the study. With their parents' approval, the

participants' profiles and present skills or problem areas written in their Individualized Education Program and Progress Report were reviewed by the researcher.

The study was conducted in a private school in the province of Rizal. Although it offered regular classes from K-12, the participants were students in the school's SPED classes. Table 2 shows the profile of the selected participants.

Table 2. Profiles of the Selected Participants

Name*	Age	Gender	Diagnosis	Program
1. Gabriel	9 years old	Male	Comorbid AD/HD and ASD	SPED primary class with mainstream to grade 3 English
2. Nehemiah	9 years old	Male	AD/HD	SPED primary class
3. Jeremiah	11 years old	Male	AD/HD	SPED class with modularized regular curriculum

*Note. *Participants' names have been assigned pseudonyms for confidentiality*
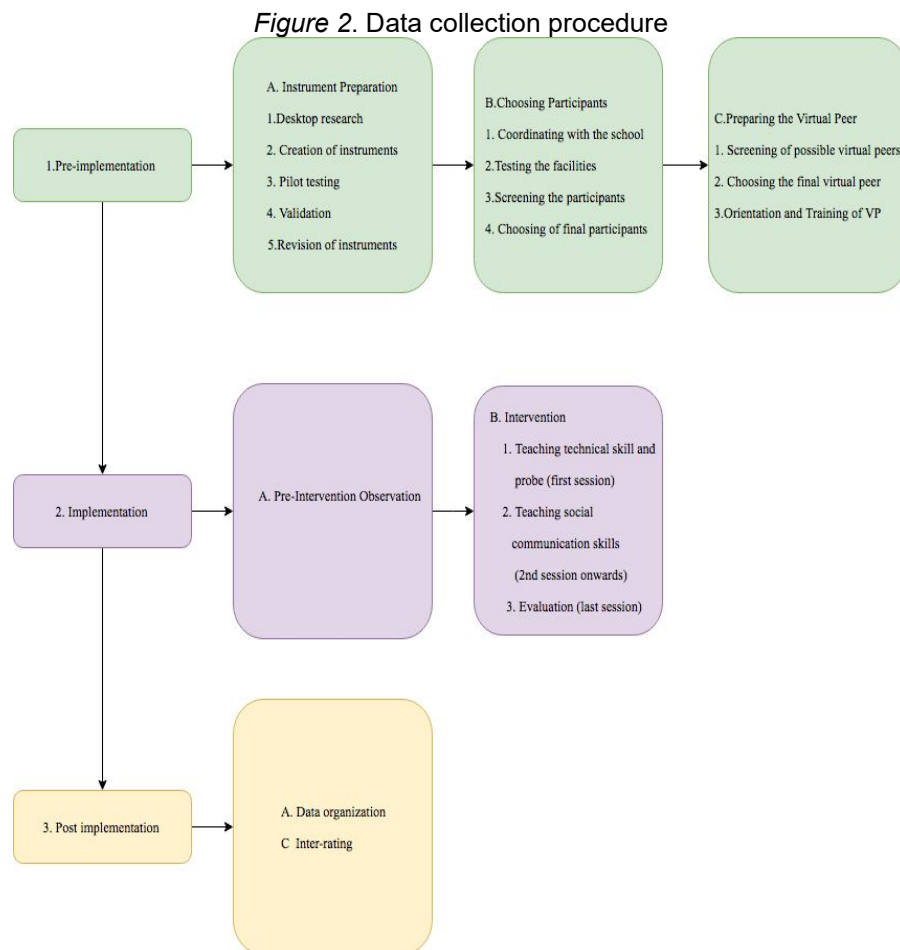
2.4. Instruments

Video Camera Recorder was used to record all activities during observations in all VR sessions and in the RL setting of each child.   A free trial version of Capto application software was used to for recording the screen during VR sessions. Social Communication Score Scale developed to measure three social communication skills such as initiating, responding and ending the conversation. Each skill was comprised of sub-skills or steps and validated.

Mann-Whitney U Test was used to measure the test of association while Cronbach's alpha to measure reliability of instruments. Each social communication skill was task analyzed to identify the sub-skills or steps. Each sub-kill was quantified by a weight or a score. The sum of the scores of all sub-skills is computed to determine the score of one communication skill per opportunity. For each observation, all opportunities that showed the social communication skill were rated as retrieved from the video camera recording. Average was obtained from three opportunities with the best scores. Average was computed for the purpose of analyzing the skills using a graph.

Field notes were used in all observations in VR and RL for the researcher to write down instances that showed the child's social communication skills or other relevant behaviors pertaining to social communication skills. Lesson Plans were developed using Madeline Hunter's Lesson Design and validated. Included in the lesson plans were the purpose of the conversation, social communication skill to learn, concepts to learn Context and topic were indicated.

2.5. Procedure

The data were collected in three phases: pre-implementation, implementation and post implementation.

Figure 2. Data collection procedure

Pre-implementation phase included stages such as instrument preparation which includes desktop research, creation of instruments, pilot testing validation and revision; choosing participants included as coordinating with the school, testing the facilities, screening the participants and choosing of final participants; and preparing the virtual peer which included screening, choosing the final virtual peer, and orientation and training.

Implementation phase included pre-intervention observation wherein the participants were observed in the RL. Field notes were used to record their behavior and social communication skills. During intervention teaching materials were prepared and communicated with the virtual peer using Messenger application daily. In preparing for VR sessions, the equipment was set 45 minutes before the first session. This was a time allowance in anticipation for possible technical difficulties and to avoid delays. Daily observations were done using Field notes in RL setting and after the VR sessions. The camera was used for both settings. The intervention was comprised of teaching the technical skills and probe, teaching social communication skills and evaluation.

Post implementation included data organization. The researcher watched all the video

recordings to rate all opportunities wherein each social communication was demonstrated. All opportunities were rated using the SCSS. The time the opportunity started and time it ended in the video recording was written as references to which part of the recordings the conversation occurred. The sequence of rating the social communication skills was in VR then in RL settings. The researcher chose one to three opportunities with the best scores for each session in VR and for each day in RL.

The Field Notes were completed by watching the recordings and writing the narrative observations focusing on social communication skills, frequent behaviors of the child and the context of those incidents. Inter-rating was done by preparing the rating sheets for the inter-rater. The best opportunities chosen was indicated in sheet through the time it started and ended in the recorded video.

2.6. Data Analysis

By watching the recordings, the social communication skills were measured using a Social Communication Score Scale. 1-3 Opportunities with the best scores were chosen for both contexts. Inter-rating was done to determine the reliability of the researcher's ratings. Average score was computed based on those opportunities chosen for each session in VR and each day in RL. The average scores were plotted on a graph to visually analyze each skill. Different parameters such as level, trend (slope), and variability in each graph was analyzed to determine the effect of VRRP during intervention.

The study is qualitative as based on the recordings, field notes were completed. Patterns of behaviors were noted and themes emerging from these patterns were studied. These patterns supported the scores obtained from the SCSS in both contexts.

2.7. Findings

The effect of the VRRP on social communication skills of children with AD/HD, specifically in initiating, responding to, and ending the conversation, was most seen in the length of the reciprocal conversation that emerged in the VR. There were no indications that the VRRP had an effect in RL of the three participants as same patterns of social communication displayed during intervention. The difference may stem from the number of opportunities the more structured VR environment offered for practice. As the participants became more familiar with the process of conversing in VR, they were keener on responding to verbal cues and the body orientation of the avatar, as such longer reciprocal conversations were observed.

The effects on the participants were varied. The participants, namely Gabriel, Nehemiah, and Jeremiah were observed during virtual reality role-play (VRRP) intervention in the VR context and in real-life setting. The duration of the VRRP intervention was approximately 15-30 minutes. Each session followed the stages of Madeline Hunter's Lesson Design where the role-play in independent practice served as the evaluation. In the independent practice, social communication skills were measured and the opportunities with three best scores were plotted in the graph. On the other hand, the real-life setting was observed for 15 minutes each day. The opportunities with three best scores were plotted in the graph as well.

VRRP covered three SCS in the following order: responding, initiating and ending the conversation. Below are the graphs that describe Gabriel, Nehemiah & Jeremiah's social communication skills during intervention in virtual reality and real-life contexts:

Figure 3. Social Communication Skill of Gabriel in VR context. This graph shows initiating, responding and skill in ending conversation of Gabriel in VR during intervention.
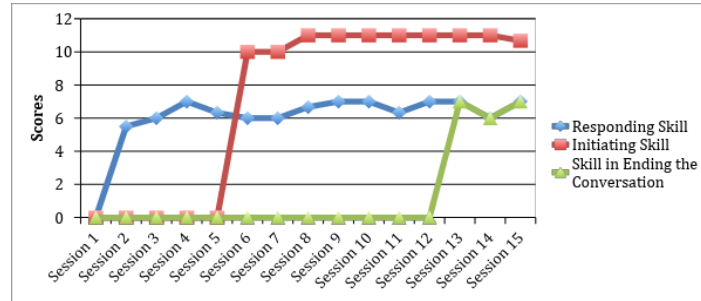

Figure 4. Gabriel's Social Communication Skill in RL. This graph shows Gabriel's plotted scores in responding and initiating skills in RL during intervention.
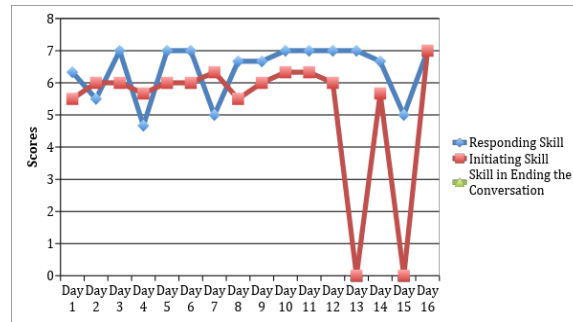

Figure 5. Nehemiah's responding skill in VR.
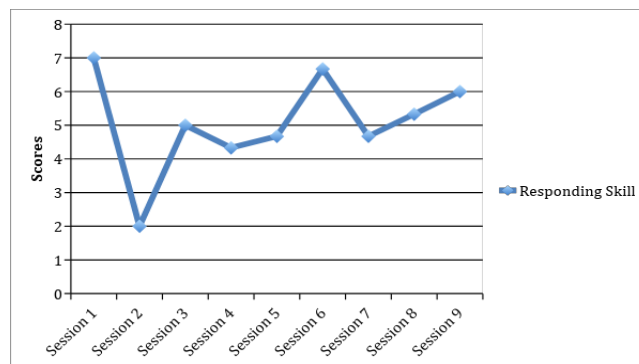*This figure shows Nehemiah's responding skill in VR during intervention.*

Figure 6. Nehemiah's social communication skills in RL. This figure shows Nehemiah's social communication skills in RL during intervention.
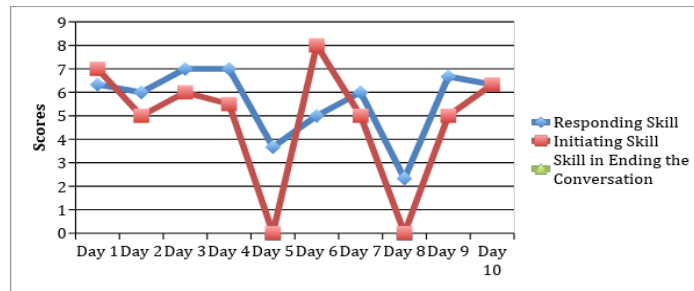

Figure 7. Jeremiah's social communication skills in VR. This figure shows Jeremiah's social communication skills in VR particularly responding and initiating during intervention.
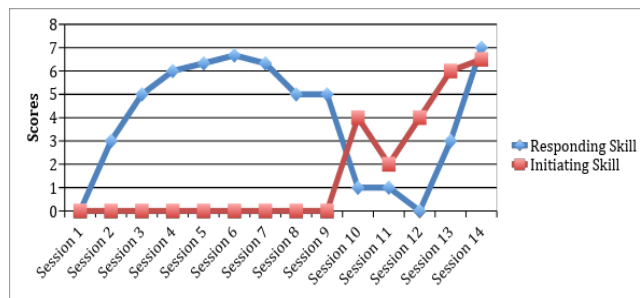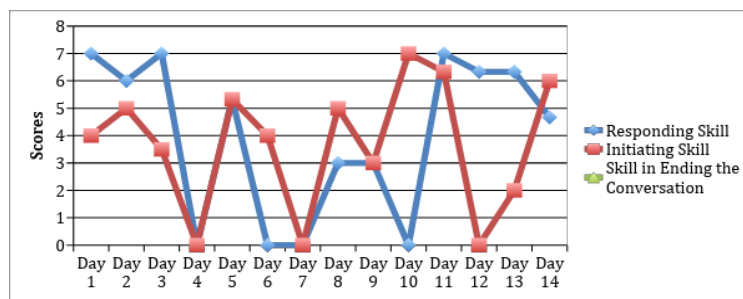

Figure 8. Jeremiah's social communication skill in RL. This figure shows Jeremiah's social communication skills in RL during intervention.

The effects of VRRP on social communication skills of the children after the intervention varied in VR. The first child with comorbid AD/HD and ASD increased in all sub-skills in initiating, responding and ending the conversation. For the second child with AD/HD, no change in score as before intervention, the sub-skills in responding were observed. For the third child with AD/HD, in responding, all sub-skills were observed. In initiating, observed sub-skills were approaching by walking towards the peer, calling the person or peer by name, initiating by asking a question, asking questions in context, using appropriate words or statement and speaking in a friendly manner or with appropriate voice were observed. For all children, in RL, it can be assumed that there were no effects in all social communication skills as the sub-skills were observed prior the intervention. Participating in longer reciprocal conversation emerged after the intervention in VR. This observation was not noted in RL.

The tables show the score per sub-skill before and after intervention. Each score is a computed average per sub-skill for comparison.

Table 3. Gabriel's initiating skill before and after VRRP in VR

Sub-skills	Weight	Before the Intervention	After the Intervention
1. Approaches by walking towards the person / peer	1	0	0.67
2. Greets the person / peer	1	0	1
3. Calls the person or peer by name	1	0	1
4. Waits quietly for the person / peer to finish his or her response	1	0	1
5. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	1
6. Initiates by giving information or asking a question	1	0	2
7. Gives information or asks questions in context	2	0	2
8. Uses appropriate words or statement	2	0	2
9. Speaks in a friendly manner or with appropriate voice	1	0	1

Table 4. Gabriel's responding skill before and after VRRP in VR

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	0	1

2. Responds not later than 3 seconds after the person's / peer's utterance	1	0	1
3. Utters an on-topic response	2	0	2
4. Uses appropriate words or statement	2	0	2
5. Speaks in a friendly manner or with appropriate voice	1	0	1

Table 5. Gabriel's skill in ending the conversation before and after VRRP in VR

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her response	1	0	1
2. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	1
3. Utters a statement that ends the conversation	2	0	2
4. Uses appropriate words or statement	2	0	2
5. Speaks in a friendly manner or with appropriate voice	1	0	1

Maintaining Conversation. Before the intervention, there was no conversation that occurred while after the intervention, Gabriel was able to participate in longer reciprocal conversations. The four role-plays ranged from 11-14 conversational turns. Moreover, role-play 3 contains 14 conversational turns was the longest reciprocal conversation in all role-plays conducted after the intervention. The conversation below shows the dialogue between Gabriel and the virtual peer in role-play 3:

Gabriel:	Hi, Alex!
Alex:	Hello, Gabriel!
Gabriel:	I was wondering about TV programs or cartoons.
Alex:	What about TV programs or cartoon?
Gabriel:	I was talking about Mr. Bean
Alex:	Oh, Mr. Bean, I like that show.
Gabriel:	I like him with his teddy.
Alex:	Can you repeat that again?
Gabriel:	Mr. Bean does have a teddy.
Alex:	Oh yes, the teddy bear, but I love the car more.
Gabriel:	Is it green?
Alex:	Yes, It's color green.
Alex:	Do you like other characters in the show? (Overlap, but Alex continued and Gabriel paused)
Gabriel:	I like only Mr. Bean and teddy. (He held the computer mouse and moved it, the teacher physically prompted him to put his hand on his lap, the conversation continued without interruption)
Alex:	Oh I see.
Gabriel:	Mrs. Wicket is gonna get mad at Mr. Bean.
Alex:	Yes, that's true I find that very funny.
Gabriel:	Mrs. Wicket has a cat.
Alex:	Yes, that cat is very grumpy.
Gabriel:	It's yellow.
Alex:	Yes, and it å a scar.
Gabriel:	In his, in it, in its face?
Alex:	Hmm, I also like Mr. Bean's girlfriend. (Gabriel would looked downward while his

Table 6. Gabriel's initiating skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Approaches by walking towards the person / peer	1	0.5	0.67
2. Greets the person / peer	1	0	0
3. Calls the person or peer by name	1	0.5	0.33
4. Waits quietly for the person / peer to finish his or her response	1	0.5	0
5. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	0
6. Initiates by giving information or asking a question	1	1	1
7. Gives information or asks questions in context	2	1	2
8. Uses appropriate words or statement	2	1	2
9. Speaks in a friendly manner or with appropriate voice	1	1	1

Table 7. Gabriel's responding skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	1	1
2. Responds not later than 3 seconds after the person's / peer's utterance	1	1	1
3. Utters an on-topic response	2	2	2
4. Uses appropriate words or statement	2	1.67	2
5. Speaks in a friendly manner or with appropriate voice	1	0.67	1

Using the SCSS, the sub-skills in ending the conversation were not observed in the RL. Before and after the intervention, it was observed that Gabriel conversed with a peer but no maintaining conversation was observed. Most conversations included the SPED teacher or the observer as the conversing partner.

Table 8. Nehemiah's responding skill before and after VRRP in VR

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	1	1
2. Responds not later than 3 seconds after the person's / peer's utterance	1	1	1
3. Utters an on-topic response	2	2	2
4. Uses appropriate words or statement	2	2	2
5. Speaks in a friendly manner or with appropriate voice	1	0.33	0.33

Table 9. Nehemiah's initiating skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Approaches by walking towards the person / peer	1	0	0
2. Greets the person / peer	1	0	0
3. Calls the person or peer by name	1	1	0.67
4. Waits quietly for the person / peer to finish his or her response	1	0	0
5. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	0
6. Initiates by giving information or asking a question	1	1	1

7. Gives information or asks questions in context	2	2	2
8. Uses appropriate words or statement	2	2	2
9. Speaks in a friendly manner or with appropriate voice	1	1	1

After the intervention, Nehemiah was able to participate in reciprocal conversation with Alex. Role-play 1 consisted of 6 conversational turns while role-play 2 consisted of 9. For both role-plays, the virtual peer was the one who initiated the conversation. For both role-plays, Nehemiah took off the earphones as an indicator that he ended the conversation. Maintaining conversation are shown below wherein Nehemiah participated in reciprocal conversation in VR after the intervention:

Table 10. Nehemiah's responding skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	1	1
2. Responds not later than 3 seconds after the person's / peer's utterance	1	1	1
3. Utters an on-topic response	2	2	2
4. Uses appropriate words or statement	2	2	1.67
5. Speaks in a friendly manner or with appropriate voice	1	0.33	0.67

Using the Social Communication Score Scale, the sub-skills in ending the conversation were not observed in the RL. Before and after the intervention, it was observed that there was no maintaining conversations between Nehemiah and a peer. Most conversations included the SPED teacher, the observer and the student teacher as the conversing partners

Table 11. Jeremiah's initiating skill before and after VRRP in VR

Sub-skills	Weight	Before Intervention	After Intervention
1. Approaches by walking towards the person / peer	1	0	0.5

2. Greets the person / peer	1	0	0
3. Calls the person or peer by name	1	0	0.5
4. Waits quietly for the person / peer to finish his or her response	1	0	0
5. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	0
6. Initiates by giving information or asking a question	1	0	1
7. Gives information or asks questions in context	2	0	2
8. Uses appropriate words or statement	2	0	1.5
9. Speaks in a friendly manner or with appropriate voice	1	0	1

Table 12. Jeremiah's responding skill before and after VRRP in VR

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	0	1
2. Responds not later than 3 seconds after the person's / peer's utterance	1	0	1
3. Utters an on-topic response	2	0	2
4. Uses appropriate words or statement	2	0	2
5. Speaks in a friendly manner or with appropriate voice	1	0	1

Jeremiah needed to learn the skill in responding by giving a comment when the conversing partner's utterance was to tell an information. Because of this, reciprocal conversation was poor. Questions asked by the virtual peer helped in maintaining the conversation. In the 4 different role-plays, Jeremiah was given 11-16 opportunities to respond. It was the virtual peer who was in control of the conversation by asking questions. The conversation below shows the complete role-play wherein Jeremiah would respond to the virtual peer or would prefer not to. He would

also relay to the teacher what Alex had uttered to him. There were also utterances indicating that he wanted to end the conversation.

Table 13. Jeremiah's initiating skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Approaches by walking towards the person / peer	1	0	0
2. Greets the person / peer	1	0	0
3. Calls the person or peer by name	1	0.67	0
4. Waits quietly for the person / peer to finish his or her response	1	0	0
5. Utters the statement not later than 3 seconds after the person's / peer's response	1	0	0
6. Initiates by giving information or asking a question	1	1	1
7. Gives information or asks questions in context	2	0.67	2
8. Uses appropriate words or statement	2	1	2
9. Speaks in a friendly manner or with appropriate voice	1	0.67	1

Table 14. Jeremiah's responding skill before and after VRRP in RL

Sub-skills	Weight	Before Intervention	After Intervention
1. Waits quietly for the person / peer to finish his or her statement	1	1	1

2. Responds not later than 3 seconds after the person's / peer's utterance	1	1	0.67
3. Utters an on-topic response	2	2	2
4. Uses appropriate words or statement	2	2	1
5. Speaks in a friendly manner or with appropriate voice	1	1	0

Using the SCSS, the sub-skills in ending the conversation were not observed in RL. Before and after intervention, it was observed that there was no maintaining conversation between Jeremiah and his peers. Most conversations included the SPED teacher or the observer as the conversing partner.

2.8. Discussion

VRRP can be used to target the problem in social communication skills of children with AD/HD. For the child in the study with comorbid AD/HD and ASD, behaviors displayed were commonly speaking off-topic statements that would divert his attention while having a session. Mentioning same topics as his preference are also common. Danby et al. (2012) indicated the importance of the complex understanding of social knowledge and what interactions are involved in building relationships. For the other child, the problem in articulation emerged, while eliciting responses from the third child was the challenge. Providing enough time for him to process and think helped him to respond.

The VRRP provided a structure wherein learners were able to engage in a conversation with turn-takings. Mancil et al. (2009) indicated that result of the intervention as increase in communication responses. Sansosti & Powell-Smith (2006) characterized this as maintaining conversation where the participant contributed to a reciprocal conversation with another peer or group of peers like engaging in small talk. With regard to the use of 3-D software, it may either increase interest or be distracting. Prompts may help in order for the child to keep him on-task as behavior problems in the study were still evident during VR sessions. This behavior problems in children with AD/HD were noted by Moore (2010) as problems with self-regulation which means poor self-control which is the lack of capacity to inhibit. The effect of the VRRP on behavior is indeterminate. It does not yet support the statement of Mancil et al. (2009) that the effects of communication training impacts behavior such as decrease in aberrant behavior. Reminder before the start of the session could help eliminate inappropriate behaviors during VR sessions.

In creating a VRRP intervention, the child's problem such as uttering off-topic statements and elaborating was addressed in VR. Choosing topics that are interesting and are within the boundary of the child's experience helped him speak more related statements. Hsiao & Bernard-Opitz (2000) noted this as shared interest wherein the same topic was the focus in the conversation. Sansosti & Powell-Smith, (2006) noted knowledge of the topic maintains conversation. The child's comprehension and reading level must be predetermined as it would include comprehension for watching clips and reading scripts. Clips and scripts that are short are effective. Solomonidou et al. (2004) mentioned that learners with AD/HD prefer to use computer with concise texts, videos or short narration. Long discussions, question and answer,

and repetitive tasks cause boredom to the child in the study. Inattention was evident in those instances. Rasha et. al (2013) characterize this as short attention span. Fidgeting was common for the two children with AD/HD which justifies Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (2013) description of hyperactivity as having excessive or talkativeness. Transitions from one activity to the next should be brief to keep the child's attention.

Task analysis is essential in teaching initiating by asking a question and responding by giving a comment. Modifications were useful as each child with AD/HD differ in their social communication skill, comprehension and behavior. More numbers of sessions would be required for the child to fully master these skills. With regard to skill in ending the conversation, the scripts that contain the statement to end a conversation is helpful. For the case of the other child, frequency of the sessions and intervals affect his behavior during the sessions.

Scaffolding as a strategy was reflected on each component in the lesson design. The very essential part for the child's learning is modeling where the child was able to watch the skill using a clip and the guided and independent practices wherein three to four different role-plays were conducted with gradual decrease of support applied. Through these strategies, mastery was achieved for most of the skills or problems pertaining the skill were identified. Moreover, the different role-plays conducted for each session provided an opportunity for the child to practice and demonstrate the skill.

Features of the 3-D software that was used to teach social communication skills helped facilitate learning for the child with comorbid AD/HD and ASD. The graphics and sounds could be attractions to children with AD/HD. Conversations through voice chatting done in role-plays with the virtual peer in an avatar form helped gave interest and helped the child pay attention. The presence of the virtual peer was impactful. Hadley & Schuele (1998) emphasized the importance of authentic positive peer interactions as preparation to establish friendships. They noted that lack of opportunity for peer confederate training and social skills. Battaglia & Radley (2014) highlighted the advantages when children practice socialization with their peers with careful selection of peers to match the specific deficit. Biggs & Carter (2017) justified the improvement in communication with peers by the efficacy of peer support. Hundert & Harrison (2014) stressed the combinations of peer buddies and social scripts training produced a generalized interaction with peers to play settings. Rogers (2000) summed up that the involvement of typically developing peers determine success of social skills intervention.

In the conversations, children would frequently look away while listening to the virtual peer. Turkstra et al. (2003) reasoned that while listening, listening without gazing lessens information to process for those with language processing disorder. Engagement was seen in the conversations between the child and the virtual peer. Engagement noted is still unclear if it could be attributed to presence however, Scoresby et al. (2011) mentioned that presence is not only confined in the fully immersed experience. Sanchez-Vives et al. (2005) identified contributors to presence is the sense of being with another person in a virtual environment. The 3-D software used as a multimedia could provide this feature and Scoresby & Shelton (2011) noted that visual and audio aspects greatly contributed to the feeling of presence. On that premise the avatar somehow distracted the learner in some parts of the session. Another source of distraction are equipment like mouse and earphones. Prompts from the teacher while seated beside the child assisted the child to focus on the task.

Aside from prompts from the teacher, her role as the moderator in the conversations through voice chat between the virtual peer and the child was crucial. The cues before starting the role-play assisted the conversing partners as overlaps in the conversation happened.

The 3-D software with all the tools available for the teacher could avoid multiple windows opened in the screen while the teacher is facilitating the session. Relevant tools for the teacher are for sharing and keeping files and chatting by typing messages. The following windows were ready for access during the session like Facebook in order to chat with the virtual peer, PDF file as slide, Quicktime for the clip and Notes for the links.

Echo of voice was heard in the virtual world. The standard use equipment such as a set of earphones with microphone should be applied to avoid this problem. In a school environment, Internet connection should be DSL as problems in voice chat occurred using a WiFi connection.

Social Communication Skills are dependent on the structure of the environment. The effects of VRRP in the child's real-life setting is inconclusive. In RL, the environment is unstructured compared to the VR. The frequencies of initiating and responding skills are evident in the natural environment however, quality of the conversation between the conversing partners are better in VR. Therefore the structure in VR contributed to this result. Krebs, McDaniel & Neeley (2010) study revealed that peer training brought advantages to participants as they displayed increase in the target behaviors but it requires an appropriate structure on how to create an intervention that fits the learner.

The child with comorbid AD/HD and ASD were different from the other two participants. He was able to achieve the sub-skills "waiting for the person or peer to finish his or her statement" and "uttering an on-topic statement." Number of turns increased in the conversation with a maintained topic. In initiating, the sub-skill "approaches by walking toward the peer was also gradually addressed." Given an instruction to ask a question, the child had difficulty, as telling an information was more frequent. The need of support in order to accomplish this task was needed. A different result was shown in the case of the other child with AD/HD wherein the social communication skill particularly responding by answering a question and giving a comment showed variability. The child's behavior and the staggered sessions were variables. Nonetheless, VRRP facilitated learning and other problems in social communication such as difficulty to articulate some words and difficulty to express longer statements became evident during intervention. The third child with AD/HD displayed responding skill that was improving during intervention, but his scores dropped when it was replaced by teaching initiating skill wherein he also was able to attain slow progression of skill.

In the VR session, the children with AD/HD in the study were able to improve in social communication skills but they varied in terms background specifically, behavior, comprehension skill and an uncontrolled variable was also identified such as staggered sessions which lead to different pacing in learning the skills.

Structure is needed in order for the children with AD/HD in the study to develop and demonstrate the social communication skills in the classroom. In the real-life setting, the social communication skills varied in accordance to the degree of structure in the environment, therefore opportunities to display social communication skills varied as well. In RL, in a less structured environment, initiating skill was more frequent while in a more structured, responding

was more evident. Conversations in the RL setting would often include the SPED teacher or the observer rather than a peer as the conversing partner. There could be opportunities to converse with peers in RL, however, there is no structure to follow in the natural setting.

Skill in ending a conversation in the RL was not common. Behaviors displayed were often not responding or leaving the conversing partner by walking away.

In conducting VRRP, the role and presence of the teacher beside each child in real-life during session was vital while having VRRP intervention as the children with AD/HD in study depended on the instructions and prompts provided by the teacher. For role-plays, the teacher who acted as a moderator of the conversations that took place were necessary in order to accomplish the objectives.

The VRRP particularly the structure of the explicit instruction design in different stages was beneficial to address the problems in social communication skills. Having said that, there were components in the lesson design that were greatly advantageous. These were modeling wherein a clip was presented and guided practice and independent practice wherein the skills were rehearsed and evaluated. Other components were essential but needed to be applied concisely.

The role-plays with combination of scaffolding and 3-D features of the software evidently promoted interest and was helpful to demonstrate social communication skills for each child with AD/HD.

Repetitions of activities could lead to boredom and would affect the child's social communication skills. Other features of the VRRP can be distracting such as the avatar and surfing.

3. Conclusion

Based on the findings of the study, the conclusions below are drawn:

A fully structured context and a less structured setting affect the social communication skills of children with AD/HD in the study. Therefore providing structure in the school setting will reinforce this skill.

The VRRP component such as the use of a 3-D software with its features supports engagement or interest for children with AD/HD to learn social communication skills. These are the clips and scripts displayed in the virtual screen, the avatar, the sounds, and the virtual peer. This interest may also lead to distraction, therefore the role of the teacher to provide support is important.

The series of role-plays where scaffolding in the scripts were major contributors for the children with AD/HD to enhance social communication skills. The scripts with topics that were familiar to them helped them utter statements.

3.1. Recommendations

Parents should promote social communication skills by having a supportive environment such as providing a structured setting wherein their child with AD/HD could perform social communication skills at home.

Children with AD/HD must be provided a program that would target their social communication skills. Structuring the school to have a supportive environment by assisting the students to interact with peers must be prioritized. Integrating the structure that teaches social communication skill can be done in all activities in the school including the natural setting such as recess time, play time or circle time.

Using VRRP, preliminary program must be considered first that will target the behavior problems of the child with AD/HD in order to manage the behavior.

In creating a VRRP, the child's first language, reading and comprehension skills must be determined. The scaffolding wherein the child would be able to practice the conversations must be done by using the scripts with topics that are interesting for the child. Series of role-play are helpful however, repeating a clip and a role-play could cause boredom for students with AD/HD. Discussion and verbal instructions must be very brief and transition from one activity to another must be quick. Facilities must include a quiet space. Connecting the computer to an Ethernet is better than a WiFi connection as Internet connections in schools would often cater to multiple devices that may interfere the online session.   Other skills in social communication must be explored as the targeted skills will progress. When mastery in initiating, responding and skill in ending a conversation are achieved, other areas could be added like, turn-taking skills, maintaining conversations or conversation in a group setting.

Another phase is recommended wherein a child would undergo role-play exercises with real-life peers such as with classmates and other children in the school. This is a structured setting however, it will include real-life people from the school.   This would serve as the transfer of the skills wherein the child would be able to apply the skills learned from the VRRP. The third phase could be giving an instruction for the child to make a conversation with peers in the natural environment wherein the teacher would monitor if the tasks were accomplished and to determine if the child was able to demonstrate the target skills in social communication. School staff and teachers should be trained in order to establish a supportive environment that would provide opportunities for children with AD/HD to practice and show their social communication skills.

Using a 3-D software promotes interest to children with AD/HD. 3-D software must be developed for children. Because the users are children with AD/HD, added features could be more gestures or animations that portray appropriate behaviors of a child in the real-word. Examples are shaking of hands, sitting still or packing away of things. Another feature includes customizing avatars with more options in terms of appearance so that the child would be able to create one with a closer resemblance to the child's real-life.   When it comes to the virtual world, places that are part of the child's regular routines can be considered. Examples of places are classroom, canteen or play area.

When it comes to accessibility, a software that includes different tools for teachers can be considered. These are options to chat using typing, storage of files such as PDF's or slides and links for videos. This is to add ease and to avoid using different windows for different application programs during sessions.

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